Research in Higher Education, Vol. 46, No. 8, December 2005 (© 2005)
DOI: 10.1007/s11162-005-6933-7

MEASURING DETERMINANTS OF STUDENT RETURN VS. DROPOUT/STOPOUT VS. TRANSFER: A First-to-Second Year Analysis of New Freshmen

Serge Herzog*,**

To reflect academic challenges and enrollment patterns of today's freshmen, this study measures the impact of high school preparation, first-year academic performance, multi-institution enrollment, and financial aid support on second-year persistence. Using multi-year cohorts at a public research university, results confirm the importance of including first-year math experience, math intensity of the declared major, simultaneous enrollment at another college/university, and second-year financial aid offers when measuring freshmen retention. The positive impact of a large-scale, state-funded scholarship program in widening access to college must be balanced against findings that show academic performance and readiness to take on and pass first-year math to be more important than aid in explaining freshmen dropout and transfer-out during both first and second semesters. Middle-income students with greater levels of unmet need face an elevated departure risk, while academically well-prepared freshmen with unmet need are more likely to transfer to other institutions.

KEY WORDS: student retention; academic preparation; financial aid; state-funded scholarship; concurrent enrollment; multinomial logistic regression.

INTRODUCTION

Student retention has been the focus of research on higher education for some time, not least due to efforts to establish a benchmark indicator of institutional performance and to gain a better understanding of enrollment-driven revenue streams. Early studies laid the theoretical foundation for scholarly inquiry into the host of factors that influence student enrollment persistence and degree completion (Astin, 1984; Bean,

*Director, Institutional Analysis, University of Nevada, Reno, USA.
**Address correspondence to: Serge Herzog, Director, Institutional Analysis, University of Nevada, Reno PBA, Mailstop 118, Reno, NV 89557, USA E-mail: serge@unr.edu

1980, 1985; Billson and Brooks-Terry, 1987; Pascarella and Terenzini, 1980; Pascarella, Terenzini, and Wolfle, 1986; Spady, 1971; Tinto, 1975). Attention centered on interactive and causal links between student background, educational and institutional commitment, and academic and social integration. These studies gave rise to validation analyses that focused on identifying constructs with the best set of complementary variables to maximize model explanation (Berger and Braxton, 1998; Braxton, Sullivan, and Johnson, 1997; Cabrera, Castaneda, Nora, and Hengstler, 1992; Cabrera, Nora, and Castaneda, 1993), while others concentrated on the impact of specific factors on retention, such as assimilation courses (Hendel, 2001; Sidle and McReynolds, 1999), selected program major (St. John, Hu, Simmons, Carter, and Weber, 2004; Mau, 2003), admission status (Laden, Matranga, and Peltier, 1999), student ethnicity and gender (Grandy, 1998; Leppel, 2002), classroom-based learning experiences (Braxton, Milem, and Sullivan, 2000; Tinto, 1997), institutional support services (Lau, 2003), intention to leave (Okun, Benin, and Brandt-Williams, 1996), academic and social integration (Beil, Reisen, and Zea, 1999), and pre-collegiate academic preparation (Cambiano, Denny, and De Vore, 2000). Though most studies examine retention at the first-to-second year stage, when students typically depart, the growing use of survival analysis and event history modeling is expanding the focus of student retention beyond the freshmen year (DesJardins, 2003; Ishitani and DesJardins, 2002; Murtaugh, Burns, and Schuster, 1999).

Retention analysis is also increasingly centered on the role financial support plays in college attendance (Braunstein, McGrath, and Pescatrice, 2001; DesJardins, Ahlburg, and McCall, 2002; Fenske, Porter, and DuBrock, 1999; Hu and St. John, 2001; Long, 1998; Somers, 1995). While financial aid looms ever larger in the enrollment calculus of students (Clabaugh, 2004; Farrell, 2005; Horn and Peter, 2003; Potter, 2003; Sanoff, 2004), the impact of aid is not always consistent among institutional studies (e.g., Perna, 1997; Somers, 1995). This is due not only to institutional differences (e.g., admissions requirements, student demographics, location, etc.), but also the result of variations in model specification.

Typically, retention models examine sets of determinants that reflect a student's demographic background, both high school and college experience, and financial aid status. Inclusion of such factors is often guided by data availability—in addition to theoretical considerations and model fit—and there is no uniform methodology governing retention analysis. While this study does not examine the relative merit of one approach vis-à-vis another, the model presented here does address three areas in the retention scholarship deemed underdeveloped. Reflecting on

Braxton's *Reworking the Student Departure Puzzle* (2000), which provides an overview of the principal schools of thought on student retention, it is worth noting that the theories presented conceptualize student departure largely from the vantage point of the institution—either a student is retained or not—thereby ignoring transfer to another institution, a growing trend among many students. For example, over a third of all 1992 high school graduates, who earned a bachelor's degree by 2000, did so at an institution other than the one of first attendance, while over 73% of those who started at a 4-year institution, and who graduated from the institution of first attendance, also enrolled at another institution (Adelman, 2004). This number is up from 40% in 1970 (Fiske, 2004). The phenomenon of students "swirling" in and out of different institutions, commonly associated with community colleges, has become a defining feature in the enrollment pattern of most students (Borden, 2004). Yet, this growing trend is not adequately accounted for in the retention literature, which treats subsequent student enrollment as a dichotomous yes/no event. Porter (2002) did present a model measuring the multiple enrollment choices associated with transfer versus stopout, but without measuring the impact of concurrent enrollment—in other words, the simultaneous enrollment at another post-secondary institution—and without controlling for the range of financial aid options students increasingly select.

A second concern is the treatment of financial aid as a covariate in retention models. Integrative approaches to measuring the direct effect of financial aid in conjunction with cognitive, affective, and economic variables (e.g., family income) have overcome some of the limitations of early studies that focused primarily on the equalization effect of aid for low-income students (Braxton, 2000). However, financial aid is captured on the basis of current-year awards *received*, without considering the inducement effect of subsequent-year *offers* (Bettinger, 2002; DuBrock and Fenske, 2000; Long, 1998; Somers, 1995; St. John, Hu, and Weber, 2001). Another problem arises when financial support for students who departed is imputed for a given term based on full-year awards (St. John et al., 2001; St. John, Hu, and Tuttle, 2000). Clearly, the effect of financial aid on re-enrollment is more accurately measured on the basis of money actually received by individual term during the academic year—allowing for comparison of the initial fall cohort with the spring returnees—while also taking into account second-year offers. Unlike money already received, offers measure more directly the inducement effect on future enrollment. Though there is some bias associated with self-selection, not all aid is offered in response to an application, not all applications result in awards, nor does an offer guarantee enrollment.

The third issue is the adequacy of retention models steeped in, or derived from, the interactionalist theories of student departure, most prominently those by Tinto (1975, 1987) and Bean (1982). Developed over 20 years ago based on academically and socio-economically more homogeneous, full-time cohorts, these models continue to enjoy ''near-paradigmatic status'' (Braxton et al., 2000), even though new freshmen today increasingly hail from first-generation, low-income, and ethnically diverse backgrounds (IHEP, 2004; Mortenson, 2003). More importantly, they are less prepared to take on college-level courses, a development driven in part by the rise in open-access institutions (particularly at the 2-year level) and the ''college-for-all'' culture permeating high-school counseling of graduating seniors (Rosenbaum, 2001). As Rosenbaum in *Beyond College For All* (2001) stresses, ''College preparation, not college attendance, is the real achievement.''

Greene and Forster, (2003) found that a mere 32% of high school graduates are qualified to enter 4-year colleges. This translates into high rates of college-level remediation, which strongly correlates with a student's chance to ever finish college. National data from the 1992 college-going high school graduates show that dropouts are over four times more likely to enroll in remedial reading than degree completers—a ratio twice as high compared to the 1982 cohort. A similar trend occurred in remedial math, underlining the growing importance of remedial enrollment in identifying students at risk of dropping out (Adelman, 2004). Of course, the fact that high school preparation is key in understanding the retention *puzzle* is not new. Several years ago Adelman (1999) pinpointed the curricular experience in high school—namely taking a math course beyond Algebra II—that dramatically improves persistence in college. The capacity to persist, however, is compromised for 35% of high school graduates who fail to meet basic math skills—the rate of deficiency being particularly pronounced for African Americans (69%) and Hispanics (56%)—according to the 2000 national report card on math comprehension (Haycock, 2002).

Thus, it is important that retention models sufficiently measure the curricular gateways to persistence at the college level that are typical extensions of key hurdles students encounter in high school. From what we learned in *Answers in the Toolbox* (Adelman, 1999), it is no surprise that the three most likely courses students fail in college are all in the area of math; likewise, the four most likely courses students repeat or withdraw from are all math related (Adelman, 2004). Yet, none of the seminal studies, nor any referenced here, measure specific course-taking experiences at the college level that relate to Adelman's findings, while controlling for the other predictor clusters as listed above. For example,

the Tinto and Bean models measure academic performance solely based on first-year GPA, while centering the analysis on student survey responses designed to measure institutional fit, social integration, commitment, and other student impressions. These are dimensions worth examining, but they scarcely capture the impact of underpreparedness in core subject requirements. Shifting the analytical focus to curricular experiences that are known to correlate strongly with persistence and degree completion is particularly important at a time when one in four college freshmen takes a remedial math course (Haycock, 2002).

CENTRAL FOCUS OF THE INQUIRY

To address the three areas considered underdeveloped in the scholarship—(1) student transfer and concurrent attendance; (2) fall vs. spring financial support and subsequent-year *offers*; and (3) key freshmen course challenges—the model presented here disaggregates non-returnees into those stopping/dropping out vs. those transferring out, while controlling for simultaneous attendance at other post-secondary institutions. Also, the model measures the impact of financial aid based on term-specific receipt, controlling for intra-year (fall-to-spring) departure and second-year offers. At the same time, a greater range of financial aid indicators is included than commonly found in comparable studies in order to illuminate the impact of a recently introduced state-funded scholarship, the Millennium program.

Millennium aid is available to state residents who graduated with a 'B' average from a state high school in 2000 or later; the scholarship dollar value awarded per term is determined on a per-credit basis; the lifetime total maximum limit is $10,000; and a student must maintain a 'C' average (to be raised for future applicants) and carry at least 12 credit hours per term.[1] Based on data from an institution that experienced significant enrollment growth since the introduction of the Millennium Scholarship program in 2000, its effect on retention is of particular interest to verify whether the program's positive impact on the state's college-going rate (which rose by 10% since 2000) extends beyond freshmen enrollment, and whether the program is successful in keeping the state's best high school graduates from transferring to out-of-state institutions. Also, the study tries to ascertain the scholarship's effect on improving the retention of remedial students, a segment that has grown 50% statewide since 1999, and over 40% at the institution on which the study is based (UCCSN, 2004).

Aid indicators are measured while controlling for remaining or unmet financial need, thereby identifying more accurately the effect of support

to students with demonstrated need (the Pell grant and subsidized loans), and institutional leverage via internal funds to retain good students.

Student propensity to be at-risk due to insufficient academic preparation is measured via inclusion of remedial course enrollments, first-year math performance, and identification of a math-intensive program major. A separate variable measures a student's *relative* academic success vis-à-vis his or her classmates (referred to as the 'peer challenge') to establish a more direct academic integration indicator.

The set of first-year college experience variables also includes a measure of a student's exposure to large classes or classes in high demand that are difficult to enroll in. This helps answer whether there is a negative effect on retention due to rapid enrollment growth. Both main and interaction effects among variables are identified where significant, while stressing differences in effect size across enrollment outcomes.

RESEARCH APPROACH

Given the saliency of measuring the impact of financial aid on retention, the study follows recommended model specifications from previous research (St. John, 2000, 1992), but with an expanded focus to address the issues above. Accordingly, the model incorporates student demographics (age, gender, ethnicity, residency, parent income), high school preparation (composite index), college experience (on-campus living and employment, credit load, GPA, math requirement in major, first-year math grades, remedial course enrollment, peer challenge score, class selection, use of recreation facilities), and financial aid status (by package, eligibility-type, source, amount, remaining need, second-year offers). Second-year (subsequent fall semester) enrollment, stopout/dropout, and transfer are measured within two semesters following the initial enrollment term based on new freshmen that entered fall semesters between 1996 and 2002. To capture the 'Millennium' effect, cohorts from 2000 through 2002 are used for most of the analysis, which includes both a fall and spring model to identify effects associated with intra-year retention and second-year aid offers. A pre-2000 model based on 1996 through 1999 cohorts is occasionally referred to in the discussion of the Millennium Scholarship. That model identifies stopout students, those returning within seven semesters and who did not transfer to another institution during that length of time. However, stopout *per se* is not examined as an enrollment outcome.

STATISTICAL METHOD

To measure the impact of selected variables on the enrollment outcome, multinomial logistic regression is employed. Logistic regression is an established method in retention studies for it handles both categorical and continuous predictor variables, which do not have to exhibit linearity and homogeneity of variance vis-à-vis the outcome variable (Gillespie and Noble, 1992; Hosmer and Lemeshow, 2000; Menard, 2001). Since the latter has several nonordered categories, a polytomous logit model is used, an approach which has yielded robust results in prior educational choice studies (Weiler, 1987). Though a path analytical approach offers greater control over direct and indirect effects of sequentially ordered variables, the method chosen here provides a basis for potential prediction analysis, while still furnishing an explanation of enrollment outcomes at both the main and second-order effect level.

To ensure the analysis yields stable and reliable measures across all examined variables, the presence of multicollinearity, data outliers, and insufficient cases across the outcome variable was tested. Collinearity diagnostics were performed on both fall and spring-retained cohorts, each showing acceptable variance inflation factors, condition indices and associated values across the variance decomposition matrix, according to established criteria (Belsley, 1991; Cohen, Cohen, West, and Aiken, 2003; Pedhazur, 1997). To identify statistical outliers in terms of (a) predictor variable value, (b) discrepancy between the predicted and observed outcome (enrollment status), and (c) influence on either individual predictor coefficient or the overall model, the following diagnostic statistics were checked: the centered leverage value, the studentized residual, Mahalanobis distance, Cook's D, and DFBetas. Results from repeated binary logistic regression (with re-enrollment as the reference outcome) yielded a few visual outliers above proposed cutoff values (Cohen et al., 2003) in terms of centered leverage and Mahalanobis distance. Similarly, Cook's D generated a few cases with visual separation, though well within cutoff limits; no outliers were observed in terms of residuals. Removal of outliers effected only changes in coefficients past the first decimal place and had minimal impact on the remaining model deviance and model fit indicators (Nagelkerke R^2, Hosmer-Lemeshow, percent of cases correctly predicted).[2] All predictor variables were crosstabulated with the enrollment outcome categories to ensure adequate cell frequencies. In some instances, variables were reconstructed, as described in the model specification section, to bolster cell frequencies. Though no consistent guidelines exist governing a minimum observation-to-predictor ratio, the latter for all models in this study is in the

mid-range based on recently reviewed logistic regression studies (Peng, So, Stage, and St. John, 2002).

The effect of each determinant is illustrated via the odds ratio (or inverse odds ratio where the logit coefficient is negative) to indicate how much the odds of not re-enrolling (i.e., transferring, dropping out, or re-enrolling when inverse) are *multiplied* as a result of an incremental unit change in the determinant (DesJardins, 2001). Since most determinants are of categorical nature, the effect of being in one category vis-à-vis the reference category is measured. Where the determinant is a continuous metric (e.g., aid dollars received), the scale is identified. Odds ratios are multiplicative, hence the effect of a multiple unit change is exponential. Significant interaction terms are also listed, *if* statistically significant. The remaining deviation chi-square value (−2Log likelihood), the pseudo R^2, and the overall percent of cases correctly predicted are furnished to measure model fit. Relative fit indicators based on Akaike's Information Criterion (AIC) and the likelihood ratio test are furnished for model comparison. Odds ratios of statistical significance ($\alpha \leq 5\%$) are highlighted in the tables listing parameter estimates. Design variables use the highest coded category as reference, while iteration settings for likelihood convergence are set for the most stringent criteria.[3]

DATA SOURCES AND MODEL SPECIFICATION

Four sources were tapped to generate the data file: the institutional student information system (SIS), which contains student demographic, academic, financial aid, and concurrent enrollment data; the institution's payroll system for student on-campus employment data; ACT's Student Profile Section (SPS) for parent income data of ACT-tested students; and the National Student Clearinghouse to identify transfer-out students. The following defines the variables used:

- *Student age* references 18-year olds right out of high school against students 19 years and older. This categorization separates those delaying college-entry after high school, since few adult students are found in the new freshmen class.
- *Ethnicity* combines African American, Hispanic, and Native American students, which together constitute a small proportion of each entering cohort, thereby stabilizing the coefficient. Asian Americans were found to be no different from Caucasian students in the preliminary bivariate analysis and combining them helps model parsimony.

- *Residency* uses the institution's primary capture area, which is the regional five county area, as the reference category and compares it to other in-state and 'Good Neighbor' students. The latter enjoy preferential tuition and are primarily from adjacent counties of the next-door state. Out-of-state students make up the third category, as these students pay a higher tuition rate.
- *Parent income* is grouped into upper, middle, and bottom thirds and adds a 'missing' category for those students without federal aid application data and without data from the ACT SPS. Complementing SIS data with ACT data helps minimize the number of cases missing, while still allowing for identification of independent students with their income via the federal aid application (FAFSA) of which there were few. ACT categorical income data are combined to reflect the larger aggregation in the design variable, thereby reducing potential errors of misclassification associated with unadjusted income. Research on student self-reported data confirms an accuracy of 72–98% depending on the data item (Laing, Sawyer, and Noble, 1988).
- The *high school preparation index* follows Adelman's (1999) "Academic Resources" composite variable: high school GPA and ACT composite test score make up a weighted index based on the respective odds ratio for each component in a bivariate logistic regression; the weight is then multiplied by the quintile score associated with each raw score. SAT scores were converted for students without an ACT record. Given the institution's liberal admission standard, index scores are grouped to account for a possible curvelinear effect between academic preparation and retention.
- *On-campus living* indicates whether a student resided in on-campus dormitories. The institution does not require on-campus living for new freshmen (this variable is omitted in the pre-Millennium model due to incomplete data).
- *Campus employment* indicates whether a student worked on campus during the first semester, either through federal or state-funded work study or through campus employment services.
- *Use of recreation facilities* identifies those students who paid for semester-length access and are assumed to have used the facilities.
- *Concurrently enrolled* indicates whether a student attended simultaneously another post-secondary institution during the first year, in this case mostly two community colleges in the local area.
- *Credit load* identifies students taking at least one regular course beyond the minimum number required to maintain full-time status.

- *Major requires Calculus 1* identifies students who selected a math-intensive program that requires the passing of a Calculus 1 course (excluding Calculus for Business majors).
- *Passed first-year math* confirms whether a student completed a first-year math course with a grade of 'C' or better or enrolled in a higher-level math course, which requires a minimum placement score.
- *Took remedial math or English* identifies those students who enrolled in developmental courses due to insufficient placement scores to enter college-level math or English.
- *Semester GPA* assigns students into three equal-size groupings to control for potential curve-linear effects associated with soaring grades; GPA is cumulative for the spring-returning cohort.
- *Peer challenge* groups students into three approximately equal-size categories based on the difference between their first-semester GPA and the average grade awarded in classes attended. A weak challenge indicates a student on average received higher grades than his/her classmates, the opposite being the case for a strong challenge.
- *First-semester class selection* groups students by average size of classes enrolled (below or above the median), and whether the student attempted to enroll in a class that was full at the time of the registration attempt. This variable is omitted in the pre-Millennium model due to insufficient data.
- *Financial aid packages* received for the fall semester separates students who had only a Millennium Scholarship from those who received additional gift aid and those who had non-gift aid in their package. This arrangement helps isolate the Millennium impact and classifies students into those with gift aid only vs. those incurring debt through loans (few students engage in college work-study). Spring semester packages for the spring-reenrolled cohort collapses recipients of non-gift aid with those having received no aid at all. Since only a handful of spring returnees went without any aid, this group served as the reference category.
- *Financial aid offered for the second year* separates Millennium offers from non-Millennium offers and packages with loans or work-study.
- Additional financial aid variables include price-response indicators based on $1000 received across types of aid, source of aid (institutional versus federal/state), Millennium-eligibility status from fall to spring, and remaining first-year need (by grouped level and per $1000) based on the processed FAFSA; all dollar amounts are inflation adjusted based on the Consumer Price Index and institutional tuition increases during the observation period. The adjustment is

weighted on the proportional contribution of tuition to the estimated total expenses as reported to the federal government (IPEDS).

Variables tested, but not entered into the model due to statistical insignificance include: pre-major status for undeclared students in their first semester; percent of incomplete or withdrawal (I/W) grades; campus dining plan subscription; advanced placement (AP) credits; average weekly hours of campus employment; educational aspiration; and the local area unemployment rate.

Pre-major students receive special counseling to ensure proper program guidance, and they have lately been of special interest to the institution. Pre-major status did not affect the odds of re-enrollment when controlling for other factors in the model. Similarly, no significant effect was associated with grouping declared major by college (e.g., arts vs. business, etc.). The percent of incomplete and withdrawal grades had no impact, as the cumulative effect is limited in the first year. The campus dining variable did not add to the model, as campus dining is chosen largely by students living on campus (a factor controlled for). Similarly, AP credits had an insignificant impact in the presence of the selected variables. Also, average weekly hours of campus employment did not add to the model, though it was deemed important to measure the effect of on-campus employment in general. ACT-based educational aspiration data were highly skewed in favor of students aiming for completion of an undergraduate or graduate degree; data compression at the high end of the scale left little variation for analysis beyond the impression that tested students tend to overproject their educational plans. The local-area unemployment rate, as quarterly reported, did not exhibit a significant effect in the models and thus was omitted as a determinant. The number of area jobs filled by students, and adjusted for seasonal variation and enrollment growth, may perhaps be a better indicator, as traditional students are unlikely to be accurately captured in employment statistics.

LIMITATION

The tested models are decidedly more focused on student academic preparation and integration with lesser emphasis on social and institutional fit as found in other studies (e.g., Astin, 1984; Billson and Brooks-Terry, 1987). Typically, these studies are based on inferential results from institutional samples (e.g., Beil et al., 1999; Cabrera et al., 1992, 1993). In contrast, the findings here are population-based (within the context of the selected years) from an institution with a high

proportion of commuter students where social life is situated primarily off campus. This may limit the transferability of lessons learned to other settings. However, adding considerations from the previous section, the shift in analytical focus is considered warranted.

Another issue is the lack of off-campus employment information that may potentially represent uncontrolled variance, if students' enrollment choices covary with outside job commitments. Availability of this information may help validate the true effect of on-campus employment. Third, determination of transfer, dropout, and stopout status is a function of the right-censored observation period; accordingly, results associated with each enrollment outcome can only be stated in the context of the defined period. Fourth, financial aid captures only amounts processed through the institution's financial aid system. Those from benefactors connected directly to the student and not routed through the institution are not included; they likely represent a negligible part of aid received, according to the institution's financial aid office. Also, some caution must be exercised in interpreting results associated with second-year aid offers due to some self-selection bias and the fact that aid continues to be offered after the defined observation period (i.e., after mid-August prior to the second fall term). Fifth, the category of missing cases for the parent income variable, containing 24% of cases, likely contains students from higher income backgrounds, as they did not apply for need-based aid. This is a reasonable assumption, according to previous studies (St. John et al., 2001), though it is possible that lower-income students are included in that group.

DESCRIPTIVE SUMMARY OF THE DATA

Varsity athletes as well as part-time, foreign, and not officially admitted students are excluded. Given the statistical method used, listwise deletion of 229 cases left 5261 (96%) students in the examined population for the 2000–2002 fall semester Millennium-year cohorts; 4671 (96%) for the spring-enrolled cohorts; and 4298 (97%) for the 1996–1999 pre-Millennium cohorts.

Trends in the data reveal several important differences between fall 1996–1999 new freshmen and those who entered in fall terms 2000–2002: Financial aid measures are based on a different aid package distribution. While almost 56% of students in the nineties had no aid, that proportion dropped to less than 11%, on average, since 2000. This change was precipitated by the introduction of the Millennium program, as the proportion of students on scholarships rose from 19% to almost 70% (Tables 1 and 2). This shift helped reduce the proportion of

TABLE 1. New Freshmen, Fall Terms 2000–2002

Descriptive summary		*N*	Percentage or mean
Enrollment year 2	Transfer within 1 year	569	10.8%
	No	680	12.9%
	Yes*	4012	76.3%
Age 19 or older	Yes	505	9.6%
	No*	4756	90.4%
Gender	Male	2272	43.2%
	Female*	2989	56.8%
Ethnicity	Unknown	231	4.4%
	African/Hispanic/Native Am	591	11.2%
	Caucasian/Asian*	4439	84.4%
Residency	Out of state	403	7.7%
	Other in-state & 'Good Neighbor'	2069	39.3%
	Local area*	2789	53.0%
Parent income	Missing	1280	24.3%
	Top 28% (>$80K)	1119	21.3%
	30–72%tile ($42–80K)	1564	29.7%
	Bottom 30% * (<$42K)	1298	24.7%
High school preparation index	Top 33%	1782	33.9%
	33–67%tile	1814	34.5%
	Bottom 32%*	1665	31.6%
Living on-campus	Yes	2711	51.5%
	No*	2550	48.5%
Campus employment	Yes	548	10.4%
	No*	4713	89.6%
Use of recreation facilities	Yes	1966	37.4%
	No*	3295	62.6%
Concurrently enrolled at other institution during first semester	Yes	353	6.7%
	No*	4908	93.3%
First-semester credit load	>14 credits	2534	48.2%
	14 Credits or less*	2727	51.8%
Selected major requires calculus 1	Yes	1237	23.5%
	No*	4024	76.5%
Passed first-year math course	Yes	4357	82.8%
	No*	904	17.2%
Took remedial English	Yes	1309	24.9%
	No*	3952	75.1%

TABLE 1. (*Continued*)

Descriptive summary		*N*	Percentage or mean
Took remedial math	Yes	649	12.3%
	No*	4612	87.7%
First-semester GPA	>3.33 (top 3rd)	1758	33.4%
	2.51–3.33 (middle 3rd)	1856	35.3%
	≤2.5 (bottom third)*	1647	31.3%
Peer challenge during first semester	Weak	1561	29.7%
	Neutral	1754	33.3%
	Strong*	1946	37.0%
First-semester class selection	Big and Full	2330	44.3%
	Small and Open	523	9.9%
	Big or Full*	2408	45.8%
Cohort	Fall 2000	1662	31.6%
	Fall 2001	1720	32.7%
	Fall 2002*	1879	35.7%
First-semester financial aid package received	Millennium scholarship only	1962	37.3%
	Scholarships and/or grants (all types)	1677	31.9%
	Packages with loans/work study	1060	20.1%
	No Aid*	562	10.7%
Millennium scholarship status at end of first (fall) semester	Non-Millennium student	1084	20.6%
	Received and lost after first semester	763	14.5%
	Received and maintains eligibility*	3414	64.9%
First-semester $ amount received	Grants (all types)	810	1496%
	Pells	644	1183%
	Non-Pell grants	370	1027%
	Subsidized loans	724	1245%
	Unsubsidized loans	545	2760%
	Loans (all types)	1062	2265%
	Millennium scholarships	4362	1134%
	Other scholarships	1985	1215%
	Institutional (by source)	1994	1224%
	State/Federal (by source)	4722	1796%
Remaining 1st year need ($ amount)		1479	4779%

*Reference category.

TABLE 2. New Freshmen, Fall Terms 1996–1999

Descriptive summary		*N*	Percentage or mean
Enrollment year 2	Dropout	291	6.8%
	Stopout within 7 semesters	169	3.9%
	Transfer within 7 semesters	526	12.2%
	Yes*	3312	77.1%
Age 19 or older	Yes	464	10.8%
	No*	3834	89.2%
Gender	Male	1928	44.9%
	Female*	2370	55.1%
Ethnicity	Unknown	193	4.5%
	African/Hispanic/Native Am	401	9.3%
	Caucasian/Asian*	3704	86.2%
Residency	Out of state	380	8.8%
	Other NV & Good N.	1370	31.9%
	Local area*	2548	59.3%
Parent income	Missing	1006	23.4%
	Top 28% (>$80K)	867	20.2%
	30–72%tile ($42–80K)	1284	29.9%
	Bottom 30%* (<$42K)	1141	26.5%
HS Preparatory Index	Top 33%	1517	35.3%
	33–67%tile	1346	31.3%
	Bottom 32%*	1435	33.4%
Concurrent enrollment at other institution	Yes	440	10.2%
	No*	3858	89.8%
Credit load	>14 credits	2002	46.6%
	≤14 Credits*	2296	53.4%
Calculus 1 required in major	Yes	1300	30.2%
	No*	2998	69.8%
Passed 1st year math	Yes	3467	80.7%
	No*	831	19.3%
Enrolled in remedial English	Yes	676	15.7%
	No*	3622	84.3%
Enrolled in remedial math	Yes	644	15.0%
	No*	3654	85.0%
First semester GPA	>3.33	1349	31.4%
	2.51–3.33	1548	36.0%
	≤2.5*	1401	32.6%
Peer challenge	Weak	1270	29.5%
	Neutral	1388	32.3%
	Strong*	1640	38.2%

TABLE 2. (*Continued*)

Descriptive summary		*N*	Percentage or mean
Campus employment	Yes	626	14.6%
	No*	3672	85.4%
Cohort	Fall 96	981	22.8%
	Fall 97	992	23.1%
	Fall 98	1063	24.7%
	Fall 99*	1262	29.4%
First semester financial aid packages	Scholarships/grants only	833	19.4%
	Packages with loans/work study	1065	24.8%
	No aid*	2400	55.8%
First-semester $ amount received	Grants (all types)	728	1492
	Pells	566	1105
	Non-Pell grants	368	1253
	Subsidized loans	760	1436
	Unsubsidized loans	444	2566
	Loans (all types)	1016	2197
	Scholarships	1903	1403
	Institutional (by source)	1885	1412
	State/Federal (by source)	1374	2522

*Reference category.

students on other types of aid and the amount received from these sources. The substitution effect gained with Millennium support also extended to students relying on campus employment, as their proportion of all students dropped by 4 percentage points. Other longitudinal trends indicate a 7 percentage points rise in the proportion of in-state students residing outside the local five-county area, a 7 percentage points drop in the proportion of students declaring a major that requires higher-level math, and an almost 10 percentage points rise in the proportion of students taking remedial English. The modest growth in remedial math enrollment is likely due to unmet demand, as students failed to register in classes that were already full.[4]

Average retention after introduction of the Millennium program dropped slightly, suggesting that the scholarship did not improve persistence at the institution, though it widened access as the number of new enrollees soared by 50% since 1999. This is a notably higher rate of growth compared to previous years. The seven-semester transfer rate for

the 1996–1999 cohorts is only slightly higher than for the two-semester-based 2000–2002 cohorts, indicating that most transfer students re-enroll somewhere else within one year.[5]

Comparing the spring-returnees with the initial fall cohorts (Tables 1 and 3), one notices a consistent decrease in the proportion of remedial students and a comparable increase of students passing first-year math or declaring a math-intensive major. At the same time, the proportion of students receiving only a Millennium Scholarship and no other aid soared by 10%. These students made up close to 50% of all spring returnees. Still, 18% of those on Millennium support in the fall lost the scholarship at the end of the semester due to insufficient GPA and/or credit hours completed. Almost 62% of spring returnees received a second-year Millennium offer by the end of the summer. The effect of these offers and variables on second-year enrollment is now further examined in the multivariate context.

FINDINGS

Almost 11% of fall students chose to transfer within one year, the majority after re-enrolling in the spring, while almost 13% dropped out, again the majority in the spring. Individual fall term cohort size grew steadily between 2000 and 2002 largely due to the state-funded Millennium Scholarship program. The following discussion is based on results from Tables 4–7.

Demographic Background

Among the tested demographic attributes, a student's residency is the only variable that weighs in on both dropout and transfer. While out-of-state students face twice the odds of dropping out and close to five times the odds of transferring, in-state students from outside the local area face similar transfer odds, but lower odds to drop out (Table 4, Full Model column). The heightened departure risk for these students does not depend on their financial aid status, as results from the reduced model show (Table 4, Excl Aid column). On the other hand, once they persist into the next semester, out-of-state students are no more likely to leave than local students—though in-state students from outside the local area are still more likely to transfer (Table 5).

Men are less likely to transfer than women, but no gender difference exists on the odds of dropping out (Table 4). Parental income weighs in for upper-income students who persisted into the second semester, as

TABLE 3. New Freshmen (Fall Terms 2000–2002 cohorts) Who Returned in Spring

Descriptive summary		*N*	Percentage (%)
Enrollment year 2 (F00-02)	Transfer within 1 Year	327	7.0
	No	444	9.5
	Yes*	3900	83.5
Age 19 or older	Yes	438	9.4
	No*	4233	90.6
Gender	Male	2000	42.8
	Female*	2671	57.2
Ethnicity	Unknown	192	4.1
	African/Hispanic/Native Am	512	11.0
	Caucasian/Asian*	3967	84.9
Residency	Out of state	333	7.1
	Other in-state& 'Good Neighbor'	1813	38.8
	Local area*	2525	54.1
Parent income	Missing	1110	23.8
	Top 28% (>$80K)	1011	21.6
	30–72%tile ($42–80K)	1398	29.9
	Bottom 30%* (<$42K)	1152	24.7
High School Preparation Index	Top 33%	1657	35.5
	33–67%tile	1623	34.7
	Bottom 32% *	1391	29.8
Living on campus	Yes	2364	50.6
	No*	2307	49.4
Campus employment	Yes	508	10.9
	No*	4163	89.1
Use of recreation facilities	Yes	1783	38.2
	No*	2888	61.8
Concurrently enrolled at other institution during fall or spring semester	Yes	396	8.5
	No*	4275	91.5
Spring semester credit load	>14 credits	2567	55.0
	14 Credits or less*	2104	45.0
Selected Major requires Calculus 1	Yes	1124	24.1
	No*	3547	75.9
Passed first-year math course	Yes	4055	86.8
	No*	616	13.2
Took remedial English	Yes	1122	24.0
	No*	3549	76.0
Took remedial math	Yes	545	11.7
	No*	4126	88.3

TABLE 3. (*Continued*)

Descriptive summary		*N*	Percentage (%)
Spring semester cumulative GPA	Top Q (> 3.47)	1188	25.4
	2nd Q (3.00–3.47)	1114	23.8
	3rd Q (2.46–3.00)	1192	25.5
	Bottom Q (< 2.46)*	1177	25.2
Peer Challenge during first semester	Weak	1494	32.0
	Neutral	1620	34.7
	Strong*	1557	33.3
Cohort	Fall 2000	1512	32.4
	Fall 2001	1494	32.0
	Fall 2002*	1665	35.6
Spring semester aid package received	Millennium only	2200	47.1
	Scholarships and/or grants (all types)	1520	32.5
	Pckg w/ Loans/work study or no aid (only 2)*	951	20.4
Second-year aid package offered by end of summer	Millennium offered	2883	61.7
	Non-Millennium scholarships/grants	387	8.3
	Pckg with loans or work study	309	6.6
	No offer by mid August*	1092	23.4

*Reference category.

they face lower dropout odds, though their transfer odds are no different from lower-income students (Table 5). During the first semester, middle-income students with greater levels of unmet need (i.e., those in the 30–72%tile with at least $2431 in remaining need) face twice the risk of dropping out, while those from upper and lower-incomes are unaffected. Middle-income students in the top third in terms of remaining need (i.e., at least $5000) are also twice as likely to transfer to another institution (Table 6, Model N). Factoring in unmet need modifies the propensity of income background as a retention determinant, underscoring the importance of considering a student's outstanding financial obligation.

Indeed, the presence of remaining need raises the odds of dropping out or transferring, regardless of the type and amount of aid received (Table 6, Model E and G), while financing via unsubsidized loans raises the dropout risk both during the first and second semester (Table 6, Model B and I). Although financial aid helps equalize the departure odds of students from different income background in the

TABLE 4. Dropout/Stopout and Transfer Odds vs. Re-Enrollment Odds, New Freshmen Fall Terms 2000–2002

		Dropout/Stopout					Transfer				
					Odds Ratio					Odds Ratio	
		Parameter Estimate	Standard Error	Sig.	Full Model	Excl Aid[a]	Parameter Estimate	Standard Error	Sig.	Full Model	Excl Aid[a]
Model A	Intercept	0.20	0.22	0.35			−1.17	0.25	0.00		
Age 19 or older	Yes	−0.13	0.15	NS	−1.14		−0.19	0.17	NS	−1.21	
Gender	Male	0.01	0.10	NS	1.01		−0.26	0.11	*	**−1.30**	**−1.31**
Ethnicity	Unknown	−0.11	0.22	NS	−1.11		0.06	0.23	NS	1.06	
	African/Hispanic/ Native Am	0.01	0.14	NS	1.01		0.19	0.14	NS	1.21	
Residency	Out of state	0.70	0.19	***	**2.02**	**2.19**	1.58	0.20	***	**4.84**	**4.35**
	Other in-state & 'Good Neighbor'	0.28	0.11	**	**1.33**	**1.39**	1.40	0.13	***	**4.04**	**4.00**
Parent Income	Missing	−0.13	0.14	NS	−1.14	**−1.30**	0.29	0.15	NS	1.33	
	Top 28%	−0.24	0.14	NS	−1.27	**−1.40**	0.10	0.15	NS	1.11	
	30–72%tile	−0.06	0.12	NS	−1.06		0.07	0.14	NS	1.08	
High School preparation Index	Top 33%	0.32	0.15	*	**1.38**	**1.39**	0.13	0.16	NS	1.14	
	33–67%tile	0.12	0.11	NS	1.13		0.11	0.12	NS	1.11	
Living on-campus	Yes	−0.56	0.11	***	**−1.76**	**−1.68**	−0.36	0.12	**	**−1.43**	**−1.38**
Campus employment	Yes	−0.19	0.16	NS	−1.21		−0.11	0.16	NS	−1.12	
Use of recreation facilities	Yes	−0.25	0.11	*	**−1.29**	**−1.30**	0.04	0.11	NS	1.04	

Concurrently enrolled	Yes	−0.66	0.24	**	**−1.94**	**−1.96**	−3.18	0.71	***	**−23.81**	**−23.81**
First-semester credit load	>14 credits	−0.30	0.10	**	**−1.36**	**−1.36**	−0.24	0.10	*	**−1.27**	**−1.29**
Major requires Calculus 1	Yes	−0.23	0.12	*	**−1.26**		−0.21	0.13	NS	−1.24	
Passed first-year math course	Yes	−1.09	0.10	***	**−2.97**	**−2.99**	−1.25	0.11	***	**−3.48**	**−3.42**
Took remedial English	Yes	−0.06	0.11	NS	−1.06		−0.25	0.12	*	**−1.29**	**−1.30**
Took remedial math	Yes	0.35	0.13	**	**1.42**	**1.42**	0.44	0.14	**	**1.56**	**1.55**
First-semester GPA	>3.33 (top 3rd)	−1.46	0.23	***	**−4.31**	**−4.33**	−1.21	0.23	***	**−3.36**	**−3.46**
	2.51–3.33 (middle 3rd)	−0.78	0.14	***	**−2.18**	**−2.18**	−0.86	0.16	***	**−2.36**	**−2.36**
Peer challenge during first semester	Weak	−0.40	0.21	*	**−1.49**	**−1.48**	0.11	0.22	NS	1.12	
	Neutral	−0.42	0.14	**	**−1.53**		0.06	0.16	NS	1.06	
First-semester class selection	Big and Full	0.00	0.10	NS	−1.00		0.05	0.10	NS	1.05	
	Small and Open	0.04	0.16	NS	1.04		0.17	0.18	NS	1.19	
Cohort	Fall 2000	−0.04	0.11	NS	−1.04		−0.16	0.12	NS	−1.17	
	Fall 2001	0.08	0.11	NS	1.08		0.29	0.11	*	**1.33**	**1.32**
First-semester financial aid package received	Millennium scholarship only	−0.11	0.16	NS	−1.11	n/a	0.31	0.18	NS	1.36	n/a
	Other scholarships single/comb.	0.07	0.17	NS	1.07	n/a	0.02	0.19	NS	1.02	n/a
	Pckg with loans or work study	0.28	0.18	NS	1.32	n/a	0.41	0.19	*	**1.50**	n/a

***$p \leq .001$; **$p \leq .01$; *$p \leq .05$; [a]Significant variables only.

TABLE 4. (*Continued*)

Model fit (full model)

	−2 Log likelihood	Chi-square	df	Sig.
Intercept	7435			
Final	6335	1099	62	0
Nagelkerke R^2		0.248		
Akaike's IC (AIC)		1.216		

Model accuracy

	Predicted			
Observed	Transfer	Dropout	Return	% correct
Transfer	60	51	458	10.5%
Dropout	38	99	543	14.6%
Return	49	52	3,911	97.5%
Overall %	2.8%	3.8%	93.4%	77.4%

Model Fit (excluding concurrent enrollment, college math variables, and remedial experience)

	−2 Log likelihood	Chi-Square	df	Sig.
Intercept	7241			
Final	6423	818	52	0
Nagelkerke R^2		0.190		

Fit comparison with full model: Chi-Square critical value $29.59 < 88$ (df = 10, $p = 0.001$).

first semester—except for middle income students with higher levels of remaining need—aid does not overcome the effect of income background in the second semester. As a result, parent income shows no significance in the first semester, but does reduce the dropout odds for high-income students in the second semester (Table 4 vs. 5). The fact that lower-income freshmen in the 1996–1999 cohorts faced higher dropout odds suggests that the Millennium Scholarship has helped improve the persistence odds of lower-income students, at least for the first semester.

High School Preparation

In addition to broadening college access for the state's high school graduates, the Millennium Scholarship was established to promote academic excellence and to encourage the state's best students to enroll and persist at in-state colleges and universities. The following results are particularly pertinent as they shed light on how well the institution that attracts, on average, the state's best prepared students is able to retain them (UCCSN, 2004). In contrast to the 1996–1999 new freshmen, the top third of students that entered since the start of the Millennium program are more likely to drop out, facing odds that are about 40% greater than those in the bottom third based on level of academic preparation (Table 4). The propensity for the better prepared to drop out prior to the second year doubles after they re-enroll in the spring. The spring re-enrolled are also more likely to transfer, with the better prepared facing almost twice the odds to do so compared to less prepared students (Table 5). Once re-enrolled in the spring, even average prepared students, those in the middle third, have second-year dropout and transfer odds that are 50–70% greater compared to the less prepared (Table 5).

College Experience

Living on-campus, use of recreation facilities, concurrent enrollment at another college, taking a greater credit load, majoring in a field requiring higher-level math, passing a first-year math course (or enrolling in higher-level math based on placement scores), receiving better grades, and doing at least as well as one's classmates (as measured via the peer challenge) all statistically *improve* the odds of second-year retention (Table 4). The same is true for students returning in the spring, except that the positive impact of grades on retention occurs only for those with a cumulative GPA in the top quartile (Table 5). For the most part, these are the same variables that reduce the odds of

TABLE 5. Dropout/Stopout and Transfer Odds vs. Re-Enrollment Odds, New Freshmen Fall Terms 2000–2002 (spring re-enrolled only)

			Dropout/Stopout				Transfer			
			Parameter estimate	Standard error	Sig.	Odds ratio	Parameter estimate	Standard error	Sig.	Odds ratio
Model O	Intercept		1.30	0.26	0.00		0.21	0.30	0.47	
Demographics	Age 19 or older	Yes	−0.37	0.20	NS	−1.45	−0.13	0.22	NS	−1.14
	Gender	Male	−0.03	0.13	NS	−1.03	−0.57	0.15	***	**−1.76**
	Ethnicity	Unknown	−0.42	0.34	NS	−1.52	−0.25	0.37	NS	−1.29
		African/Hispanic/ Native Am	−0.08	0.18	NS	−1.08	0.14	0.20	NS	1.16
	Residency	Out of state	−0.27	0.22	NS	−1.31	−0.08	0.24	NS	−1.08
		Other in-state & 'Good Neighbor'	0.24	0.15	NS	1.27	1.06	0.17	***	**2.88**
	Parent Income	Missing	−0.49	0.19	**	**−1.63**	−0.01	0.22	NS	−1.01
		Top 28%	−0.49	0.19	**	**−1.63**	0.01	0.22	NS	1.01
		30–72%tile	−0.24	0.16	NS	−1.27	−0.14	0.19	NS	−1.15
	High School Preparation Index	Top 33%	0.97	0.20	***	**2.63**	0.64	0.23	**	**1.90**
		33–67%tile	0.56	0.15	***	**1.74**	0.41	0.17	*	**1.50**
College experience	Living on-campus	Yes	−0.57	0.15	***	**−1.77**	−0.18	0.17	NS	−1.20
	Campus employment	Yes	0.07	0.21	NS	1.07	0.29	0.21	NS	1.33
	Use of recreation facilities	Yes	−0.12	0.14	NS	−1.13	0.05	0.15	NS	1.05

	Concurrently enrolled	Yes	−0.56	0.29	*	**−1.75**	−1.26	0.41	**	**−3.53**
	Second semester credit load	>14 credits	−0.40	0.13	**	**−1.49**	−0.35	0.15	*	**−1.42**
	Major requires Calculus 1	Yes	−0.42	0.16	**	**−1.53**	−0.38	0.19	*	**−1.46**
	Passed first-year math course	Yes	−0.54	0.15	***	**−1.72**	−0.67	0.17	***	**−1.95**
	Took remedial English	Yes	−0.13	0.15	NS	−1.14	−0.09	0.17	NS	−1.10
	Took remedial math	Yes	0.10	0.18	NS	1.11	0.22	0.19	NS	1.24
	Second semester cumulative GPA	Top Q (>3.47)	−0.75	0.29	**	**−2.11**	−0.30	0.32	NS	−1.35
		2nd Q (3.00–3.47)	−0.44	0.24	NS	−1.55	−0.28	0.27	NS	−1.32
		3rd Q (2.46–3.00)	−0.31	0.18	NS	−1.36	−0.25	0.21	NS	−1.28
	Peer challenge	Weak	−0.27	0.24	NS	−1.31	0.21	0.27	NS	1.24
		Neutral	−0.03	0.17	NS	−1.04	0.31	0.20	NS	1.36
	Cohort	Fall 2000	−0.07	0.14	NS	−1.07	−0.12	0.17	NS	−1.13
		Fall 2001	0.04	0.15	NS	1.04	0.23	0.16	NS	1.26
Financial Aid	Second semester aid package	Millennium only	−0.75	0.18	***	**−2.11**	−0.74	0.20	***	**−2.11**
	received	Millennium & grants/other gift aid	−0.25	0.18	NS	−1.28	−0.29	0.20	NS	−1.34
	Second year aid package	Millennium offered	−3.39	0.17	***	**−29.41**	−4.36	0.25	***	**−77.96**
	offered by end of summer	Non-Millennium scholarships/grants	−1.59	0.20	***	**−4.90**	−1.61	0.21	***	**−5.01**
		Pckg with loans or work study	−3.10	0.34	***	**−22.22**	−3.21	0.36	***	**−24.76**

***$p \leq 0.001$; **$p \leq 0.01$; *$p \leq .05$.

TABLE 5. (*Continued*)

Model fit

	−2Log likelihood	Chi-Square	df	Sig.
Intercept	5198			
Final	3554	1.644	64	0
Nagelkerke R^2		0.440		
Akaike's IC (AIC)		0.775		

Model accuracy

	Predicted			
Observed	Transfer	Dropout	Return	%correct
Transfer	69	57	201	21.1%
Dropout/Stopout	39	118	287	26.6%
Return	31	65	3804	97.5%
Overall %	3.0%	5.1%	91.9%	85.4%

TABLE 6. Dropout/Stopout and Transfer Odds versus Re-Enrollment Odds, New Freshmen Fall Terms 2000–2002

		Dropout/Stopout				Transfer			
		Parameter estimate	Standard error	Sig.	Odds ratio	Parameter estimate	Standard error	Sig.	Odds ratio
Model B: Aid Type	Pells	0.16	0.11	NS	1.18	0.06	0.13	NS	1.06
First-semester amount	Non-Pell Grants	0.01	0.18	NS	1.01	0.13	0.18	NS	1.14
received (per $1000)	Subsidized Loans	−0.04	0.11	NS	0.96	0.03	0.12	NS	1.03
	Unsubsidized Loans	0.12	0.04	**	**1.13**	0.05	0.04	NS	1.05
	Millennium Scholarships	−0.03	0.12	NS	0.97	0.30	0.13	*	**1.35**
	Other Scholarships	−0.02	0.07	NS	0.98	−0.19	0.08	*	**−1.21**
Model C: Source	State/Federal	0.10	0.03	**	**1.10**	0.06	0.03	*	**1.07**
First-semester amount	Institutional	−0.03	0.07	NS	0.97	−0.19	0.07	**	**−1.21**
received (per $1000)									
Model D: Millennium Status	Non-Millennium student	0.46	0.89	**	**1.54**	−0.12	0.16	0.46	0.89
	Received and lost after first semester	0.00	1.81	***	**2.54**	0.59	0.15	***	**1.81**
Model E: First-semester	Pells	−0.07	0.13	NS	0.93	−0.13	0.14	NS	0.88
amount received & first-year	Non-Pell Grants	−0.08	0.18	NS	0.93	0.06	0.18	NS	1.07
remaining need (per $1000)	Subsidized Loans	−0.07	0.11	NS	0.93	0.00	0.12	NS	1.00
	Unsubsidized Loans	0.13	0.04	***	**1.14**	0.06	0.04	NS	1.06
	Millennium Scholarships	0.03	0.12	NS	1.03	0.36	0.14	**	**1.43**
	Other Scholarships	0.02	0.07	NS	1.02	−0.16	0.08	*	**−1.18**
	Remaining Need	0.09	0.02	***	**1.10**	0.08	0.02	***	**1.08**
Model F: First-year remaining need (per $1000)		0.08	0.02	***	**1.09**	0.07	0.02	***	**1.07**

TABLE 6. (*Continued*)

		Dropout/Stopout				Transfer			
		Parameter estimate	Standard error	Sig.	Odds ratio	Parameter estimate	Standard error	Sig.	Odds ratio
Model G: First-semester aid package received and remaining need (per $1000)	Millennium scholarship only	−0.09	0.16	NS	0.92	0.33	0.18	NS	1.39
	Other scholarships single/comb.	0.00	0.17	NS	1.00	−0.03	0.19	NS	0.97
	Pckg with loans or work study	0.18	0.18	NS	1.20	0.34	0.19	NS	1.40
	Remaining 1st year need ($ amount)	0.08	0.02	***	**1.08**	0.07	0.02	***	**1.07**
Model M: HS Prep/Remaining 1st year need (Yes/No) Interaction (1st sem aid controlled): Top 33% with remaining 1st year need		0.13	0.25	NS	1.14	0.60	0.26	*	**1.86**[a]
Model N: Parent Income/Remaining 1st year need (ordinal) Interaction (1st sem aid controlled): 30–72% tile Parent Income	Top 3rd remaining need (> $4999)	0.82	0.33	*	**2.33**[a]	0.87	0.38	*	**2.43**[a]
	Middle 3rd remaining need ($2431–$4999)	0.92	0.35	**	**1.83**[a]	0.69	0.41	NS	1.99
	Bottom 3rd remaining need (< $2431)	0.35	0.36	NS	1.41	0.72	0.40	NS	2.04

***$p \leq 0.001$; **$p \leq 0.01$; *$p \leq 0.05$.

[a]Product of main effects and interaction effect.

Note: Each model derived separately using the demographic, high school, and college experience variables in Table 4.

transferring out. Notably stronger is the effect of concurrent enrollment at another post-secondary institution in keeping students from transferring out during the first semester. The transfer-out risk is also mitigated for students in remedial English (Table 4). The college experience results of the Millennium cohorts are comparable to the pre-Millennium cohorts, except that being in need of math remediation has emerged as a dropout and transfer-out risk. Conversely, students selecting math-intensive majors have more favorable second-year return odds, particularly once they persist into the spring semester, compared to pre-Millennium cohorts that were not impacted by the math-intensity of the major.

These results confirm that the great increase in available aid due to the Millennium program has not diminished the role of academic performance and integration in determining student retention. As the odds ratios show, better grades and passing a first-year math course are the two most important factors during the first semester in lowering the dropout risk followed by concurrent enrollment, living on campus, and doing academically no worse than one's classmates (Table 4). A similar picture emerges on the transfer-out side. While both grade point average and peer challenge are less significant once the student makes it into the second term, the importance of math endures. Specifically, succeeding in a first-year math course and selecting a math-intensive major lowers the dropout and transfer risk during both the first and second semester; in contrast, peer challenge is no longer a factor in the second term, and cumulative grade average reduces dropout odds for only the top quartile and does not affect the transfer risk (Tables 4 and 5).

The disparate impact of remedial math vs. remedial English further demonstrates the importance of math as an at-risk indicator. Enrollment in remedial math raises the odds to both dropout and transfer-out, while remedial English actually reduces the odds to transfer out (Table 4). Unlike math, deficiency in English is more likely due to the soaring number of non-native speakers entering the institution, not simply a lack of sufficient preparation in high school. The readiness to take on, and pass, math—a subject matter typically considered difficult and less popular for most students—showed up early in the analysis as a likely factor weighing on retention. A simple cross tabulation confirmed that freshmen who took no math at all during the first year were five times less likely to return in the second year.

While living on campus and taking at least one course beyond the minimum full-time requirement (i.e., more than 14 credit hours) had an expected positive impact on retention—the former measuring social integration, the latter indicating student commitment—use of recreation facilities and concurrent enrollment are not widely used factors in

retention studies. Results suggest that recreation has an initial impact—helping students get together—but one that apparently wears out during the second term. Concurrent enrollment, on the other hand, affects both first and second term enrollees, with a distinctly greater impact on reducing the odds of transferring out (Tables 4 and 5).

Financial Aid

The impact of financial aid on retention has been magnified with the arrival of the Millennium Scholarship in fall 2000, as students from lower-income backgrounds no longer face increased dropout odds during the first semester. However, this equalization effect does not carry over into the second semester, with upper-income students facing reduced dropout odds compared to those from middle and lower incomes (Tables 4 and 5). As discussed in the demographics section, the financially induced risk of increased departure may not be the same for all students. Controlling for remaining need across income groups suggests that middle-income students with greater amounts of outstanding first-year need are the ones affected by insufficient support. And the greater the remaining need, the higher the dropout risk for these students (Table 6, Model N). Conversely, there was no significant interaction effect for lower-income students across all possible combinations of financial aid indicators; thus, support for these students appears to be sufficient as their retention odds are not negatively impacted.

Results based on package type show that loans, or work study, increase a student's transfer risk, but do not affect dropout (Table 4). This is likely due to the addition of Millennium dollars received, as packages with loans and work study did raise the dropout odds for pre-Millennium students. The positive effect of Millennium support is particularly strong for students who persisted into the spring term (Table 5). At that point, a Millennium Scholarship by itself appears to be more effective in retaining students than a combination of scholarships or packages with loans and/or work study, whether second-year offers are factored in or not (see Table 7, Model J). As much as the Millennium Scholarship helps students stay enrolled, losing it due to insufficient grades or credits completed raises the dropout and transfer-out odds beyond the level of non-Millennium students. While the latter face 1.5 times the dropout odds compared to Millennium students who retain scholarship eligibility, those losing eligibility incur 2.5 times the dropout odds (Table 6, Model D).

Using the spring cohorts allows the incorporation of second-year offered aid into the model and its effect on other predictors. Controlling for second-year offers enhances the impact of Millennium support and

TABLE 7. Dropout/Stopout and Transfer Odds vs. Re-Enrollment Odds New Freshmen Fall Terms 2000–2002 (spring re-enrolled only)

		Dropout/Stopout				Transfer			
		Parameter estimate	Standard error	Sig.	Odds ratio	Parameter estimate	Standard error	Sig.	Odds ratio
Model I:	Pells	0.16	0.14	NS	1.18	0.10	0.16	NS	1.11
Spring semester	Non-Pell Grants	−0.10	0.22	NS	−1.11	0.25	0.21	NS	1.28
amount received	Millennium Scholarships	−0.30	0.12	**	**−1.35**	−0.06	0.14	NS	−1.06
(per $1000)	Other Scholarships	0.00	0.07	NS	1.00	−0.06	0.08	NS	−1.06
	Unsubsidized Loans	0.12	0.06	*	**1.13**	0.09	0.06	NS	1.09
	Subsidized Loans	0.01	0.12	NS	1.01	−0.06	0.14	NS	−1.06
Model J:	Millennium only	−0.44	0.16	**	**−1.55**	−0.38	0.17	*	**−1.46**
Spring semester aid	Millennium & grants/other gift aid	−0.22	0.16	NS	−1.24	−0.32	0.18	NS	−1.38
package received	Millennium offered	−3.34	0.17	***	**−27.78**	−4.29	0.25	***	**−71.43**
Model K:	Non-Millennium scholarships/grants	−1.41	0.19	***	**−4.08**	−1.44	0.21	***	**−4.22**
Second year aid package offered	Pckg with loans or work study	−2.86	0.33	***	**−17.54**	−2.96	0.35	***	**−19.23**

***$p \leq 0.001$; **$p \leq 0.01$; *$p \leq 0.05$.

Note: Each model derived separately using the demographic, high school, and college experience variables in Table 5.

confirms the significant influence aid offers have on second-year retention (Table 7, Model K). Though some caution must be exercised in interpreting effect size (as previously mentioned), the fact that every type of package offered appears to improve retention, both on the dropout and transfer side, is indicative of the strong inducement financial *offers* have on student enrollment. This connection has been well examined on the recruitment side (Braunstein, McGrath, and Pescatrice, 1999; St. John, 2000), but not in the retention context. The importance of including offered aid in the analysis is underlined by the notable improvement in model fit and prediction accuracy (Tables 4 and 5).

Looking at the price-response effect of $1000 in first-semester aid received, three types of aid have a significant effect on retention in relation to students without aid. Unsubsidized loans slightly increase the dropout odds; the same amount of Millennium money raises the transfer-out odds by a greater margin; while $1000 in other types of scholarships reduces the transfer-out odds by a somewhat smaller degree (Table 6, Model B). Factoring in remaining need alters the effect size of the price response to these three aid types only minimally (Table 6, Model E). The effect of $1000 in remaining need is very consistent, whether the price response to different types of aid is included or not, raising the dropout and transfer-out odds around seven to ten percent (Table 6, Model E, F, G). Unsubsidized loans have the same effect on dropout in the second term as in the first term (Tables 6, Model B and 7, Model I). Price response to Millennium dollars is different in the second term, reducing the odds of dropout with no effect on transfer-out (Table 7, Model I). Lastly, examining the price response by source of aid, institutional aid, which occurs mostly in form of grants and scholarships, reduces the odds of transferring out. In contrast, state and federal aid slightly heightens the odds of both types of departure (see Table 6, Model C).

DISCUSSION

Results in this study are based on new freshmen enrolled at a public university with a liberal admissions policy and a largely commuter campus in a medium-size urban area. Comparisons with previous studies are designed to find some congruence on specific parameter effects, notwithstanding differences in population or sample attributes, model specification, and methodological approach.

Among demographic attributes, the finding that non-local students are more difficult to retain is supported by DuBrock and Fenske (2000), but not McGrath and Braunstein (1997). The latter study also showed

gender to have no impact on retention, unlike Somers (1995), who found women to depart at a greater rate than men. In this study, women are at greater risk of transferring to another institution, but they are no more likely to drop out than men. Corroboration of income background results is more difficult to establish as most other studies did not test second-term returnees *per se*, which is a key factor in this study. Still, the findings in Hu and St. John (2001), Paulsen and St. John (2002), Cofers and Somers (1998), and Leppel (2002) that low-income or first-generation students (Ishitani, 2003) are more likely at risk of dropping out tend to support the results for second-term returnees here. Bresciani and Carson (2002) as well as McPherson and Schapiro (1990) support the finding here that remaining need has a negative effect on retention. Paulsen and St. John (2002) also lend support to the conclusion here that, depending on income background, adding loans to an aid package worsens a student's chance of return. Results from the Paulsen and St. John study apply only to low-income students, compared to middle-income students in this study. The finding that aid helps equalize enrollment persistence for students from different income backgrounds is echoed in St. John (2000) and Braunstein et al. (2001). However, the positive effect of aid may not last beyond the first term of attendance, as this study shows. Cambiano et al. (2000) confirm the importance of high school preparation in bolstering freshmen retention, while Leppel (2002), Tinto (1997), Cabrera et al. (1993), Perna (1997), and Hu and St. John (2001) all parallel the results here that grade point average is a strong predictor of student persistence. The finding in this study that students selecting math-intensive majors are more likely to persist is echoed by Fenske et al. (1999), who concluded that low-income and minority students with physical sciences majors had a lower dropout rate; conversely, St. John et al. (2004) reported a higher dropout for Caucasian students majoring in the less math-intensive social sciences. The positive effect associated with using recreational facilities is supported by Belch, Gebel, and Maas (2001).

Results from this investigation are important to theory development—having addressed three areas considered underdeveloped in retention modeling—and of practical significance to the institution from which the data are drawn. On the theoretical side, the call to measure more directly specific curricular requirements that strongly correlate with student persistence finds consistent support in this study, both in terms of overall model fit and individual parameter significance. Next to the college grade point average, student performance in first-year math courses is the strongest retention predictor for new freshmen in their first semester. Even more important than overall grades is math

performance in the second semester, which affects a student's chance to dropout *or* transfer out. The significance of academic preparation in that area is further underlined by the greater dropout and transfer risk of remedial math students. In contrast, the need for remediation in English does not jeopardize retention, which supports Adelman's (1999) finding that the level of math comprehension attained in high school is the single most important preparatory factor for student success at the post-secondary level. This may also explain why students in more math-intensive majors are increasingly less likely to drop out as they move from first to second term. Considering the set of variables controlled for in this study, the discrete effect of a student's first-year math experience on second-year retention confirms the need to more closely examine preparation and curricular requirements in math and its relationship to student retention.

The inclusion of an indicator tracking simultaneous enrollment at other college-level institutions, coupled with measuring its effect on both dropout and transfer-out, further illuminates new freshmen enrollment behavior, particularly as it relates to swirling in and out of different institutions. Results suggest that concurrent enrollment at another institution cuts the dropout risk by half and reduces the transfer-out risk considerably during the first and second semester. A significant factor also in the enrollment behavior of the 1996–1999 pre-Millennium cohorts, concurrent enrollment may be another way to measure a student's educational commitment. Simultaneous enrollment at multiple institutions may offer students the kind of complementary choices that facilitate scheduling of classes and completion of the required course load that are of growing importance in their effort to balance school with work and to progress towards a degree. This explanation seems reasonable, considering that 75% of students at 4-year institutions are working, while 40% are simultaneously enrolled at two or more institutions (Gardner, McClenney, and Terenzini, 2004). The much greater impact of concurrent enrollment in reducing the transfer-out risk, compared to its effect on dropout, suggests, at least in this case, that students look for added choices, not to leave the institution for another. Knowing which courses students take concurrently, and where they take them, may help substantiate the view that student enrollment decisions are increasingly guided by consumeristic considerations—emphasizing choice, flexibility, low cost, and faster completion.

Equally important to understanding second-year enrollment choices of freshmen is the role of financial aid. Students on loans or work study are more likely to transfer out after the first semester compared to those receiving no aid at all. The dropout risk is particularly pronounced for

middle-income students with a greater amount of unmet need. Similarly, students who take out unsubsidized loans—for the first or second semester—face an elevated dropout risk. Coupled with results from the price-response models that measure the effect of dollars received, these findings are not surprising. Unsubsidized loans are typically the last resort for students in need and constitute an immediate payback burden—forcing some students to give up school for work. Immediate-payback loans do not affect transfer-out odds, however, as holders of these loans are likely unable to stay in school. The impact of aid received must also be examined in conjunction with remaining (unmet) need, a factor that consistently raised the dropout and transfer-out risk across different models examined (Table 6, Model E, F, G, M, N).

Term-specific analysis of financial aid, separation of aid into awards received vs. second-year offers made, analysis of interaction effects with other factors by aid type, and isolation of the effects of a large-scale, state-funded scholarship all yielded additional insights into how economics shapes new freshmen persistence into the second year. Results show that the first-semester equalization effect of financial support for students from different income backgrounds does not endure into the second semester. Income is highly correlated with years of formal education,[6] socioeconomic status, and a focus on education (Cabrera and La Nasa, 2001). Hence, the effect of greater social and cultural capital at the higher income level cannot be cancelled out with aid alone.

The importance of examining aid separately for the first and second semester is also borne out in the results associated with aid package. For example, after re-enrolling in the spring, freshmen who depend solely on the state-funded Millennium Scholarship are twice as likely to return compared to students with combined aid packages. Being able to count on one, comparatively reliable source of support, which covers the entire tuition, may be a distinct advantage to students who like to avoid having to rely on multiple, less certain funding sources that involve a greater amount of application paperwork.

Once a student persists into the second term, the prospect of support for the second year has a decidedly stronger effect on retention than first-year aid received. Including second-year financial aid offers in the analysis may further improve prediction of a student's second-year enrollment choice. Establishing the exact inducement effect of aid awards is complicated, though, due to selection bias and the fluid timing of award processing across different offers. For example, some awards are easily anticipated by students, but not formally made until weeks later. In this study, information on second-year aid offers enhanced the prediction accuracy of the spring model, as reflected in

the large effect size associated with aid offers. Such information could be added to enrollment predictions at staggered points in time during the spring semester to facilitate timely intervention with at-risk students. Employing prediction models in this way is not new, and the ability to target individual students based on departure risk and underlying risk factors should yield operationally useful information to student support services and academic advising alike. Since a student's financial aid status may change substantially (e.g., loss of scholarship eligibility from one term to the next), the model used to generate predicted enrollment at a given point should be guided by availability of reliable data, the comparative accuracy of models that control different financial aid aspects, as well as statistical considerations associated with non-ordered multinomial outcomes (see, e.g., Weiler, 1987, 1996).[7]

Finally, the study furnishes several insights into the effect of a large-scale, state-funded scholarship, the Millennium program. Unquestionably, Millennium aid has been the prime catalyst behind the 10% rise in the college-going rate of the state's high school graduates since the inception of the program (UCCSN, 2004). At the institution, the average proportion of new freshmen on scholarship aid more than tripled during that period. Contrary to the national trend of steady increases in the proportion of non-gift aid financing (IHEP, 2004), students at this institution rely less on debt-incurring assistance, thanks to Millennium support. The proportion of new freshmen on loans dropped by 4 percentage points, without a notable increase in the amount borrowed.

Benefits associated with the Millennium-driven growth in new freshmen enrollment—from increased funding to drawing more students from outside the local area, particularly from the high population center at the south-end of the state—must be tempered by the absence of any improvement in the overall retention rate and a diluted level of academic preparation in new freshmen that occurred with the start of the scholarship. For example, average new freshmen ACT Composite, first-semester GPA, and second-semester GPA dropped by 1.45, 0.40, and 0.17 points. A rise in the proportion of remedial students, a drop in those selecting math-intensive majors, and, perhaps most importantly, a 20% scholarship eligibility attrition rate among Millennium students after the *first* semester are signs that a growing number of underprepared students are entering the institution. Having tied first-semester eligibility to a reasonably achievable high school GPA of 3.0—the average high school GPA for new freshmen being 3.37—the great majority of in-state high school graduates qualifies for the scholarship, as confirmed by the rising proportion of entering freshmen with Millennium support

since the start of the scholarship (UCCSN, 2004). And although the higher departure odds of non-local students since the beginning of the Millennium program cannot be directly tied to it, as the reduced model without aid shows (Table 4), the portability of Millennium aid facilitates transfer within the state, particularly for students from the south-end of the state, where a comparable range of undergraduate programs is offered.

Another issue of concern is the retention of well prepared freshmen. The higher departure odds of these students—a problem that worsens in the second term—may hint at two problems: Millennium aid attracts students that previously did not consider the institution an enrollment choice, but now make use of the free tuition for the first year or two before transferring to a more selective school out of state. Descriptive data based on the study's 1-year tracking window suggest that Millennium students who maintained scholarship eligibility and transferred out of state are on average better than those who decided to stay in-state (Table 8). Secondly, some of the better prepared students may leave due to insufficient institutional support. For example, better prepared students with unmet need are more likely to transfer out compared to the less prepared whose needs are met (Table 6, Model M).

From an institutional perspective, both issues raise the question of how best to allocate available aid in order to promote access without compromising academic preparation and retention. For example, students who lost Millennium eligibility had on average significantly lower ACT scores and first-semester GPAs compared to those who maintained eligibility or never received the scholarship (Table 9). More importantly, the ones who lost eligibility entered with higher high school grades compared to non-Millennium students that had higher standard test scores (Table 9). Clearly, basing initial Millennium eligibility on high school grades complicates institutional efforts to improve academic preparation of new freshmen without raising admission standards. Meanwhile, the negative impact of unmet need on better students suggests that giving greater priority to test scores over high school grades when awarding institutional aid may help attract *and* retain such students. Indeed, institutional scholarships awarded to only well prepared students offer the prestige and recognition that promotes the kind of enrollment loyalty, which is less likely the case with a portable, statewide scholarship that is available to the vast majority of students. Since the propensity to remain enrolled is influenced by financial support from the institution *and* a student's unmet need, according to the findings, adjusting financial aid awards for those students with marginally positive or negative return

TABLE 8. Fall 2000–2002 New Freshmen Transfer-Out Students by Millennium Status and Transfer Destination

First semester millennium status		Transfer destination: Out of state *N*	Out of state Mean	In-state *N*	In-state Mean	Total *N*	Total Mean
Not received	ACT composite	89	22.18	72	20.13	161	21.26
	High school GPA	98	3.21	74	2.88	172	3.07
	First semester GPA	89	2.53	72	1.75	161	2.18
	Total 1st semester Aid ($1K)	100	1.05	75	1.24	175	1.13
	1st Sem. institutional aid ($1K)	100	0.26	75	0.25	175	0.26
Received and lost after first semester	ACT Composite	15	21.40	140	21.08	155	21.11
	High school GPA	15	3.11	146	3.17	161	3.16
	First semester GPA	13	0.93	131	1.28	144	1.25
	Total 1st semester Aid ($1K)	15	1.36	146	1.63	161	1.60
	1st Sem. institutional aid ($1K)	15	0.06	146	0.16	161	0.15
Received and eligible after first semester	ACT composite	50	24.02	225	22.41	275	22.70
	High school GPA	50	3.53	232	3.36	282	3.39
	First semester GPA	50	3.19	232	2.98	282	3.02
	Total 1st semester aid ($1K)	50	1.96	232	2.10	282	2.08
	1st Sem. institutional aid ($1K)	50	0.55	232	0.26	282	0.31
Total	ACT composite	154	22.70	437	21.61	591	21.89
	High school GPA	163	3.30	452	3.22	615	3.24
	First semester GPA	152	2.61	435	2.26	587	2.35
	Total 1st semester Aid ($1K)	165	1.35	453	1.81	618	1.69
	1st Sem. institutional aid ($1K)	165	0.33	453	0.23	618	0.25

The shaded values indicate that only 8% of Millennium-supported students who maintained eligibility after the first semester transferred to an out-of-state institution. Yet, on average, they are among the best students in the new freshmen class. The loss of better students to out-of-state institutions also occurs among those who never received Millennium support.

TABLE 9. Fall 2000–2002 New Freshmen by Millennium Status and Second Year Enrollment Outcome

		Transfer within 1 Year		Dropout/ Stopout		Return		Total	
First semester millennium status		*N*	Mean	*N*	Mean	*N*	Mean	*N*	Mean
Not received	ACT composite	161	21.26	184	21.52	711	22.19	1056	21.93
	High school GPA	172	3.07	202	2.98	757	3.15	1131	3.11
	First semester GPA	161	2.18	189	1.73	759	2.72	1109	2.47
	Total 1st semester Aid ($1K)	175	1.13	203	1.20	761	1.31	1139	1.27
	1st Sem. institutional aid ($1K)	175	0.26	203	0.23	761	0.32	1,139	0.30
Received and lost after first semester	ACT composite	155	21.11	253	21.25	400	21.65	808	21.42
	High school GPA	161	3.16	261	3.21	410	3.22	832	3.21
	First semester GPA	144	1.25	237	1.21	398	1.97	779	1.61
	Total 1st semester aid ($1K)	161	1.60	261	1.74	410	1.62	832	1.65
	1st Sem. institutional aid ($1K)	161	0.15	261	0.18	410	0.24	832	0.21
Received and eligible after first semester	ACT composite	275	22.70	266	22.81	2909	23.12	3450	23.06
	High school GPA	282	3.39	273	3.43	2962	3.47	3517	3.46
	First semester GPA	282	3.02	273	2.93	2964	3.22	3519	3.18
	Total 1st semester aid ($1K)	282	2.08	273	1.96	2964	1.96	3519	1.97
	1st Sem. institutional aid ($1K)	282	0.31	273	0.40	2964	0.48	3519	0.46

TABLE 9. (*Continued*)

First semester millennium status		Transfer within 1 Year		Dropout/ Stopout		Return		Total	
		N	Mean	*N*	Mean	*N*	Mean	*N*	Mean
Total	ACT composite	591	21.89	703	21.91	4020	22.81	5314	22.59
	High school GPA	615	3.24	736	3.23	4129	3.39	5480	3.35
	First semester GPA	587	2.35	699	2.02	4121	3.01	5407	2.81
	Total 1st semester aid ($1K)	618	1.69	737	1.67	4135	1.81	5490	1.78
	1st Sem. institutional aid ($1K)	618	0.25	737	0.28	4135	0.43	5490	0.39

The shaded values indicate that over 50% of those who lost eligibility after the first semester did not return; in contrast, only 15% of those who maintained eligibility transferred or dropped out, while 33% of those without Millennium support (e.g., out-of-state students) did so. The Millennium scholarship also attracts underprepared students based on grades and test scores of those who lost eligibility: Their average first-semester GPA was 1.61, compared to 3.18 and 2.47 for those who maintained eligibility or never had one from the start, respectively. Similarly, their ACT scores are lower compared to those maintaining eligibility or those who never had one (21.42 vs. 23.06 and 21.93). The latter group, however, entered with a lower average high school GPA (3.11 vs. 3.21) compared to those who lost scholarship eligibility, which may indicate an inflationary effect on high school grades associated with GPA-based initial Millennium awards.

odds may help maximize the institution's retention rate for a given amount of available aid.

Variables in the tested models that show no significant relationship to second-year enrollment behavior of new freshmen include student age, ethnicity/race, campus employment, class size, and the difficulty of getting into a class due to limited enrollment capacity. Age has had an inconsistent impact on retention in other studies (McGrath and Braunstein, 1997; Somers, 1995), and the results here suggest that delaying entry into college after graduating from high school does not appear to be a risk factor. Both main and interaction effects across all variables in the model produce no significance along student ethnicity, a finding that is supported by most of the cited studies. Similarly, campus employment does not weigh in on retention; a conclusion also arrived at by Beeson and Wessel (2002). Since, campus employment did diminish the dropout risk for pre-Millennium students, availability of the scholarship seemingly evened out the retention risk for the non-employed. Certainly, introduction of the Millennium Scholarship coincides with a lessened need for campus work, as the proportion of students employed on campus dropped by over 4 percentage points. This economic argument may have to be supported by confirming the absence of any academic or social integration effect due to on-campus employment. Finally, the lack of any statistical significance associated with average class size and class enrollment difficulty helps assuage concern that soaring new freshmen enrollment may have led to class sizes or insufficient class offerings that are negatively affecting student retention.

CONCLUSIONS

The departure risk of students is typically the highest in the first year, which requires a solid understanding of which factors are likely to elevate that risk and at what point during the freshmen year. This study attempted to shed some light on how to approach the retention challenge, in the context of both theory development and institutional operation. The former is addressed with greater emphasis on three areas considered underdeveloped in retention research, namely the growing trend among students to attend multiple institutions, either concurrently or sequentially; the impact of financial aid, or lack thereof, including the effect of large-scale, state-funded merit aid; and the mounting challenge of retaining students that are insufficiently prepared to take on introductory college-level work.

Findings demonstrate the significance of examining risk factors from both a dropout and transfer-out perspective, while controlling for the

probability that a student may be enrolled concurrently at another institution. The level of departure risk associated with a given factor varies between dropout and transfer-out and is influenced also by simultaneous enrollment somewhere else. Similarly, how one accounts for the range of financial aid conditions students face has a significant bearing on which factors are seen as principal hazards to student persistence. At the same time, aid impact analysis can scarcely proceed without factoring in a student's level of academic preparation and academic challenges that are typically encountered during the first year.

In the debate over access vs. preparation it is worth noting that the state-funded merit aid program—one of a dozen in the country—examined here has helped widen the college-going rate in the state. However, its effect on *retention* at the institution is ephemeral compared to a student's academic experience, particularly in math. For the same reason, academically well prepared students, who seek to maximize their learning experience, are more difficult to retain with aid alone, as shown in this study. The biggest retention return on aid is likely to come from middle-income students who take on larger debt, as the findings suggest. As the institution devises programs to enhance freshmen retention, the results here help target those students identified at risk where programmatic intervention may have the greatest prospect for success.

ACKNOWLEDGMENT

The author wishes to thank the anonymous reviewers for their helpful comments.

ENDNOTES

1. For more information, check the website at: http://millennium.state.nv.us/
2. E.g., removal of 48 cases based on Mahalanobis distance <61.10 (X^2 critical value at $p < 0.001$, df = 31) and predicted $p = 0.1$ through 0.9 had no meaningful change on model fit indicators. Detailed diagnostic results may be obtained from the author.
3. These are in most cases the default settings in SPSS, version 12.0.1, the statistical package used. This maximizes the power of the algorithm to seek likelihood convergence.
4. An internal analysis (PBA, 2–27–03) revealed that, on average, the rate of successful enrollment in remedial courses for students that tried to enroll in classes that were already full dropped from 5.6% to 2% for fall 1997–1999 cohorts; the average number of remedial English classes offered during fall terms was 23, while the number of remedial Math classes was 10.
5. Results for the pre-Millennium 1996–99 cohorts may be obtained from the author.
6. A correlation of 0.95 was calculated using 2003 Census Bureau statistics. U.S. Department of Commerce, Bureau of the Census, Current Population Reports, Series P-60, various years.

7. In multinomial models, accuracy of predicted *departure* is typically poor due to the lop-sided distribution in actual enrollment outcomes (i.e., most institutions retain many more students than they lose), the assumption that alternative outcomes to retention are equally likely, and computational constraints in measuring model specificity vs. sensitivity across more than two outcomes via established criteria (e.g., Brier score, Hosmer-Lemeshow fit, ROC graphing). Selecting a random sample of retained students of equal size to dropouts and transfer-out students is typically employed when prediction is the goal.

REFERENCES

Adelman, C. (2004). *Principal Indicators of Student Academic Histories in Postsecondary Education, 1972–2000*, US Department of Education, Washington, DC.

Adelman, C. (1999). *Answers in the Tool Box*, US Department of Education, Washington, DC.

Astin, A. W. (1984). Student involvement: A developmental theory for higher education. *Journal of College Student Personnel* 25(4): 297–308.

Bean, J. P. (1985). Interaction effects based on class level in an explanatory model of college student dropout syndrome. *American Educational Research Journal* 22(1): 35–65.

Bean, J. P. (1982). Student attrition, intentions, and confidence: interaction effects in a path model. *Research in Higher Education* 17(4): 291–319.

Bean, J. P. (1980). Dropouts and turnover: The synthesis and test of a causal model of student attrition. *Research in Higher Education* 12(2): 155–187.

Beeson, M., and Wessel, R. (2002). The impact of working on campus on the academic persistence of freshmen. *Journal of Student Financial Aid* 32(2): 37–45.

Beil, C., Reisen, C. A., and Zea, M. C. (1999). A longitudinal study of the effects of academic and social integration and commitment on retention. *NASPA Journal* 37(1): 376–385.

Belch, H., Gebel, M., and Maas, G. M. (2001). Relationship between student recreation complex use, academic performance, and persistence of first-time freshmen. *NASPA Journal* 38(2): 254–268.

Belsley, D. A. (1991). *Conditioning Diagnostics*, Wiley, New York.

Berger, J. B., and Braxton, J. M. (1998). Revising Tinto's interactionalist theory of student departure through theory elaboration: Examining the role of organizational attributes in the persistence process. *Research in Higher Education* 39(2): 103–119.

Bettinger, E. (2002, August). How financial aid affects persistence. Working paper, Case Western Reserve University.

Billson, J. M., and Brooks-Terry, M. (1987). A student retention model for higher education. *College and University* 62(4): 290–305.

Borden, V. M. H. (2004). Accommodating student swirl: When traditional students are no longer the tradition. *Change* 36(2): 10–17.

Braunstein, A., McGrath, M., and Pescatrice, D. (2001). Measuring the impact of financial factors on college persistence. *Journal of College Student Retention* 2(3): 191–203.

Braunstein, A., McGrath, M., and Pescatrice, D. (1999). Measuring the impact of income and financial aid offers on college persistence. *Research in Higher Education* 40(3): 247–259.

Braxton, J. M. (2000). *Reworking the Student Departure Puzzle*, Vanderbilt University Press, Nashville, TN.

Braxton, J. M., Milem, J. F., and Sullivan, A. S. (2000). The influence of active learning on the college student departure process. *Journal of Higher Education* 71(5): 569–590.

Braxton, J. M., Sullivan, A. S., and Johnson, R. M. (1997). Appraising Tinto's theory of college student departure. In: Smart, J. C. (ed.): *Higher Education: Handbook of Theory and Research (Vol. 10)*, Agathon Press, New York, pp. 107–164.

Bresciani, M. J., and Carson, L. (2002). A study of undergraduate persistence by unmet need and percentage of gift aid. *NASPA Journal* 40(1): 104–123.

Cabrera, A. F., and La Nasa, S. M. (2001). On the path to college: Three critical tasks facing America's disadvantaged. *Research in Higher Education* 42(2): 119–149.

Cabrera, A. F., Nora, A., and Castaneda, M. (1993). College persistence: Structural equations modeling test of an integrated model of student retention. *Journal of Higher Education* 64(2): 123–39.

Cabrera, A. F., Castaneda, M. B., Nora, A., and Hengstler, D. (1992). The convergence between two theories of college persistence. *Journal of Higher Education* 63(2): 143–64.

Cambiano, R. L., Denny, G. S., and De Vore, J. B. (2000). College student retention at a midwestern university: A six-year study. *Journal of College Admission* 166(Winter): 22–29.

Clabaugh, J. (2004, January 15). Sallie Mae doles out record student loans. *Washington Business Journal*. Retrieved January 29, 2004, from http://washington.bizjournals.com/washington/stories/2004/01/12/daily27.html.

Cohen, J., Cohen, P., West, S. G., and Aiken, L. S. (2003). *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*, 3L. Erlbaum Associates Publishers, Mahwah, NJ.

Cofers, J., and Somers, P. (1998, April). I sold my soul to the company store: low debtload influences student decisions at public and private colleges. Paper presented at the American Educational Research Association annual meeting, San Diego, CA.

DesJardins, S. (2003). Event history methods: Conceptual issues and an application to student departure from college. In: Smart, J. C. (ed.): *Higher Education: Handbook of Theory and Research*, (Vol. XVIII), Kluwer Academic Publishers, Norwell, MA, pp. 421–471.

DesJardins, S. (2001). A comment on interpreting odds-ratios when logistic regression coefficients are negative. *AIR Professional File* 81(Fall): 1–7.

DesJardins, S., Ahlburg, D., and McCall, B. (2002). Simulating the longitudinal effects of changes in financial aid on student departure from college. *Journal of Human Resources* 37(3): 653–79.

DuBrock, C., and Fenske, R. (2000, May). Financial aid and college persistence: a five-year longitudinal analysis. Paper presented at the 40th annual forum of the Association for Institutional Research, Cincinnati, OH.

Farrell, E. F. (2005, February 4). More students plan to work to help for college, record percentages of freshmen also expect to take on high debt. *Chronicle of Higher Education* 51(22): A1.

Fenske, R., Porter, J., and DuBrock, C. (1999, May–June). Analyzing student aid packaging to improve low-income and minority student access, retention, and degree completion. Paper presented at the 39th annual forum of the Association for Institutional Research, Seattle, WA.

Fiske, E. B. (2004, Spring). Student success. *Focus* (Lumina Foundation): 4–23.

Gardner, J. N., McClenney, K., and Terenzini, P. T. (2004, April). Rethinking Retention. National Resource Center for the First-Year Experience and Students in Transition, Teleconference #3 of the 2004 Teleconference Series.

Gillespie, M., and Noble, J. (1992) Factors Affecting Student Persistence: A Longitudinal Study. ACT Research Report, pp. 92–94.

Grandy, J. (1998). Persistence in science of high-ability minority students. *Journal of Higher Education* 69(6): 589–620.

Greene, J. P., and Forster, G. (2003, September). Public High School Graduation and College Readiness Rates in the United States (Education Working Paper No. 3). New York: Manhattan Institute.

Haycock, K. (2002). Still at risk. *Thinking K-16* 6(1): 3–22(Education Trust).

Hendel, D. D. (2001, April). The relative contribution of participating in a first-year seminar on student satisfaction and retention into the sophomore year. Paper presented at the annual meeting of the American Educational Research Association, Seattle, WA.

Horn, L., Peter, K., and Carroll, D. (2003). *What Colleges Contribute: Institutional Aid to Full-Time Undergraduates Attending 4-Year Colleges and Universities (NCES Report 2003–157)*, US Department of Education, Washington, DC.

Hosmer, D. W., and Lemeshow, S. (2000). *Applied Logistic Regression*, 2nd Ed., Wiley, New York.

Hu, S., and St. John, E. P. (2001). Student persistence in a public higher education system: Understanding racial and ethnic differences. *Journal of Higher Education* 72(3): 265–86.

IHEP [Institute for Higher Education Policy]. (2004, May). Investing in America's Future: Why Student Aid Pays Off For Society and Individuals. Washington, DC.

Ishitani, T. T. (2003). A longitudinal approach to assessing attrition behaviour among first-generation students. *Research in Higher Education* 44(4): 433–49.

Ishitani, T. T., and DesJardins, S. L. (2002). A longitudinal investigation of dropout from college in the United States. *Journal of College Student Retention* 4(2): 173–201.

Laden, R., Matranga, R., and Peltier, G. (1999). Persistence of special admissions students at a small university. *Education* 120(1): 76–81.

Lau, L. K. (2003). Institutional factors affecting student retention. *Education* 124(1): 126–136.

Leppel, K. (2002). Similarities and differences in the college persistence of men and women. *Review of Higher Education* 25(4): 433–450.

Laing, J., Sawyer, R., and Noble, J. (1988). Accuracy of self-reported activities and accomplishments of college-bound students. *Journal of College Student Development* 29(4): 362–368.

Long, S. (1998) Influence of work study, loans, need-based gift aid, merit-base aid, and satisfaction with financial aid on freshmen-to-sophomore retention. Unpublished doctoral dissertation, University of Missouri, Columbia.

Mau, W. (2003). Factors that influence persistence in science and engineering career aspirations. *Career Development Quarterly* 51(March): 234–43.

McGrath, M., and Braunstein, A. (1997). The prediction of freshmen attrition: An examination of the importance of certain demographic, academic, financial, and social factors. *College Student Journal* 31(September): 396–408.

McPherson, M. S., and Schapiro, M. O. (1990, April). Does student aid affect college enrollment? New evidence on a persistent controversy. Williams Project on the Economics of Higher Education (Discussion Paper No. 1). Williamstown, MA: Williams College.

Menard, S. (2001). *Applied Logistic Regression Analysis*, (2nd Ed.), CA: *Sage*, Newbury Park.

Mortenson, T. (2003, November). Emerging higher education policy trends and roles for institutional research. Paper presented at the Midwest Institutional Research Association, Bloomington, MN.

Murtaugh, P. A., Burns, L. D., and Schuster, J. (1999). Predicting the retention of university students. *Research in Higher Education* 40(3): 355–371.

Okun, M. A., Benin, M., and Brandt-Williams, A. (1996). Staying in college: Moderators of the relation between intention and institutional departure. *Journal of Higher Education* 67(September/October): 577–596.

Pascarella, E. T., Terenzini, P. T., and Wolfle, L. M. (1986). Orientation to college and freshman year persistence/withdrawal decisions. *Journal of Higher Education* 57(2): 155–175.

Pascarella, E. T., and Terenzini, P. T. (1980). Predicting freshman persistence and voluntary dropout decisions from a theoretical model. *Journal of Higher Education* 51(1): 60–75.

Paulsen, M., and St. John, E. P. (2002). Social class and college costs: Examining the financial nexus between college choice and persistence. *Journal of Higher Education* 73(2): 189–236.
Pedhazur, E. J. (1997). *Multiple Regression in Behavioral Research*, Harcourt Brace, New York.
Peng, C. J., So, T. H., Stage, F. K., and St. John, E. P. (2002). The use and interpretation of logistic regression in higher education journals: 1988–99. *Research in Higher Education* 43(3): 259–93.
Perna, L. W. (1997). The contribution of financial aid to undergraduate persistence. Paper presented at the 22th annual forum of the Association for Study of Higher Education, Albuquerque, NM.
Porter, S. R. (2002). Including transfer-out behavior in retention models: Using the NSC EnrollmentSearch data. *Air Professional File* 82(Winter): 1–16.
Potter, W. (2003, October 2). Students overestimate cost of attending college, report says. *Chronicle of Higher Education* 50(9): A27.
Rosenbaum, J. E. (2001). *Beyond College For All*, Russell Sage, New York.
Sanoff, A. P. (2004, April 30). Americans see money for college somewhere over the rainbow. *Chronicle of Higher Education* 50(34): B6.
Sidle, M. W., and McReynolds, J. (1999). The freshman year experience: Student retention and student success. *NASPA Journal* 36(4): 288–300.
Somers, P. (1995). A comprehensive model for examining the impact of financial aid on enrollment and persistence. *Journal of Student Financial Aid* 25(1): 13–27.
Spady, W. G. (1971). Dropouts from higher education: An interdisciplinary review and synthesis. *Interchange* 1(1): 64–85.
St. John, E. P. (2000). The impact of student aid on recruitment and retention: what the research indicates. *New Directions for Student Services* 89(Spring): 61–75.
St. John, E. P. (1992). Workable models for institutional research on the impact of student financial aid. *Journal of Student Financial Aid* 22(3): 13–26.
St. John, E. P., Hu, S., Simmons, A., Carter, D. F., and Weber, J. (2004). What difference does a major make? the influence of college major field on persistence by African American and White students. *Research in Higher Education* 45(3): 209–232.
St. John, E. P., Hu, S., and Weber, J. (2001). State policy and the affordability of public higher education. *Research in Higher Education* 42(4): 401–28.
St. John, E. P., Hu, S., and Tuttle, T. (2000). Persistence by undergraduates in an urban public university: Understanding the effects of financial aid. *Journal of Student Financial Aid* 30(2): 23–37.
Tinto, V. (1997). Classroom as communities: Exploring the educational character of student persistence. *Journal of Higher Education* 68(6): 599–623.
Tinto, V. (1987). *Leaving College: Rethinking the Causes and Cures of Student Attrition*, University of Chicago Press, Chicago.
Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of Educational Research* 45(1): 89–125.
UCCSN [University and Community College System of Nevada]. (2004, March). Performance Indicator Report 2003–2004. Reno, NV: UCCSN, Office of Academic & Student Affairs.
Weiler, W. C. (1996). Factors influencing the matriculation choices of high ability students. *Economics of Education Review* 15(1): 23–36.
Weiler, W. C. (1987). An application of the nested multinomial logit model to enrollment choice behavior. *Research in Higher Education* 27(3): 273–282.

Received September 15, 2004.