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Gender Bias: An Analysis of the Distribution of Institutional Aid

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This study is based on the premise that equity in the distribution of institutional student aid is related to a student's academic ability and need. Thus, to establish evidence of gender bias, this study examined the influence of gender on students' institutional aid awards while controlling for these two factors, as well as other related student and institutional characteristics. This study found no direct evidence of gender bias when examining the relationship between student characteristics and institutional aid. However, when examining institutional characteristics, indirect implications suggested that gender was related to the relationship between academic ability as measured by SAT/ACT and institutional aid.

Since 1970 the number of women enrolled in postsecondary education has increased more rapidly than men. This trend is expected to continue and by 2009 the gender gap is projected to be 9.4 million women versus 6.9 million men (U.S. Department of Education, 1999). It is no surprise, therefore, that academic leaders are concerned about the gender balance on their campuses. In fact, there are reports that some institutions seek to maintain a 60 percent threshold of either gender when admitting a desired class (Lewin, 1998, p. 38). Concurrently, new enrollment management practices have emerged in response to constrained institutional resources and intensified competition for students. Most recently, these practices include predictive modeling, which serves as a basis for understanding the impact of financial aid on enrollment (McPherson & Schapiro, 1998; Gose, 1999, p. A52). With the help of this new tool, financial aid administrators can statistically predict what financial aid award will lure or deter an applicant or, even more specifically, a particular gender type. These facts, taken together, suggest that an environment now exists where postsecondary school administrators may be tempted to use financial aid as a means to achieve gender balance on their campuses.

The purpose of this study is to investigate whether there is evidence of gender bias in the awarding of financial aid. Specifically, this study investigates institutional aid, which

consists of grants and scholarships, loans, work-study, and other funds, including assistantships, drawn on institutional resources. No other form of aid—federal, state, or private—was examined. Institutional aid was selected because it represents a form of aid over which institutions have some discretion.

The significance of this study is two-fold. First, American higher education has a tradition of providing scholarship awards to “deserving and needy” students (McPherson & Schapiro, 1998). This tradition was built on the belief that the country should provide “equal opportunity for all.” Today, as student demographics threaten the gender balance on campuses and financial aid practices include predictive modeling, this value may be at risk. Second, Title IX of the federal education amendments of 1972 (20 USC 1681 et seq.) and regulations that went into effect in July 1975 forbid sexual discrimination in any activity or program receiving federal funds, including all of the operations of a local educational agency, vocational school system or any other type of school system that receives federal aid (see 20 USC 1687; see also School Law, 1994, p. 297). It is important, therefore, to understand whether the distribution of financial aid is awarded based on gender—this would represent a change from its traditional purpose and would be illegal as well.

Theoretical Perspective

A sociological perspective suggests that an open system highlights the interdependence of organizations and their environments. Organizational environments may be defined as technical or institutional (Scott, 1992). “Technical environments are those in which organizations produce a product or service that is exchanged in a market such that they are rewarded for effective and efficient performance. By contrast, institutional environments are characterized by the elaboration of rules and requirements to which individual organizations must conform in order to receive legitimacy and support” (Scott, 1992, p.132). Olson (1994) further explains institutional environments as consisting of social limitations or constraints on organizations. He observed that, “these include shared beliefs, norms, laws, agreements, and customs. Organizations need to conform more or less to these social limitations to maintain their legitimacy and continue functioning with a minimum of external interference” (Olson, 1996, p. 5). Colleges and universities, as service organizations, operate within strong institutional environments (Scott, 1992). Thus, they must maintain policies and practices that are consistent with the public’s values and shared beliefs; if they do not, they jeopardize their legitimacy and support.

An economic perspective of education focuses on three key areas: wealth distribution, student response to price and student aid, and equal opportunity (Leslie & Brinkman, 1988). Underlying these three areas is the fundamental economic theory of supply and demand. Supply and demand theory, as applied

in this study, suggests that there will be a tendency for schools to award institutional aid based on the supply and demand of a particular gender type. When an excess supply of one gender exists, award amounts could be driven down for this gender type as amounts increase for the gender type in short supply. Given this application, differentials in the amount of institutional aid awarded to men and women may occur in an environment where more women than men are seeking postsecondary education. Thus, gender bias could result.

Research Design

This study examined data from the National Postsecondary Student Aid Study (NPSAS:96)—the fourth in a series of studies conducted every three years since 1987 by the National Center for Education Statistics (NCES) of the U. S. Department of Education. At the time of this study, NPSAS:96 was the most recent data available. The subsample abstracted from NPSAS:96 was composed of traditional undergraduate students who had received institutional aid from either a public or private institution that offered at least a bachelor's degree, excluding athletes. The traditional undergraduate student was defined as enrolled full-time in a four-year institution, single, dependent on his or her parents, and living on campus. The sample under investigation included 3,620 students in 246 institutions.

NPSAS:96 calculates financial need according to the formula used to award federal student aid, which subtracts the student's expected family contribution (EFC) from the student's total cost of attendance (COA). EFC and COA are calculated using rules established by the U.S. Congress and implemented by the U.S. Department of Education. COA components include the student's tuition and fees, books and supplies, room and board, transportation, loan fees, and personal expenses. Components of the EFC include the family's net assets, family size, number in college, and income before taxes (U.S. Department of Education, 1999). Because income is a factor in the financial need calculation, this study does not address income independently.

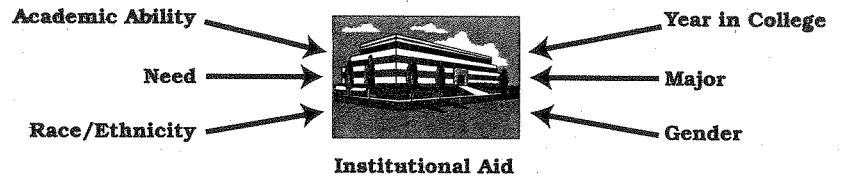
The fundamental question addressed by this study was whether environmental changes and norms had resulted in a difference in the distribution of institutional aid to students in terms of gender. To pursue this inquiry, the following research questions were addressed: 1) What are the relationships among institutional aid, student characteristics, and institutional characteristics? 2) What factors influence the amount of institutional aid received among students? 3) Are these factors different between men and women?

Hierarchical linear modeling (HLM) was used to calculate linear equations that explain the distribution of institutional aid among individuals in institutions as a function of the characteristics of both the individuals and the institutions. (For a more complete discussion on HLM procedures, see Hergenrother,

Figure 1
The Model of the Study

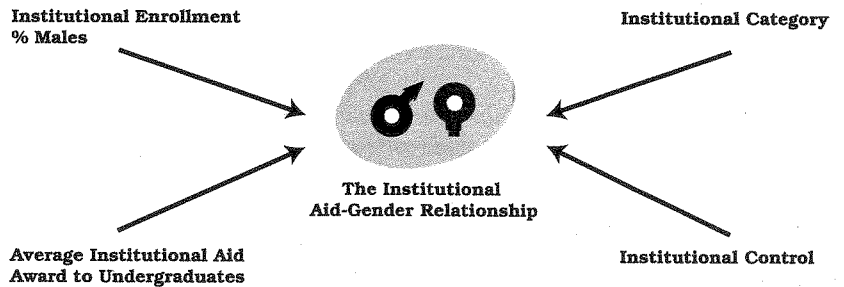
Within-Institution

Student Characteristics—Level 1



Between-Institution

Institutional Characteristics—Level 2



Olson, Smyth, and Beasley, 2001.) Students are nested within institutions. At the student level (Level 1), there is variance among students within an institution on both institutional aid and those characteristics of students that influence institutional aid. In addition, at the institutional level (Level 2), there is variance among institutions on the characteristics that influence average institutional aid and the relationships between student characteristics (e.g., academic ability) and institutional aid (Arnold, 1992).

Hierarchical linear modeling allows researchers to consider the possibility that both average institutional aid and the relationships between student characteristics and institutional aid vary across institutions. First, regression equations for each school predict institutional aid as a function of student characteristics within each school. Next, the intercepts and coefficients of these regression models, which represent average institutional aid and the within-

institution relationships between student characteristics and institutional aid, are used as dependent variables in regression equations with institutions as the unit of analysis and institutional characteristics as independent variables (Bryk & Raudenbush, 1992).

Specifically, this study investigates two dependent variables: institutional aid, and the relationship between gender and institutional aid. Figure 1 presents the model of this study, showing the ten factors considered in the analysis. The Appendix defines the terms relating to the student and institutional characteristics.

Results and Discussion

Five HLM models were run to examine the factors of interest. The results of the first unconditional hierarchical model showed that at $p < 0.001$, 65.4% of the variance in institutional aid awards was accounted for between institutions at Level 2. The remaining 34.6% was accounted for within institutions at Level 1. These results suggest that between-institution factors play a greater role in determining institutional aid awards than individual student factors.

Level 1 Results

A second HLM, a random effects analysis of covariance (ANCOVA) model, was calculated to investigate how student characteristics influenced institutional aid and to assess the variability in average institutional aid after controlling for student characteristics. The dependent variable, the logarithm of Institutional Aid, was modeled at the student level within each institution as a function of student characteristics. To compare the relative impact of the student level characteristics, each was standardized. Table 1 shows the statistical significance and relative influence (b) of each Level 1 predictor variable controlling for other student characteristics. These results suggest several interesting conclusions.

First, Academic Ability and Need were positive and statistically significant, suggesting that the expected size of a student's institutional aid award increases as a student's ability and need increases. This finding suggests that despite environmental changes and norms, institutions continue to employ policies and practices that are consistent with the public's shared values and beliefs—that is, that financial aid should be awarded to “deserving and needy” students. Thus, regarding the distribution of institutional aid, colleges and universities, which are governed by strong institutional environments (Scott, 1999; Olson, 1994; 1996), do not appear to be at risk of losing their legitimacy and therefore can expect to function with a minimum of external interference.

Second, Race/Ethnicity was positive and significant, suggesting that the expected size of a student's institutional aid

It was expected that the size of institutional aid awards would be influenced by the gender dominance in a major. It was not.

award will increase if a student is other than Caucasian, non-Hispanic.

Third, Year in College was significant and inversely related to institutional aid suggesting that more aid was awarded to students in their first year of college than to students in their sophomore, junior, and senior years. One plausible explanation is that institutions treat freshmen differently from upperclassmen. For example, some institutions may employ the practice of "front loading," that is, giving more aid to students in their first year of college and decreasing that aid in the sophomore, junior, and senior years (Lee & Clery, 1997). Another explanation could be that institutions implement "increases over time in the award levels to successive cohorts of students" (McPherson & Schapiro, 1998, p. 127).

Fourth, this study sought to investigate whether the expected size of a student's institutional aid award would be influenced by the male or female dominance in a major. Given reports that academic administrators attempt to recruit and retain students from underrepresented population groups (Adelman, 1998), it was expected that the size of institutional aid awards would be influenced by the gender dominance in a major. It was not. The variable Percent Males in the Major was not significantly related to institutional aid.

Fifth, Gender was not significant after controlling for a student's ability, need, race/ethnicity, year in college, and major. Further, there was no interaction effect between gender and percent males in the major. Thus, at the student level of analysis, there was no evidence of gender bias in the distribution of institutional student aid.

Nonetheless, after controlling for student characteristics, the estimate of between-institution variance in institutional aid was 0.199. The within-institution variance component was 0.0549. A comparison of the final estimation of variance for this student level within-institution model and the original unconditional model (0.0620) shows that student characteristics accounted for only 11.5 percent of the variance in institutional aid awards within institutions. Moreover, there was still statistically significant between-institution variability in institutional aid after controlling for student characteristics [$c^2 = 8255.76$, $df=245$, $p < 0.001$].

Level 2 Results

The variables predicted to vary across institutions at Level 2 were Institutional Aid, Academic Ability, Need, and Gender. Thus, a third HLM model (i.e., a fully random regression coefficients model) was calculated to allow for the variability of these factors. The results indicated that Average Institutional Aid and the slopes for Institutional Aid, Academic Ability, and Gender varied across institutions. However, the relationship between

Institutional Aid and Need did not. Thus, Need was treated as fixed, not random, in the fourth HLM.

A fourth model was then calculated to estimate the variance in Institutional Aid and the relationships that varied significantly. The results showed significant variability in the slopes across institutions for each factor: Average Institutional Aid [$c^2=27996.81$, $df=190$, $p < 0.001$]; Academic Ability (SAT/ACT) [$c^2=2957.378$, $df=190$, $p < 0.001$]; Academic Ability (GPA) [$c^2=2534.745$, $df=190$, $p < 0.001$]; and Gender [$c^2=1871.789$, $df=190$, $p < 0.001$]. The latter result for Gender is important because it suggests that some institutional characteristic may predict a gender discrepancy in the distribution of Institutional Aid.

A fifth, fully specified HLM model was then calculated to investigate how the institutional characteristics of interest influenced Average Institutional Aid, and the relationships between Institutional Aid and the student characteristics that were found to vary across institutions (i.e., Academic Ability and Gender). Table 1 presents the results of this analysis. This information adds further insight.

First and foremost, the relationship between Percentage of Males at the Institution and Average Institutional Aid was not statistically significant. This finding is consistent with the within-institution result at Level 1 indicating no direct evidence of gender bias in the distribution of institutional aid.

Second, Average Institutional Aid was found to vary significantly across institutions. After controlling for institutional characteristics at Level 2, the results suggest that research and private sector institutions award larger average institutional aid awards. This finding was not surprising; research and private sector institutions are known to have stronger resource bases owing, in part, to higher tuition rates, external grant funding, and larger endowments.

Third, the relationship between Need and Average Institutional Aid did not vary significantly across institutions. This result, when considered in context with the within-institution result for Need at Level 1 (i.e., as a student's need increases, a student's institutional aid award increases) suggests that all institutions distribute institutional aid in a manner consistent with the public's shared values and beliefs (i.e., financial aid should be awarded to needy students).

Fourth, the relationship between Academic Ability and Institutional Aid was measured using two variables, GPA and SAT/ACT. The first relationship of interest, Academic Ability (GPA) and individual institutional aid was found to vary significantly across institutions. This result when considered in context with the positive result for Academic Ability (GPA) at Level 1 (i.e., as a student's academic ability (GPA) increased, the expected size of a student's institutional aid award also increased) suggests that although the Academic Ability (GPA) and Average Institutional Aid relationship varied across institutions, the

The Percentage of Males at the Institution was found to be significantly related to the relationship between Academic Ability (SAT/ACT) and Average Institutional Aid.

TABLE 1
Results of the Fully Specified HLM

Fixed Effects

Variable Names	γ	Standard Error	t	df
Average Institutional Aid				
Intercept	3.420	0.01	227.406 **	242
% Males in Institution	0.002	0.002	0.917	242
Carnegie Classification	-0.048	0.006	-7.578 **	242
Institutional Control	0.588	0.030	19.915 **	242
Academic Ability (SAT/ACT)				
Intercept	0.109	0.031	3.526 *	242
% Males in Institution	0.005	0.002	2.160 *	242
Carnegie Classification	0.048	0.016	2.887 *	242
Institutional Control	-0.014	0.049	-0.284	242
Academic Ability (GPA)				
Intercept	0.075	0.025	2.926 *	242
% Males in Institution	-0.003	0.002	-1.412	242
Carnegie Classification	0.026	0.015	1.781	242
Institutional Control	0.032	0.048	0.667	242
Ability Interaction (SAT/ACT x GPA)	0.067	0.023	2.891 *	3419
Need	0.023	0.005	4.361 **	3419
Gender				
Intercept	-0.001	0.033	-0.024	242
% Males in Institution	-0.001	0.006	-0.185	242
Carnegie Classification	-0.003	0.015	-0.171	242
Institutional Control	0.011	0.043	0.257	242
Year in College	-0.038	0.010	-3.797 **	3419
% Males in Major	-0.001	0.009	-0.131	3419
Race/Ethnicity	0.031	0.009	3.321 *	3419
Interaction (Gender x % Males in the Major)	0.011	0.009	1.227	3419

Notes: Gender: 0 = Male 1 = Female
Year in College: 0 = Freshman 1 = Upperclassman
Race/Ethnicity: 0 = White, Non-Hispanic 1 = Other
Carnegie Classification: 1 = Research Universities 5 = Comprehensive I
2 = Research Universities II 6 = Comprehensive II
3 = Doctoral Universities I 7 = Baccalaureate I
4 = Doctoral Universities II 8 = Baccalaureate II
Institutional Control: 1 = Public 2 = Private

* $p < 0.05$. ** $p < 0.001$.

relationship was, on average, positive. In other words, students with more Academic Ability (higher GPAs) received higher average institutional aid awards. This finding, coupled with the results for the variable Need, suggests that institutions appear to be distributing institutional aid to students with higher financial need and higher demonstrated academic ability. The Percent of Males at the Institution was not significantly related to the relationship between Academic Ability (GPA) and Average Institutional Aid.

Analysis of the second Academic Ability relationship (i.e., Academic Ability (SAT/ACT) and Average Institutional Aid) suggests that after controlling for institutional characteristics, this Academic Ability relationship was stronger in undergraduate schools regardless of institutional control. The Percentage of Males at the Institution, however, was found to be significantly related to the relationship between Academic Ability (SAT/ACT) and Average Institutional Aid. Although this relationship was not defined as a key factor of interest when the study began, this finding is important because it suggests that across all institutions, Gender may influence the relative importance of Academic Ability (SAT/ACT) when institutional aid awards are distributed.

For this sample, the mean SAT (or converted ACT) scores for males and females were 1098 and 1073, respectively. As the percentage of males at an institution increased, the academic ability of the student, as measured by the SAT/ACT score, became a stronger predictor of who received institutional aid. This suggests that when there was a higher percentage of men at an institution, and thus men were not in demand, academic standards for rewarding institutional aid were more stringent. Conversely, at institutions where there were fewer male students, and thus men were in more demand, the SAT/ACT requirements for institutional aid tended to be lower.

Conclusion and Recommendation

At the within-institution level of analysis, the results suggest that current policies and practices governing the distribution of institutional aid are effective and consistent with the public's shared values and beliefs—i.e., that assistance should go to deserving and financially needy students. However, because the between-institution level of analysis disclosed indirect evidence that points to gender as having an influence on the distribution of institutional aid, caution is recommended. More research is needed to understand better the variation in the relationship between gender and institutional aid across institutions, as well as how to confirm whether the percentage of men at postsecondary institutions influences the relationship between SAT/ACT and average institutional aid. For example, regarding the latter, future research might focus on whether the percentage of male undergraduates at postsecondary institutions

influences the relationship between SAT/Math and average institutional aid in the sciences.

Another reason for caution rests in the fact that this study examined undergraduate students attending postsecondary education during the 1995-96 academic year—the most recent NPSAS year available at the time this study was conducted. However, reports pertaining to the gender gap and financial aid modeling are, for the most part, recent. Therefore, the data extracted from the NPSAS:96 data base may not reflect current trends.

It is recommended that this investigation be viewed as a base study for future research, which might include the investigation of enrollment and admissions data. Continued investigation will provide valuable information for the public as well as postsecondary school administrators and others who are responsible for establishing the policies and practices that govern this vital enrollment management function.

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Appendix
DEFINITION OF TERMS

Student Characteristics

Gender is the gender of a student (i.e., male or female).

Need is the difference between a student's total cost of attendance and the amount that a student's family is deemed able to pay (U.S. Department of Education, 1999).

Academic Ability is a measure of a student's ability as defined by a student's SAT, ACT, or GPA score.

Year in College is the grade level of an undergraduate student. It provides a means for investigating the differences in the amount of student aid awarded to students at different grade levels. In this investigation, year in college represents two student groups – freshmen and upperclassmen (i.e., sophomores, juniors, and seniors).

Major classifies majors on the basis of gender (i.e., the male or female dominance in a major). This study investigated the percentage of males in the major to examine whether an imbalance in participation by gender influenced the distribution of institutional student aid.

Race/Ethnicity classifies students on the basis of nationality, or geographical distribution.

Institutional Characteristics

Institutional enrollment - % Males is the percentage of males enrolled in postsecondary education across all institutions.

Average institutional aid awarded to undergraduates is the average institutional aid awarded to traditional full-time undergraduate students across all institutions.

Institutional category classifies institutions by Carnegie classification which groups institutions with similar missions and programs (i.e., giving high priority to either research or undergraduate education). While the Carnegie Foundation never intended that the classification system establish a hierarchy among higher learning institutions, it has been found to be significant and it has been used by previous researchers (Paul, 1990; Lee & Clery, 1997; McPherson & Schapiro, 1998). Further, the Carnegie classification is an ordinal variable used as a ratio variable in this study. Although this may not be strictly appropriate, it provides an economy, and it was significant.

Institutional control classifies colleges and universities on the basis of type (i.e., public or private institution).