

Financial Aid Packages and College
Enrollment Decisions: An Econometric Case Study

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Abstract

We study the effects of a change in financial aid policy introduced by a Northeastern university in 1998. Prior to that time, the university's financial aid packages for low-income students consisted of grants, loans, and campus jobs. After the change, the entire loan portion of the package for low-income students was replaced with grants. We find the program increased the likelihood of matriculation by low-income students by about 3 percentage points, although the effect is not statistically significant. The effect among low-income minority students was about twice that size and statistically significant at the 10 percent level.

I. Introduction

In recent decades, the average cost of attending a four-year college has risen substantially, from \$9,539 in 1988 to \$12,282 in 1998 (in 1999 constant dollars) [*Digest of Education Statistics*, 2000]¹. This increase has engendered concerns that attending college is beyond the financial reach of many students. The public policy response has been to introduce or expand a variety of government grant and scholarship programs.² At the same time, a number of colleges and universities have augmented their own financial aid programs in order to attract low-income students. This can be done in two non-mutually exclusive ways. The first is to increase the amount of aid; the second is to alter the *composition* of the aid package, changing the mix of grants, loans, and jobs.

Although there is a substantial academic literature on the impact of tuition levels on enrollment decisions (see, e.g., Manski and Wise [1973], McPherson and Schapiro [1991a,b], Kane [1994], and Rouse [1994]), not much research has been done on the effects of different types of financial aid on student enrollment. The key result in the literature is that enrollment decisions are, in fact, sensitive to the amount of tuition. Further, Kane [1994] finds that the decision to enroll in college is sensitive to both tuition and the level of Pell Grants. The effects are roughly of equal magnitude and opposite sign suggesting that net college cost (as opposed to “sticker price”) is the relevant variable in the matriculation decision.³ A smaller literature has attempted to estimate the effect of college costs on enrollment at a particular institution. Hoenack [1971], Ehrenberg and Sherman [1984], and Moore, Studenmund and Slobko [1991] each

¹ All dollar values in this paper are in 1999 dollars unless otherwise specified.

² For example, during the 1990s Congress increased the level of Pell grants, made student loans more generous, and introduced college tax credits (Kane [1999]). In addition, there is growing interest in reducing the loan burden of low-income students by such measures as front-loading Pell grants.

estimate the probability that a student accepts an offer at a particular school; they find that higher net college costs make students less likely to enroll at a particular institution. Further, Ehrenberg and Sherman find that the response is largest for minority students, middle to upper income students, and more scholastically able students (as measured by SAT scores). These results are also consistent with those of Jackson [1990], who separately analyzes the responsiveness to financial aid of black, Hispanic, and white students using the *High School and Beyond* dataset. He finds that blacks are more responsive to financial aid than whites, and that blacks are more responsive to grants than to loans.

A potential problem with many of these papers is that the data lack a source of variation in college costs or financial aid composition that is exogenous to student characteristics. College financial aid offers often depend on the characteristics of the student; students who are considered more desirable by the college administration may receive more generous offers. Hence, college costs and financial aid packages are likely correlated with student characteristics. As a result, in a regression of the attendance decision on net college cost, it is difficult to identify the independent effect of college cost. In particular, the coefficient on college cost may partially reflect the impact of unobserved characteristics of the student. In an attempt to address the selection problem, van der Klaauw [1996] uses a regression discontinuity approach to estimate that the financial aid offer has a significant effect on college enrollment. Dynarski [1999, 2000] uses the end of the Social Security Student Benefits program and the creation of the Hope

³ See also Schwartz [1985] and Savoca [1991].

Scholarship in Georgia as exogenous sources of variation and finds, in both cases, positive effects of grant aid on student enrollment in college.⁴

In this paper, we analyze the effect of grant aid on student matriculation at a major Northeastern university (hereinafter referred to as “NEU”). Like most selective colleges, NEU administers its own financial aid program, and in this analysis we exploit a change in NEU’s financial aid policy. Prior to 1998, NEU’s financial aid package to low-income students included loans, scholarships, and jobs. Beginning with the class of 2002 (which entered NEU in September, 1998), the loan component was entirely eliminated and replaced with grants. Because this change in the financial aid policy induced systematic variation in the financial aid packages of low-income students that is likely uncorrelated with other student characteristics, this exogenous policy variation allows more meaningful estimates of the effect of the form of financial aid on college enrollment. We implement a “difference-in-differences” estimator to study the impact of this policy change on the probability that admitted low-income students enroll at NEU. Our main finding is that converting loans to grants had no statistically discernible effect on the matriculation rate of low-income admits. However, there was a marginally significant positive impact on the likelihood of enrollment among low-income minority students.

The rest of the paper is organized as follows. Section II provides a description of the financial aid program at NEU, both before and after the 1998 change, and outlines our

⁴ Under the Social Security Student Benefits program, which ended in 1982, 18- to 22-year-old children of deceased, disabled or retired Social Security beneficiaries received substantial monthly payments while enrolled full-time in college. Under the Hope Scholarship program, all Georgia residents with at least a B average in high school can attend a public college in Georgia for free.

econometric model. Section III describes the data. Some descriptive statistics and the econometric results are presented in Section IV. Section V concludes.

II. Institutional Background

In 1998 NEU announced that the loan component of the financial aid packages of students would be replaced by grants. University officials identified two major reasons for this change. The first was to reduce the importance of financial barriers in the decision to apply to or attend the school, and the second was to ensure that a recent drop in the number of low-income students matriculating did not become a trend. Officials emphasized that this policy was not undertaken to lure students away from other institutions, but rather to fulfill NEU's commitment to provide adequate financial aid to all students.

When a student applies for aid, NEU first computes his or her "demonstrated need," which is the difference between the cost of college and NEU's estimate of the student's ability to pay based on his or her family's financial position. The student receives this amount of support in the form of a package that potentially consists of three components: grants, loans, and jobs. Grant aid includes funds from any source (federal Pell grants, university endowment funds, etc.) that are provided without expectation of repayment or any work done by the student. Loans must be repaid with interest, although the payments and accrual of interest may be deferred until some time after the student's graduation, and interest is charged at less than market rates. Job aid consists of a paid position at the university, usually made available through the financial aid or a related

office. At NEU, such jobs usually require nine hours of work each week during the academic year.

These three forms of aid have different costs and values to both the college and the student. Jobs are relatively inexpensive for the university because the student performs services of value in return for the funds. Some student jobs are also subsidized by the federal work-study program, which pays part of a qualified student's wages. Loans are less expensive than grants for the loan provider, as they are repaid (even though the interest rate is usually low and the payments are often deferred for several years). To a student, grants are the most valuable, being essentially "free money." In contrast, the present discounted value of a dollar of loan aid is only about fifty cents.⁵

Financial aid offers for students admitted NEU are calculated according to the following process. The financial aid staff begins by determining the student's family contribution (a function of the family's financial resources). If the family's calculated ability to pay is less than the cost of attending NEU, then the student qualifies for financial aid. In composing the financial aid package, the financial aid staff begins with a standard amount of job aid and a base loan amount; grants fill the remaining gap between the student's ability to pay and the cost of NEU. The final financial aid package is then adjusted by the financial aid staff where deemed appropriate. Because of this final adjustment, there is no straightforward algorithm that exactly determines each student's financial aid package.

The cost of attending NEU rose from \$27,729 in 1988 to \$34,171 in 2000, and NEU's financial aid packages grew along with it. (All dollar figures in this paper are

⁵ The precise value, of course, depends on factors such as the particular terms of the loan and the student's discount rate (McPherson and Schapiro [1991b], Feldstein [1992]).

expressed in 1999 dollars unless otherwise specified). In 1988, the standard financial aid package included \$2,028 in job aid, rising slightly to \$2,109 in 2000. Over the same period, the base loan amount increased from \$3,731 to \$4,063, and the remaining grant component increased from a median of \$11,865 to \$14,842.⁶

The new policy announced in January 1998 made NEU more attractive to low-income students by giving them grants in place of the loans they would have received under the old regime. Under the new policy, the loan component of these students' packages was completely eliminated and replaced with grants. That is, a low-income student who would have been expected to borrow \$4,000 per year was instead given an additional \$4,000 in grants for 1998-1999.⁷ The total amount of financial aid was not affected, only the composition.

Clearly, an important aspect of the process is how the financial aid office classifies students as "low-income." Before 1998, the financial aid office defined low-income status based on expected parental contribution.⁸ If the student's parental contribution was less than \$2,000, he or she would likely be classified as low-income. Low-income students were asked to take smaller loans than other students – \$500 to \$2000 less for the poorest students in 1997, less than that in earlier years. Under the new

⁶ The median is calculated among students receiving grant aid.

⁷ NEU made other changes to its financial aid policy for the class of 2002. For students whose family incomes are just above the low-income range, loans were reduced by smaller, graduated, amounts. In addition, for low- and middle-income students, family assets were redefined to include only a portion of housing equity. We ignore these changes in this paper. However, low-income students tend to have fairly little housing equity and the family resources of students who benefit from the redefinition of housing equity are sufficiently high that they do not qualify as low-income even with the redefinition. We anticipate that, if anything, our estimates are downward biased due to these other changes.

⁸ The student's ability to pay is composed of two parts: the expected parental contribution and the contribution from the student's own resources (e.g., from summer jobs and external scholarships).

policy, students are classified as low-income if their family income is less than the national median family income – \$41,955 for the class entering in 1998.⁹

NEU officials estimate that this new program will cost approximately \$1.7 million per year by the time it is fully phased-in, in fiscal year 2002. The goal of this paper is to determine whether this expenditure has increased the yield (percent of admits enrolling) among low-income students, and if so, by how much.

III. Data and Econometric Model

A. Data

The data come from the administrative archives of NEU's Financial Aid Office. The database contains detailed financial aid and admissions information on each year's admitted students, including their financial position (family income, assets, and so on) and the composition of their financial aid packages. We analyze data from the classes of 1992 through 2004 (who entered in 1988 through 2000). The data are proprietary and sensitive, as they contain detailed individual financial information on NEU's undergraduates and alumni. The archiving is done after the admissions process is complete but before the students actually begin classes.

We begin with 25,958 records on individual students and drop 1,433 observations with missing or ambiguous information.¹⁰ Additionally, because the program is particularly targeted at American students and because international students' financial indicators are relatively difficult to interpret, for most of the analysis we focus our

⁹ This figure is the median among families with children under age 18 in 1996, the latest year for which data were available when the cutoff was set in late 1997 for students entering NEU in the fall of 1998. This is reported in nominal currency because the Financial Aid Office based its low-income classification on nominal dollars.

attention on U.S. citizens, reducing the sample by an additional 2,465 records. Another 8,359 admitted students are excluded from the analysis because they applied for early decision or early action.¹¹ These students choose to commit to, or at least focus on, NEU before they receive financial aid offers. Their enrollment decisions, therefore, are likely less sensitive to financial aid, and it is not appropriate to analyze them along with regular admission applicants. More importantly, early decision application binds the student to attend if accepted, so there is no decision to make conditional on admission.

B. Econometric Model

We have data only on students who were admitted, not on all who applied, so we focus on the probability of acceptance conditional on admission to NEU. (In aggregate form this translates into the “yield rate,” defined as the percentage of admitted applicants who enroll.) Hence, we cannot assess the impact of the change in financial aid policy on the pool of applicants from which the admissions office chooses.

We model the individual student’s decision to accept NEU’s admissions offer as a conventional probit model:

$$E_{it} = F[\alpha + P_t\beta_1 + LI_{it}\beta_2 + (P_t * LI_{it})\beta_3 + X_{it}\gamma] \quad (1)$$

where E_{it} is the probability that student i chooses to enroll at NEU in year t , $F[\]$ is the cumulative normal distribution, X_{it} is a vector of student characteristics (described in the next section), P_t is a binary variable that equals 1 if the student applied after the 1998

¹⁰ In most of these cases, there was a problem in the coding of the student’s enrollment decision.

change in financial aid (i.e., it equals one for all students in the classes of 2002, 2003, and 2004), LI_{it} is a binary variable that equals 1 if the student is classified as low-income, and β_1 , β_2 , β_3 , γ and α are parameters to be estimated. To allow comparisons between low-income students before and after the policy change, we reclassify students from all classes as low-income according to the definition adopted by the Financial Aid Office at the time of the policy change. That is, we classify students as low-income if their family income is below the national median for families with children under 18 in the year before their application.

The coefficient β_1 reflects the change in the probability that students in the classes of 2002, 2003, and 2004 (those that applied after the change in financial aid) enrolled at NEU relative to those who applied earlier. As such, it measures the impact of all aspects of the post-program environment that might have affected the probability of accepting an offer of admission. The coefficient β_2 reflects the difference in probability of enrolling at NEU between students who are classified as low-income and those who are not, for all classes. As a result, the coefficient β_3 on the interaction between P_t and LI_{it} reflects the incremental effect on the probability of accepting admission at NEU for low-income students after the change in financial aid took effect. It is, therefore, our coefficient of interest -- the differences-in-differences estimator for this program. The identifying assumption is that the change in financial aid policy did not affect the enrollment rates of non-low-income students.

¹¹ NEU switched from a non-binding "early action" policy to a binding "early decision" policy beginning with the class of 2000.

The specification in equation (1) implicitly assumes that the effect of the new program was the same for each class. We also estimate an alternative specification in which we allow the effect of the program to vary by class:

$$E_{it} = F[\alpha' + C_t\beta_{1t} + LI_{it}\beta_2' + (C_t * LI_{it})\beta_{3t} + X_{it}\gamma] \quad (2)$$

where C_t is a set of binary variables that take a value of one if a student is in a particular class, and zero otherwise (the omitted class is 1992), and $C_t * LI_{it}$ is a set of interactions between the class effects and a dichotomous variable indicating whether the student is low-income, and the other notation is as defined above. Each of these interactions shows, for the respective class, the difference in the probability of acceptance between low-income students in that class and the other students, *ceteris paribus*. This specification contains no single regression coefficient that summarizes the effect of the program. We therefore estimate the effect of the program by computing the average of the coefficients of the interaction terms (β_{3t}) during the program period (i.e., for the classes of 2002, 2003, and 2004), and compare it to the average for the classes in the years before the program.¹² The difference between the averages is the net program effect.

IV. Results

A. Descriptive Statistics

Table 1 exhibits mean student characteristics over the entire sample period. These statistics apply to admitted U.S. citizens who applied regular decision, not early

¹² Weighting this average by sample sizes in each year has no substantial effect on the results.

action or early decision. We present means broken down by income status, financial aid status, sex, census division of residence, ethnicity, whether the student is a recruited athlete, and the student's academic and non-academic ratings by the admissions office. The ratings were assigned by the Office of Admissions during the admissions process. The academic rating was based on factors such as high school grades, SAT scores, prior experience with graduates of the same high school, and teacher recommendations. An academic rating of A was given to students who are best-prepared academically (e.g., with high grades and high SAT scores); an academic rating of E was given to the least prepared students. The non-academic rating was determined by a variety of attributes such as leadership, athletic or musical ability, and volunteer work. The non-academic ratings also ranged from A to E. We break down the various student characteristics by whether the student was low-income (again retroactively applying the post-change definition) and by whether the student enrolled.

Ninety-eight percent of the admitted low-income students in our analysis sample were awarded financial aid,¹³ compared to only 47 percent of non-low-income students. Further, relative to high-income students, low-income students had on average lower admissions ratings (both academic and non-academic), were less likely to be athletes and alumni children, and were more likely to be minorities. (Throughout our analysis, we classify students as minority if they identify themselves as African-American, Hispanic, or Native American. We do not classify Asian students as minority.) The fraction of minority students in our sample is quite high, reaching nearly one-third by the end of the analysis period. This is higher than the overall fraction of minority students at NEU, as

¹³ The remaining two percent of students had substantial assets despite low income.

Table 1:
Means of Student Characteristics
Regular Admission U.S. Citizens in the Graduating Classes of 1992-2004

	Admitted			Enrolled		
	All	Not low-income	Low-income	All	Not low-income	Low-income
Low-income	0.101	0.000	1.000	0.109	0.000	1.000
Financial Aid Recipient	0.487	0.432	0.983	0.515	0.457	0.989
Financial Aid Applicant	0.618	0.576	1.000	0.642	0.598	1.000
Female	0.470	0.470	0.473	0.448	0.448	0.454
Census Division:						
New England	0.054	0.055	0.042	0.050	0.051	0.038
Middle Atlantic	0.320	0.325	0.278	0.358	0.362	0.328
East North Central	0.101	0.104	0.067	0.095	0.099	0.059
West North Central	0.034	0.034	0.030	0.030	0.029	0.032
South Atlantic	0.113	0.112	0.117	0.113	0.114	0.109
East South Central	0.062	0.062	0.065	0.066	0.066	0.066
West South Central	0.068	0.064	0.111	0.070	0.065	0.109
Mountain	0.034	0.032	0.048	0.030	0.028	0.047
Pacific	0.172	0.171	0.175	0.140	0.140	0.141
Academic Rating:						
A	0.266	0.279	0.143	0.176	0.184	0.109
B	0.355	0.366	0.256	0.354	0.369	0.235
C	0.222	0.210	0.337	0.254	0.246	0.323
D	0.126	0.114	0.233	0.171	0.157	0.284
E	0.022	0.021	0.030	0.038	0.037	0.047
Non Academic Rating:						
A	0.022	0.023	0.012	0.023	0.024	0.013
B	0.215	0.222	0.157	0.246	0.254	0.186
C	0.433	0.439	0.376	0.436	0.441	0.391
D	0.301	0.288	0.413	0.271	0.260	0.366
E	0.020	0.017	0.041	0.017	0.014	0.042
Admissions Ratings Missing	0.009	0.010	0.001	0.007	0.007	0.003
Athlete	0.153	0.157	0.117	0.228	0.236	0.169
Alumni child	0.065	0.071	0.017	0.091	0.100	0.015
African-American	0.146	0.129	0.297	0.118	0.100	0.263
Latino	0.033	0.028	0.079	0.035	0.029	0.082
Mexican	0.057	0.046	0.162	0.049	0.039	0.130
Other Hispanic	0.011	0.010	0.017	0.011	0.010	0.018
Native American	0.010	0.008	0.021	0.011	0.008	0.029
Asian	0.152	0.158	0.101	0.121	0.125	0.087
Number of Observations	13701	12322	1379	6558	5842	716

minority students were relatively more likely to apply regular decision, and hence to be included in our analysis sample.

Table 2 contains time series data on key characteristics of NEU students in our analysis sample. Since the early 1990s, the percentage of admitted students who were low-income has ranged from about 7 to 14 percent; the percentage of enrolled students who were low-income has ranged from 8 to 12 percent.¹⁴ The percentage of these students who receive financial aid has been in the 50 to 60 percent range. Over time, the percentages of females and minorities have increased. Both the academic and nonacademic ratings of the classes have improved.¹⁵ Further, smaller proportions of the class have been recruited athletes and children of alumni.

Aggregate yield rate data from the classes of 1992 through 2004 are summarized in Table 3. The first column indicates that yield rates at NEU have been increasing over time, starting at about 55 percent in the early 1990s and ending at 72 percent for the class of 2004. As noted in Section III, we focus on students who go through the regular admission process. Since early decision students are committed to enroll, and early action students were very likely to do so, the yield rates for students admitted under regular admission are lower than those for all admitted students, and although they have also been increasing, the trend has been at a substantially slower rate (from 48 percent at the beginning of the period to 53 percent at the end).

The next two columns show the yield rates by income status, again imposing the 1998 definition of “low-income” on all classes. For convenience, these rates are graphed in the upper panel of Figure 1. At the beginning of the period, the yield rate for low-

¹⁴ These calculations use the national-median based low-income definition to all classes, retroactively for those earlier than the class of 2002.

Table 2:
Time Series of Student Characteristics
Regular Admission U.S. Citizens in the Graduating Classes of 1992-2004

Class	Proportion A or B ¹										Average Financial Aid Award ²	Cost of Attendance	
	Low-income students	Financial Aid Recipient	Financial Aid Applicant	Female	Minority	Acad. Rating	Nonacad. Rating	Athlete	Alumni Child	Median Income of Applicants			
Admitted students													
1992	0.096	0.449	0.571	0.395	0.200	0.552	0.508	0.173	0.863	\$77,111	\$11,037	\$28,013	
1993	0.117	0.480	0.603	0.439	0.229	0.518	0.198	0.188	0.777	\$76,330	\$12,262	\$28,448	
1994	0.109	0.470	0.595	0.454	0.233	0.592	0.174	0.174	0.599	\$79,229	\$12,421	\$28,951	
1995	0.088	0.473	0.612	0.453	0.247	0.568	0.176	0.181	0.756	\$79,049	\$12,575	\$29,414	
1996	0.100	0.492	0.598	0.486	0.246	0.527	0.178	0.182	0.553	\$78,404	\$14,397	\$30,275	
1997	0.098	0.486	0.615	0.462	0.280	0.612	0.201	0.157	0.504	\$85,151	\$13,768	\$31,023	
1998	0.107	0.505	0.609	0.494	0.283	0.593	0.210	0.161	0.582	\$84,543	\$16,920	\$31,715	
1999	0.094	0.522	0.643	0.493	0.282	0.616	0.195	0.163	0.049	\$79,297	\$18,651	\$32,245	
2000	0.107	0.506	0.641	0.483	0.259	0.694	0.206	0.124	0.663	\$82,554	\$16,623	\$32,712	
2001	0.083	0.479	0.654	0.480	0.253	0.690	0.247	0.123	0.599	\$91,620	\$16,234	\$33,143	
2002	0.096	0.534	0.656	0.510	0.284	0.722	0.233	0.111	0.062	\$88,947	\$19,479	\$33,874	
2003	0.110	0.479	0.656	0.498	0.277	0.774	0.243	0.110	0.694	\$94,531	\$16,750	\$34,262	
2004	0.098	0.478	0.627	0.519	0.314	0.735	0.277	0.094	0.707	\$92,018	\$18,372	\$34,371	
Enrolled students													
1992	0.102	0.454	0.570	0.395	0.162	0.465	0.511	0.249	0.117	\$73,270	\$13,701	\$28,013	
1993	0.122	0.481	0.593	0.431	0.185	0.386	0.202	0.273	0.132	\$73,420	\$13,970	\$28,448	
1994	0.134	0.520	0.644	0.420	0.225	0.483	0.195	0.259	0.864	\$77,548	\$14,676	\$28,951	
1995	0.070	0.493	0.628	0.415	0.189	0.439	0.215	0.280	0.122	\$80,959	\$14,232	\$29,414	
1996	0.105	0.547	0.649	0.440	0.200	0.425	0.211	0.275	0.915	\$72,731	\$16,857	\$30,275	
1997	0.113	0.547	0.670	0.414	0.234	0.496	0.254	0.262	0.820	\$82,374	\$15,980	\$31,023	
1998	0.113	0.551	0.632	0.472	0.247	0.490	0.253	0.251	0.688	\$80,587	\$18,355	\$31,715	
1999	0.101	0.575	0.695	0.478	0.268	0.518	0.223	0.243	0.660	\$78,200	\$19,210	\$32,245	
2000	0.127	0.532	0.667	0.478	0.236	0.604	0.230	0.187	0.760	\$79,516	\$17,779	\$32,712	
2001	0.079	0.484	0.662	0.445	0.211	0.630	0.284	0.184	0.086	\$89,644	\$16,569	\$33,143	
2002	0.095	0.556	0.673	0.496	0.250	0.649	0.264	0.163	0.706	\$88,623	\$20,136	\$33,874	
2003	0.144	0.499	0.672	0.457	0.247	0.698	0.300	0.171	0.788	\$86,343	\$19,286	\$34,262	
2004	0.108	0.476	0.616	0.517	0.271	0.679	0.318	0.144	0.926	\$89,611	\$19,587	\$34,371	

Notes: Only includes non-early admission U.S. citizens. Minority students include those who self-report as African-American, Hispanic, or Native American. All dollar amounts are in 1999 dollars. The cost of attendance is the sum of tuition, fees, room and board, and estimated additional expenses. Whether or not a student is categorized as "low-income" is defined retroactively according to the post-2002 definition (see text).

¹ "A" is the highest admissions rating; "B" is the second highest (see text). Non-academic rating is 1992 is coded differently and is not comparable.

² Among financial aid recipients.

**Table 3:
Yield Rates at NEU for the Graduating Classes of 1992-2004**

Graduating Class	All admits	Regular admission US citizens				
		All	All		Minority	
			Not low-income	Low-income	Not low-income	Low-income
1992	54.59%	47.30%	47.01%	50.00%	34.29%	53.57%
1993	54.81%	46.75%	46.50%	48.65%	37.44%	38.46%
1994	55.93%	46.53%	45.26%	56.83%	40.19%	58.02%
1995	55.93%	42.91%	43.76%	34.04%	35.61%	23.33%
1996	56.34%	43.02%	42.81%	44.86%	33.50%	39.68%
1997	57.82%	43.88%	43.17%	50.46%	35.48%	41.27%
1998	58.98%	45.66%	45.34%	48.28%	39.48%	41.10%
1999	62.96%	48.55%	48.18%	52.13%	46.05%	46.30%
2000	68.80%	51.26%	50.12%	60.78%	44.81%	52.38%
2001	68.13%	50.32%	50.52%	48.10%	41.03%	45.65%
2002	71.86%	54.69%	54.76%	54.02%	46.41%	55.10%
2003	70.95%	52.89%	50.85%	69.46%	40.54%	70.37%
2004	72.52%	53.12%	52.53%	58.54%	44.23%	51.85%
Average	61.50%	47.87%	47.41%	51.92%	39.87%	47.10%
Number of Observations	24805	13701	12322	1379	2729	794

Minority students include those who self-report as African-American, Hispanic, or Native American.

income students was below that for students who were not, but by the end of the sample period, the situation was reversed. Enrollments of African-American, Hispanic, and Native American (“minority”) students have been a matter of special concern at NEU and a number of other institutions, so in the last two columns (and the lower panel of Figure 1) we show yield rates among minorities.

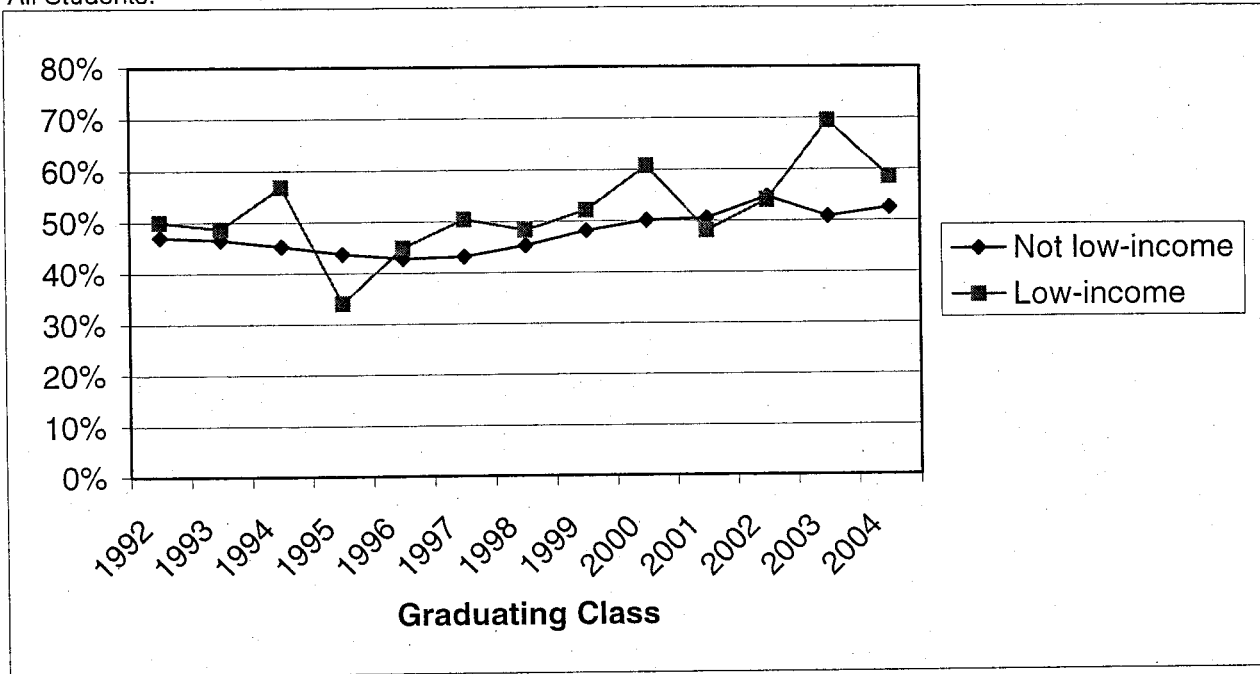
Figure 1 suggests that the difference in yield rates between low-income and not-low-income students has widened since the change in the financial aid program, suggesting that the change in financial aid composition had a sizeable impact on the matriculation of low-income students. However, the figure also highlights some difficulties with this conclusion. First, note that the yield rates for classes in the early 1990s were quite a bit lower than those for the last three classes, the “treatment” group. Hence, if we visually compare the last three classes with their predecessors as a group, it appears that the yield rates increased during the program period. On the other hand, suppose that we choose to make the “comparison” group only the four classes before the program was introduced. In this case, the answer from visual inspection is no longer quite so clear.

In the same way, we cannot know whether the unusually low yield among low-income students for the class of 2001 reflected a permanent change in the yield rates that would have continued had NEU not changed its financial aid policy, or whether it was a transitory change. If the yield for the class of 2001 reflected a permanent change, then it makes sense to use it as a base from which to evaluate the financial aid program. In contrast, if the yield for the class of 2001 reflected a transitory change, then its inclusion in the analysis will artificially inflate the estimated impact of the program.

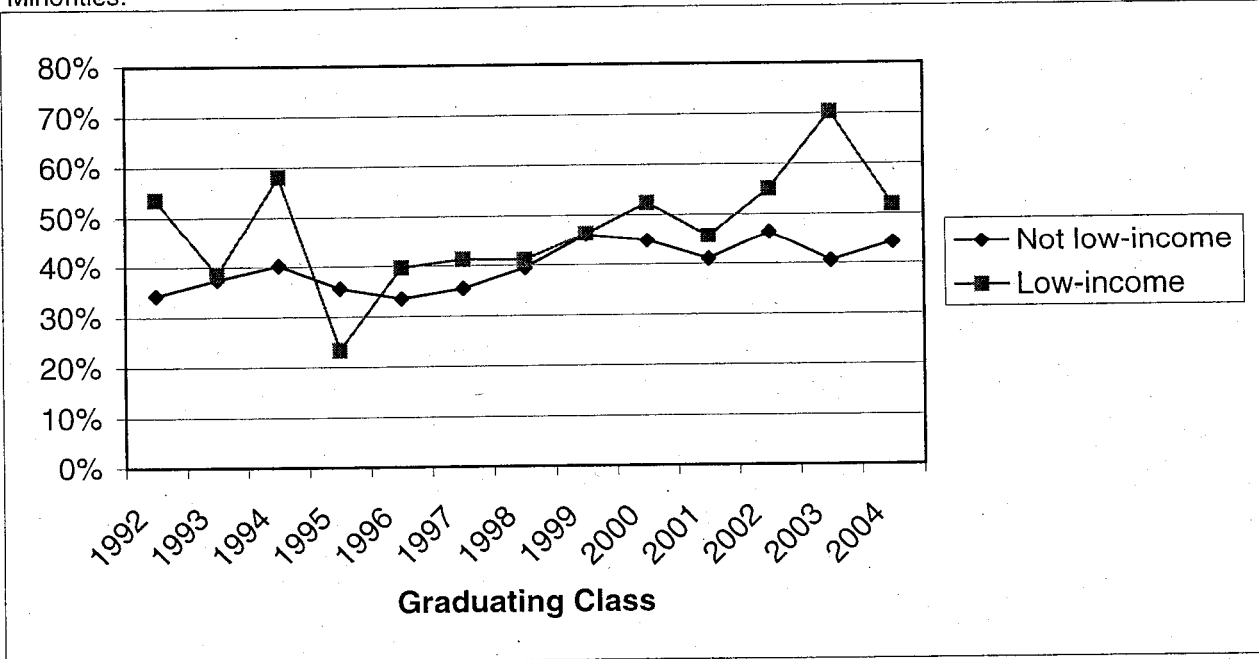
¹⁵ The nonacademic ratings for the class of 1992 are on a different scale than other classes.

Figure I: Yield Rates among Regular Decision U.S. Citizens

All Students:



Minorities:



Notes:

Yield rate is the percentage of admitted students who enroll.

These calculations show only U.S. citizens who did not apply early action or early decision.

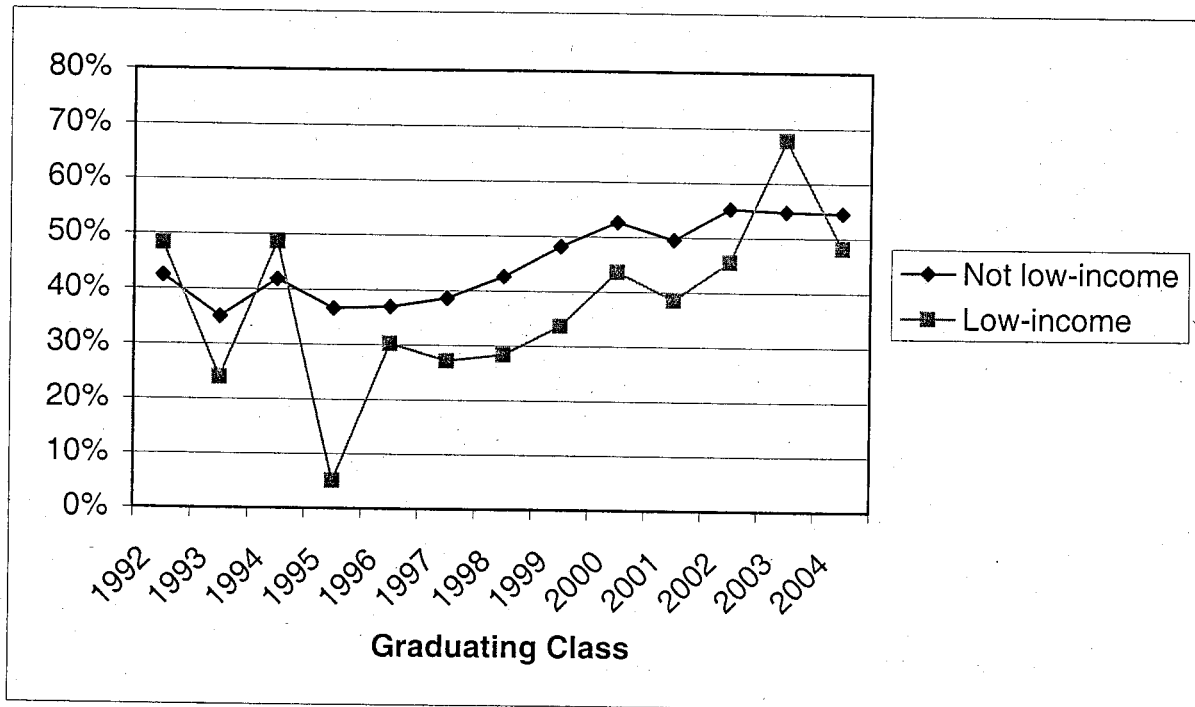
Minority is defined as Black, Hispanic, or Native American (self-reported).

One possibility is that the patterns in Figure 1 are driven by changes in student characteristics over time. To investigate this issue, in Figure 2 we show the time series in yield rates adjusted for student characteristics. (The adjustments are based on a probit regression that controlled for race, gender, total size of financial aid award, alumni child, region of permanent residence, recruited athlete, and both academic and nonacademic rankings for admission.) While the regression-adjusted variation in yield rates is somewhat smaller than the unadjusted, the patterns do not change enough to resolve the ambiguities just discussed. In short, the time series pattern of yield rates raises the possibility that our substantive results may be sensitive to the choice of comparison classes. Our statistical analysis explicitly takes this possibility into account.

Another concern is that the yield rates among different income groups may have moved differently over time for reasons that have nothing to do with the financial aid practices of NEU. Of course, we cannot know what would have happened at NEU if it had not changed its policy. However, we can compare the time series on yield rates at NEU to the pattern at several similar universities in the Northeast. We were not able to obtain data on other schools' yield rates by students' incomes. However, the Consortium on Financing Higher Education (COFHE) provided us with data on overall yield rates and yield rates among minorities at a group of similar universities.¹⁶ The yield rate data for these schools are summarized in Figure 3. Note that the yield data for NEU in this figure differ from those in previous figures. In order to make the two panels of Figure 3 fully comparable, we use the COFHE data for NEU as well, thus re-introducing the early admissions and international students to the sample.

¹⁶ For consistency we have again excluded Asians from our definition of minority.

Figure II: Regression-Adjusted Yield Rates for Regular Decision U.S. Citizens
 Controlling for student characteristics and total aid award



National-median based low-income codings, 1999 as base year

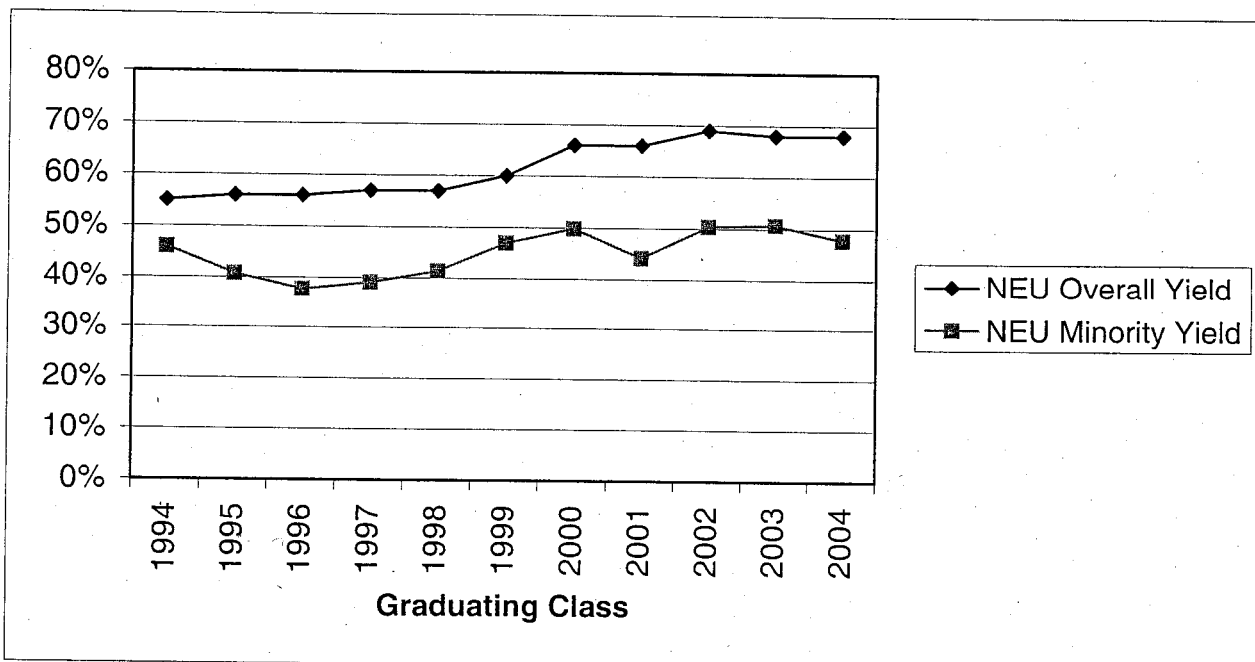
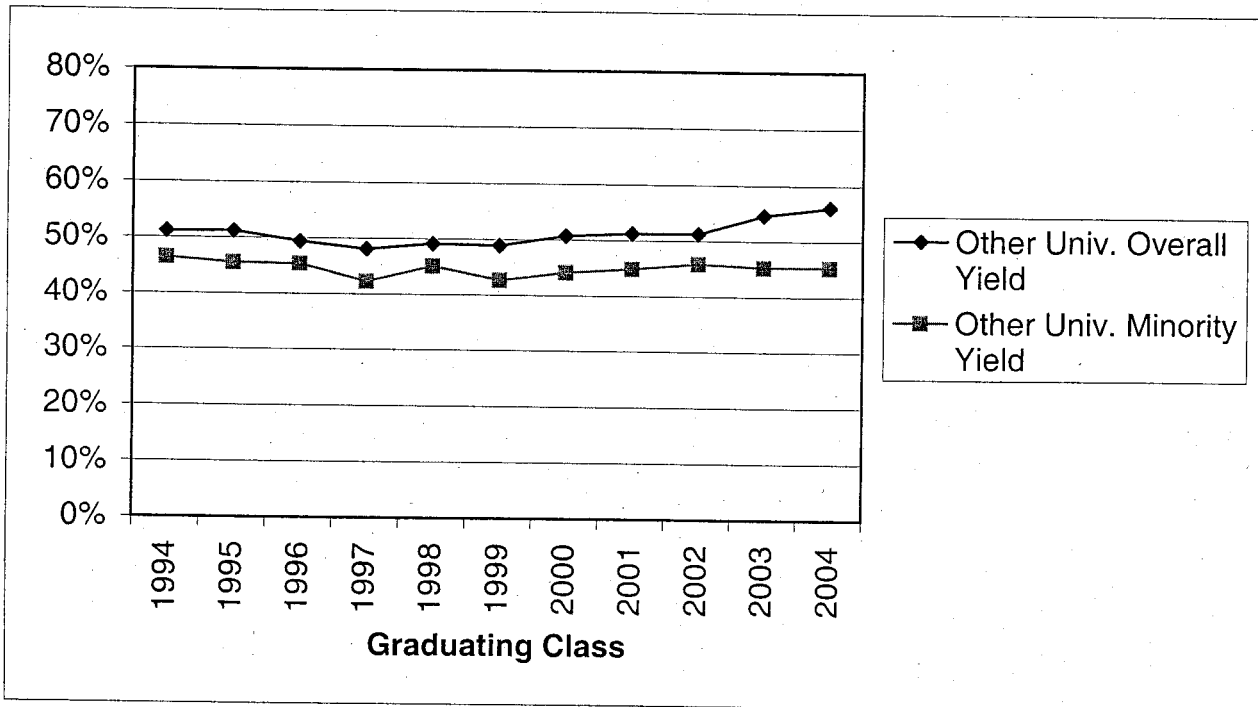
Low income rate for each class year computed as sum of low-income coefficient, class dummy coefficient, class * low-income interaction, and base yield (1999 not low-income).

Not low-income rate for each class year computed as sum of class dummy coefficient and base yield (1999 not low-income).

Yield rates adjusted using the marginal effects probit regression reported in Table 4 column 3

Figure III: Yield Rates at Similar Universities

For minorities and for all students at seven other prestigious Northeastern universities



Both panels, including NEU, from data provided by the Consortium on Financing Higher Education. NEU data in this figure are not comparable to previous figures due to the inclusion of early admissions and foreign students, included here for comparability with COFHE data from other universities. Minority refers to African-American, Hispanic, and Native American students.

Figure 3 suggests that NEU's peer institutions did not experience the dip in the yield rate that occurred in NEU's class of 2001. This might suggest that the dip at NEU was, in fact, transitory, for if more fundamental forces were at work, NEU's peer institutions would likely have experienced a similar phenomenon. In addition, Figure 3 reveals that yields for the peer institutions did not change much after the class of 2002. In contrast, NEU's minority yields increased by 11% in the post-program period. This is consistent with the notion that any change we find at NEU is plausibly attributable to the specific financial aid policy changes instituted there.

B. Multivariate Analysis

1. Overall Results

Column (1) of Table 4 shows the results from equation (1) without individual covariates (X_{it}). The coefficient on the program variable indicates that during the period it has been in effect, the yield rate for non-low-income students was 3.6 percentage points higher than previously, an increase that is statistically significant at the 5 percent level. Further, the coefficient on the interaction term indicates that the probability of a low-income student accepting the offer was 4.7 percentage points higher than that, although the difference is not statistically significant. Hence, in this basic model, we cannot detect a statistically discernible effect of the program on the yield of low-income students.

As shown in Table 2, the composition of the admitted students changed substantially during the program period. Thus, in column (2) of Table 4 we control for a variety of individual characteristics. All of the variables are dichotomous and familiar from Table 1 except for the student's financial aid award, which reflects the value (in

Table 4:
Probit Analysis of Enrollment Decision at NEU

	Regular Admission U.S. Citizens			
	No Controls	Add Student Characteristics	Allow for Class Effects	Reintroduce Early Applicants
	(1)	(2)	(3)	(4)
Low-income	0.036 (0.016)	-0.038 (0.019)	-0.052 (0.057)	0.004 (0.040)
Program	0.066 (0.011)	0.168 (0.013)		
Program * Low-income	0.047 (0.036)	0.020 (0.038)		
Net program effect			0.023 (0.039)	0.010 (0.028)
Financial Aid Award/10 ³ (1999\$)		0.006 (0.001)	0.005 (0.001)	0.004 (0.000)
Female		-0.026 (0.009)	-0.029 (0.009)	-0.024 (0.007)
Alumni Child		0.155 (0.019)	0.150 (0.019)	0.146 (0.014)
Academic Rating:				
A		-0.644 (0.040)	-0.698 (0.041)	-0.600 (0.032)
B		-0.423 (0.039)	-0.454 (0.040)	-0.416 (0.031)
C		-0.265 (0.038)	-0.289 (0.039)	-0.266 (0.030)
D		-0.152 (0.039)	-0.166 (0.039)	-0.145 (0.031)
Non-academic Rating:				
A		-0.206 (0.045)	-0.218 (0.046)	-0.225 (0.032)
B		-0.057 (0.006)	-0.060 (0.035)	-0.072 (0.024)
C		-0.006 (0.032)	-0.007 (0.033)	-0.022 (0.023)
D		0.006 (0.033)	0.008 (0.033)	-0.010 (0.023)
Admissions Ratings Missing		-0.565 (0.068)	-0.563 (0.069)	-0.581 (0.046)
Recruited Athlete		0.084	0.078	0.038
<hr/>				
African-American		(0.017) -0.370 (0.017)	(0.017) -0.385 (0.017)	(0.013) -0.339 (0.013)
Latino		-0.263 (0.028)	-0.276 (-0.276)	-0.226 (0.023)
Mexican		-0.300 (0.023)	-0.314 (0.024)	-0.270 (0.019)
Other Hispanic		-0.097 (0.043)	-0.099 (0.043)	-0.107 (0.029)
Native American		-0.145 (0.047)	-0.161 (0.047)	-0.174 (0.040)
Asian		-0.047 (0.013)	-0.053 (0.014)	-0.056 (0.010)
Graduating Class				
1992			-0.087 (0.024)	-0.074 (0.017)
1993			-0.084 (0.024)	-0.076 (0.017)
1994			-0.088 (0.024)	-0.058 (0.017)
1995			-0.102 (0.025)	-0.073 (0.017)
1996			-0.092 (0.025)	-0.063 (0.017)
1997			-0.074 (0.024)	-0.043 (0.017)
1998			-0.054 (0.024)	-0.038 (0.017)
2000			0.056 (0.025)	--
2001			0.053 (0.025)	-0.010 (0.020)
2002			0.129 (0.025)	0.058 (0.020)
2003			0.106 (0.026)	0.035 (0.020)
2004			0.138 (0.026)	0.071 (0.020)
Low-income * Graduating Class				
1992			0.051 (0.074)	-0.020 (0.053)
1993			0.010 (0.073)	-0.054 (0.052)
1994			0.152 (0.074)	0.089 (0.053)

1995	-0.106 (0.082)	-0.132 (0.055)
1996	0.012 (0.078)	-0.055 (0.054)
1997	0.036 (0.077)	-0.038 (0.054)
1998	0.004 (0.076)	0.014 (0.055)
2000	0.040 (0.079)	-0.039 (0.058)
2001	-0.065 (0.083)	-0.102 (0.060)
2002	-0.066 (0.081)	-0.089 (0.059)
2003	0.163 (0.081)	0.050 (0.058)
2004	0.019 (0.084)	-0.042 (0.059)
Applied early action/decision		0.425 (0.008)
Early decision year		0.135 (0.019)

Census Division dummies	No	Yes	Yes	Yes
Log Likelihood	-9457.319	-8444.490	-8376.591	-13023.924
Number of Observations	13701	13701	13701	24805
Base Probability	0.479	0.479	0.479	0.615

Notes: Standard errors are in parentheses. Coefficients reported are marginal effects. The net program effect in columns (3) and (4) is calculated as the average of the class * low-income interactions after the policy change (2002-2004) minus the average of the interactions before the policy change. student The base probability is the predicted probability of enrollment evaluated at the mean student characteristics. Class of 2000 effect is omitted in column (4) because of colinearity with program and early decision year

1999 dollars) of the student's total financial aid from all sources. Controlling for the size of the package allows us to focus on the effect of the composition of the package.¹⁷ Women were 2.7 percentage points less likely to accept an offer than men; alumni children were 15 percentage points more likely than their non-alumni counterparts to do so. As both academic and nonacademic ratings increased, the probability of accepting an offer fell. Recruited athletes were about 26 percentage points more likely to accept an admissions offer; minority students were less likely to accept an offer than were non-minorities.¹⁸ The difference-in-differences estimate of the program effect, β_3 from equation (1), is smaller when the covariates are taken into account, 0.024 versus 0.047 from column (1), and is still not statistically different from zero.

As noted above, the specification in equation (1) implicitly assumes that the effect of the new program was exactly the same for each class. In column (3) of Table 4 we allow the effect for low-income students to vary by class as described in equation (2). The second figure in the column, the net program effect, is 0.028 with a standard error of 0.039. This is essentially the same as the estimate of the program effect from column (2). Hence, allowing for separate class effects has little impact on our assessment of the impact of the program. We also note that the coefficients on the other covariates are barely affected.

Beginning with the class of 2000, two years before the financial aid policy change, NEU switched from a non-binding early action program to a binding early-decision program. If this change affected the composition of the regular-decision body of

¹⁷ If we use expected family contribution to control for family financial resources, we obtain substantially similar results.

¹⁸ We have also estimated specifications in which we interact academic rating with other characteristics (such as race, whether athlete or child of alumni) with substantively similar results.

students, one might be concerned that the exclusion of early admission students from our analysis biases our results. In column (4) of Table 4 we reintroduce the early applicants from all classes into our analysis and add controls for whether the student applied early action/decision and whether the university followed an early action or early decision policy in that year. The coefficient of interest becomes somewhat smaller, and remains insignificantly different from zero (as well as insignificantly different from the previous estimate). The estimated program effect falls because the indicator for early decision years (the classes of 2000-2004) captures some of the recent rise in yields. We conclude that the change in early admission policy does not significantly affect our results.

2. Alternative Comparison Classes

The models of Table 4 are estimated using the data for every class available to us. However, as noted above, including all previous classes in the comparison group may be inappropriate. In particular, the decision-making process of students admitted in the early years of our sample might have been quite different from those of the students admitted since 1998, perhaps because of differences in unobservable characteristics. An additional concern mentioned earlier is that the yield rate among low-income students in the year just prior to the adoption of the program may have been transitorily low.

Because we have no compelling *a priori* reasons to view some years as more suitable for inclusion in the comparison group than others, we estimate the model with several different comparison groups. Table 5 shows the outcomes when we exclude the class of 2001 (column (1)), the classes of 2000 and 2001 (column (2)), all classes before 1997 (column (3)), and all classes before 1997 as well as 2000 and 2001 (column (4)).

**Table 5:
Alternative Specifications**

	Sample Excludes the Specified Graduation Classes			
	2001 (1)	2000 and 2001 (2)	All Classes Before 1997 (3)	Pre-1997, 2000, 2001 (4)
Low-income	-0.034 (0.019)	-0.036 (0.020)	-0.035 (0.027)	-0.037 (0.034)
Program	0.180 (0.013)	0.194 (0.013)	0.129 (0.014)	0.167 (0.016)
Program * Low-income	0.011 (0.038)	0.012 (0.039)	0.034 (0.042)	0.024 (0.046)
Financial Aid Award/10 ³ (1999\$)	0.006 (0.001)	0.006 (0.001)	0.005 (0.001)	0.006 (0.001)
Female	-0.025 (0.009)	-0.029 (0.010)	-0.026 (0.012)	-0.027 (0.014)
Alumni Child	0.149 (0.020)	0.158 (0.021)	0.112 (0.026)	0.110 (0.030)
Academic Rating:				
A	-0.657 (0.041)	-0.661 (0.042)	-0.730 (0.075)	-0.705 (0.080)
B	-0.427 (0.040)	-0.426 (0.040)	-0.492 (0.074)	-0.465 (0.078)
C	-0.263 (0.039)	-0.262 (0.039)	-0.334 (0.073)	-0.303 (0.078)
D	-0.148 (0.039)	-0.145 (0.040)	-0.229 (0.074)	-0.193 (0.078)
Non-academic Rating:				
A	-0.226 (0.047)	-0.232 (0.049)	-0.204 (0.060)	-0.244 (0.070)
B	-0.066 (0.035)	-0.072 (0.037)	-0.038 (0.046)	-0.061 (0.053)
C	-0.015 (0.034)	-0.024 (0.035)	0.001 (0.044)	-0.031 (0.051)
D	-0.001 (0.034)	-0.014 (0.036)	0.010 (0.044)	-0.028 (0.051)
Admissions Ratings Missing	-0.567 (0.069)	-0.562 (0.070)	-0.697 (0.189)	-0.659 (0.192)
Recruited Athlete	0.082 (0.017)	0.080 (0.018)	0.101 (0.024)	0.105 (0.028)
African-American	-0.375 (0.018)	-0.373 (0.018)	-0.379 (0.023)	-0.374 (0.026)
Latino	-0.276 (0.029)	-0.278 (0.031)	-0.262 (0.038)	-0.279 (0.044)

Mexican	-0.309 (0.024)	-0.314 (0.025)	-0.323 (0.030)	-0.340 (0.035)
Other Hispanic	-0.117 (0.044)	-0.125 (0.045)	-0.067 (0.051)	-0.098 (0.056)
Native American	-0.156 (0.049)	-0.159 (0.051)	-0.174 (0.056)	-0.188 (0.063)
Asian	-0.050 (0.014)	-0.054 (0.015)	-0.040 (0.017)	-0.045 (0.020)
Census Division Dummies Included?	Yes	Yes	Yes	Yes
Number of Observations	12749	11799	7700	5798
Log Likelihood	-7825.920	-7214.539	-4754.616	-3549.307
Base Probability	0.477	0.474	0.502	0.497

Notes: See notes to Table 4.

Includes only regular admission U.S. citizens

As before, we focus on the coefficient on the interaction of the program and low-income dichotomous variables. The overall results are remarkably insensitive to the choice of years to include. The point estimates of the program effect range from 1.5 to 3.8 percentage points, in the same ballpark as those in Table 4, and also are not statistically significant. In short, the finding that the program has no significant effect is robust to alternative specifications of the comparison group.

3. Effects by Race and Ethnicity

Much of the discussion of financial aid packages for low-income students has focused on recruiting minorities. In this context, an important question is whether minorities are similar to the sample as a whole with respect to their responsiveness to changes in financial aid packages. Thus, we estimate the basic models from Table 4 with the sample restricted to minority students. This analysis compares the change in yield among low-income minorities to the change in yield among non-low-income minorities – we look for an effect of the program by low-income status within the minority population, not for an effect of the program on minorities as a group.¹⁹

The results are presented in Table 6. The key finding is that the program effect was between 8 and 9 percentage points, and that this effect is significant at about the 10 percent level. This is a large effect relative to the base yield of 40 percent for minorities before the class of 2002. In the specification that does not control for ethnic differences within the minority sample, the significance level is 0.079; when we include dichotomous

¹⁹ Twenty-three percent of minority students were low-income, higher than the 10 percent of the overall sample, but still a relatively small fraction. As a result, the program did not have any significant effect on the matriculation of minorities as a group (since over three-fourths of them were not affected by the policy change).

Table 6:
 Probit Analysis of Enrollment Decision at NEU among Minorities

	Regular Admission U.S. Citizens				
	No Controls	Add Student Characteristics	Add Race	Allow for Class Effects	Reintroduce Early Applicants
	(1)	(2)	(3)	(4)	(5)
Low-income	0.051 (0.023)	-0.084 (0.026)	-0.092 (0.026)	-0.145 (0.076)	-0.101 (0.071)
Program	0.054 (0.022)	0.116 (0.024)	0.118 (0.024)		
Program * Low-income	0.098 (0.049)	0.089 (0.051)	0.082 (0.051)		
Net program effect				0.081 (0.052)	0.100 (0.049)
Financial Aid Award/10 ³ (1999\$)		0.008 (0.001)	0.008 (0.001)	0.008 (0.001)	0.007 (0.001)
Female		0.006 (0.018)	0.010 (0.018)	0.006 (0.018)	0.002 (0.017)
Alumni Child		0.157 (0.074)	0.155 (0.074)	0.149 (0.074)	0.126 (0.065)
Academic Rating:					
A		-0.533 (0.081)	-0.601 (0.082)	-0.674 (0.084)	-0.644 (0.076)
B		-0.474 (0.070)	-0.500 (0.071)	-0.574 (0.073)	-0.587 (0.066)
C		-0.359 (0.069)	-0.364 (0.069)	-0.434 (0.071)	-0.455 (0.065)
D		-0.199 (0.069)	-0.197 (0.069)	-0.243 (0.071)	-0.258 (0.064)
Non-academic Rating:					
A		-0.177 (0.119)	-0.218 (0.122)	-0.226 (0.124)	-0.168 (0.103)
B		-0.076 (0.053)	-0.076 (0.053)	-0.093 (0.055)	-0.078 (0.050)
C		-0.041 (0.046)	-0.036 (0.047)	-0.046 (0.047)	-0.043 (0.043)
D		-0.029 (0.046)	-0.017 (0.046)	-0.016 (0.046)	-0.024 (0.042)
Admissions Ratings Missing		-0.050 (0.304)	-0.029 (0.308)	-0.077 (0.307)	-0.718 (0.136)
Recruited Athlete		0.199	0.189	0.183	0.130

	(0.049)	(0.049)	(0.050)	(0.045)
Latino		0.117 (0.030)	0.120 (0.030)	0.115 (0.029)
Mexican		0.063 (0.027)	0.068 (0.027)	0.070 (0.025)
Other Hispanic		0.243 (0.046)	0.258 (0.046)	0.211 (0.037)
Native American		0.202 (0.048)	0.206 (0.048)	0.163 (0.046)
Graduating Class				
1992			-0.058 (0.051)	-0.080 (0.047)
1993			-0.131 (0.049)	-0.170 (0.046)
1994			-0.063 (0.049)	-0.068 (0.045)
1995			-0.115 (0.050)	-0.100 (0.045)
1996			-0.112 (0.050)	-0.103 (0.045)
1997			-0.095 (0.047)	-0.084 (0.044)
1998			-0.056 (0.048)	-0.030 (0.045)
2000			0.045 (0.051)	--
2001			0.014 (0.050)	-0.066 (0.050)
2002			0.071 (0.049)	0.005 (0.049)
2003			0.066 (0.051)	0.006 (0.051)
2004			0.064 (0.049)	-0.002 (0.049)
Low-income * Graduating Class				
1992			0.204 (0.107)	0.137 (0.098)
1993			0.034 (0.102)	0.075 (0.094)
1994			0.214 (0.100)	0.179 (0.093)
1995			-0.170 (0.112)	-0.178 (0.099)
1996			0.077 (0.106)	-0.012 (0.096)

1997				0.030	-0.032
				(0.104)	(0.098)
1998				0.002	-0.058
				(0.101)	(0.096)
2000				0.055	-0.030
				(0.106)	(0.100)
2001				0.035	-0.006
				(0.112)	(0.104)
2002				0.048	0.043
				(0.110)	(0.104)
2003				0.275	0.220
				(0.110)	(0.103)
2004				0.082	0.060
				(0.108)	(0.102)
Applied early action/decision					0.525
					(0.029)
Early decision year					0.113
					(0.047)

Census Division dummies	No	Yes	Yes	Yes	Yes
Log Likelihood	-2375.878	-2205.500	-2180.132	-2148.199	-2585.493
Number of Observations	3523	3523	3523	3523	4442
Base Probability	0.415	0.409	0.407	0.406	0.460

Notes: Standard errors are in parentheses. Coefficients reported are marginal effects.

The omitted race category is African-American.

The net program effect in columns (4) and (5) is calculated as the average of the class * low-income interactions after the policy change (2002-2004) minus the average of the interactions before the policy change.

The base probability is the predicted probability of enrollment evaluated at the mean student characteristics.

Class of 2000 effect is omitted in column (5) because of colinearity with program and early decision year

variables for Hispanic and Native American origins, the significance level is 0.106. Including the early admissions students, as in column (4) of Table 4, the significance level improves to better than 5%.

We conclude that, on average, the program had a larger impact on low-income minorities -- the point estimate is about twice that for the entire sample, while its standard error is not much larger.²⁰ This is consistent with Jackson [1990], who, using an approach rather different from ours, found that in the decision to attend a college African-Americans respond positively to grants but not significantly to loans, and that African-Americans are about twice as responsive to grants as whites.²¹

4. Discussion

Why didn't NEU's change from loans to grants have a statistically discernable impact on the overall yield rate among low-income applicants? One possibility is that admitted students were not fully aware of the program. However, the program did have a significant (at the 10 percent level) effect among minorities, and we have no reason to believe that minorities were better informed about the program. Additionally, even if students were not aware of the program when they decided to apply, they usually received financial aid details at the same time as the admission offer, so they should have known how the program affected them at the time they made their enrollment decisions.

²⁰ Along the lines of Table 5, we checked the robustness of this finding to the inclusion of various classes. The effect is not very sensitive to these changes. To the extent there is a change, the impact becomes larger when we exclude the earlier classes.

²¹ There are substantial differences between Jackson's study and our own. His estimates are based on a sample of applicants to all colleges (*High School and Beyond*) as opposed to applicants to a single college. Further, Jackson models the probability of attending college as a function of the presence of loans or grants as opposed to examining a change in regime from loans to grants. Also, Jackson estimates separate effects for blacks and Hispanics. We do not attempt to estimate separate effects because the number of Hispanics

Second, the change in financial aid (loan replacements of approximately \$4,000 per year) was fairly small relative to the average financial aid package of low-income students – \$25,734, of which an average of about \$20,000 would have been grants in the absence of the loan-replacement program (the remainder being jobs). It may be that this incremental change was too small to have had a detectable effect on enrollment decisions.

A third, closely related possibility is that the underlying elasticity may be small, so the effect of a program this size was not big enough to be estimated precisely given the inherent noisiness of the process. In this context, it is useful to compare our results to those of Dynarski [1999, 2000], who, as noted in the introduction, uses two different datasets to estimate the elasticity of college enrollment to financial aid awards. First, studying the Georgia Hope Scholarship she estimates that \$1,000 in aid increased the enrollment rate at Georgia colleges by 3.7 to 4.2 percentage points. Second, studying the end of the Social Security Student Benefits program she estimates an elasticity for enrollment with respect to aid amount between 0.7 and 0.8. While these estimates are for enrollment at any college and for increases in total aid rather than shifts in the composition of the package, they do provide a base of comparison for our point estimates.

Table 7, below, shows the predicted effect of NEU's financial aid policy change using Dynarski's estimates of the behavioral parameters. The perceived equivalent increase in total aid corresponding to a shift from loans to grants is hard to calculate, so we report a range of values: loans valued at one-half, one-third, and one-quarter of the face value. For example, consider the implications of Dynarski's estimated elasticity of

is low. However, the estimates computed using only the sample of African-Americans are not substantially different from those that include Hispanics and Native Americans as well.

0.75 assuming (a) NEU's base yield among pre-program low-income admits is 50%, (b) the pre-program base grant is \$20,000, and (c) the \$4,000 shift from loans to grants is valued by students at \$2,000 (on the high side of the previous literature). In this case, the predicted effect on yield rates is an increase of 3.75 percentage points.²² Our estimated effect implied by Table 4, column (3), is 2.3 percentage points with a standard error of 3.8 percentage points. Therefore, the predicted impact based on Dynarski's elasticity is not significantly different from our estimate. Neither, however, is it significantly different from zero. The calculations reported in the other cells in the table yield qualitatively similar results.

Table 7
Predicted Effect of NEU's Policy Change Using Dynarski's Estimated Effects of Financial Aid on College Attendance

Relative loan value	Predicted Percentage Point Change in NEU's Yield Rate	
	Georgia Hope Scholarship 3.7 to 4.2 percentage points per \$1,000	Social Security Student Benefits [elasticity = 0.075]
0.50	7.4 to 8.4	3.7
0.33	4.9 to 5.6	2.5
0.25	3.7 to 4.2	1.9

In short, while it is possible that NEU's program had no effect on overall matriculation, we cannot reject the possibility that it had an impact similar to that found in previous analyses of enrollment decisions.

A question remains, however, why the program appears to have had a larger effect on the matriculation of minority applicants. One possibility is that the result is attributable to economic resource differences, since family financial status is so highly

²² The calculation is as follows. By definition, the elasticity is $(\Delta \text{Yield} / \text{Yield}_0) * (\text{Aid}_0 / \Delta \text{aid})$. Substituting into this expression, $0.75 = (\Delta \text{Yield} / 0.5) * (\$20,000 / \$2,000)$. Solving, $\Delta \text{Yield} = 0.0375$.

correlated with race and ethnicity. For three reasons, however, we do not believe that family resources are the primary explanation for the differences by minority status. First, our model controls for the total size of the financial aid package, which, as observed above, is a one-dimensional index of a family's overall financial position. Second, the minorities affected by the loan-replacement program are not actually much poorer than the whites so affected. Among low-income minority admits, the mean family income is \$24,177, only ten percent less than the mean among low-income whites of \$26,836. Plotting the income density (not shown) reveals that the distributions are similar as well.

Third, recall that the basis of our estimates is a difference-in-differences comparison between non-low-income and low-income students, within racial/ethnic groups. Further, the mean income for minorities was \$75,929 and \$100,822 for whites, among those financial aid applicants who reported family income. Thus, the difference in average incomes between low-income and non-low-income whites is greater than the corresponding figure for minorities. If anything, this would tend to bias our estimates towards finding a *smaller* effect among minorities.

Finally, although we have no direct evidence, the result is consistent with differing perceptions between minorities and nonminorities about the cost of financing college through loans. Such differences may be due to greater uncertainty among minorities about the future returns to college education, and hence ability to repay loans.

V. Conclusion

We examine a program instituted at a Northeastern university to replace loans with grant aid for low-income students. We find the program increased the likelihood of

matriculation by low-income students by about 3 percentage points, although the effect is not statistically significant. The effect among low-income minority students was about twice that size and statistically significant at the 10 percent level. While it is perilous to generalize on the basis of the experience of a single institution, an important lesson emerges from our analysis: within the population of low-income students, program effects may vary with race and ethnicity. This possibility should be taken into account in the design and analysis of such programs.

References

- Consortium on Financing Higher Education (COFHE). 1998. "Tuition, Student Budgets, and Self-Help at the Consortium Institutions for Academic Year 1998-99." (COFHE Yellow Book), (June).
- Digest of Education Statistics*. 2000. (Washington, D.C.: Department of Health, Education, and Welfare, Education Division, National Center for Education Statistic).
- Dynarski, Susan. 1999. "Does Aid Matter? Measuring the Effect of Student Aid on College Attendance and Completion," NBER Working Paper #7422.
- Dynarski, Susan. 2000. "Hope for Whom? Financial Aid for the Middle Class and Its Impact on College Attendance," NBER Working Paper #7756.
- Ehrenberg, Ronald G. and Daniel R. Sherman. 1984. "Optimal Financial Aid Policies for a Selective University." *Journal of Human Resources* 19(2): 202-30.
- Feldstein, Martin. 1992. "College Scholarship Rules and Private Saving," NBER Working Paper #4032.
- Hoernack, Stephen. 1971. "The Efficient Allocation of Subsidies to Higher Education." *American Economic Review*, 61 (June): 302-311.
- Jackson, Gregory A. 1990. "Financial Aid, College Entry, and Affirmative Action." *American Journal of Education*, August 1990, 523-550.
- Kane, Thomas. 1994. "College Entry by Blacks since 1970: The Role of College Costs, Family Background, and the Returns to Education." *The Journal of Political Economy*, 102(5): 878-911.
- Kane, Thomas. 1999. *The Price of Admission: Rethinking How Americans Pay for College*. Washington, DC: The Brookings Institution.
- Manski, Charles F. and David A. Wise. 1983. *College Choice in America*. Cambridge: Harvard University Press.
- McPherson, Michael S. and Morton Owen Schapiro. 1991a. *Keeping College Affordable: Government and Educational Opportunity*. Washington, DC: The Brookings Institution.
- McPherson, Michael S. and Morton Owen Schapiro. 1991b. "Does Student Aid Affect College Enrollment? New Evidence on a Persistent Controversy." *American Economic Review* 81(1): 309-318.

- Moore, Robert L., A. H. Studenmund, and Thomas Slobko. 1991. "The Effect of the Financial Aid Package on the Choice of a Selective College." *Economics of Education Review*, 10(4), 311-321.
- Rouse, Cecilia Elena. 1994. "What to Do After High School: The Two-Year versus Four-year College Enrollment Decision." *Choices and Consequences: Contemporary Policy Issues in Education* (Ronald G. Ehrenberg, editor) (Ithaca, NY: ILR Press).
- Savoca, Elizabeth. 1991. "The Effect of Changes in the Composition of Financial Aid on College Enrollments" *Eastern Economic Journal* 17(1): 109-121.
- Schwartz, J. Brad. 1985. "Student Financial Aid and the College Enrollment Decision: the Effects of Public and Private Grants and Interest Subsidies." *Economics of Education Review*. 4(2), 129-144.
- U.S. Department of Education, "SFA [Student Financial Aid] Handbook," 1997-1998, 1998-1999, and 1999-2000 versions. At http://ifap.ed.gov/csb_html/fsfabknew.htm
- van der Klaauw, Wilbert. 1996. "A Regression-Discontinuity Evaluation of the Effect of Financial Aid Offers on College Enrollment," New York University mimeo.