The Determinants of Donative Revenue Flows from Alumni of Higher Education: an Empirical Inquiry

Carlena K. Cochi Ficano and Brendan M. Cunningham

Abstract

Institutions of higher education are increasingly relying upon alumni giving and endowment earnings as sources of funding, yet little is known about the determinants of those revenue streams. This paper utilizes a new database on average alumni donations at the institutional level and institutional characteristics spanning a fifteen-year horizon to explore the role that lagged institutional characteristics and policy have on subsequent donations to the institution. Our results confirm the non-contemporaneous effects of variations in the average scholastic achievement of matriculated students (a proxy for both student quality and student socio-economic status) on subsequent donative revenue flows and, in addition, indirectly address some of the open questions left by previous theoretical inquiries into the economics of higher education.

*Ficano: Department of Economics, Yager Hall, Hartwick College, Oneonta, NY 13820. Cunningham: U. S. Naval Academy, Economics Department, 589 McNair Road, Annapolis, MD 21402-5030. This paper will be presented at the *Cornell Higher Education Research Institute Conference on Financing Education Institutions in the 21st Century*. We would like to thank Ron Ehrenberg, Larry Malone and two anonymous referees for extremely helpful comments. We would also like to acknowledge the generosity of Peterson's, a Thompson Learning Company, and Mark Zidzik thereof, for providing access to their Archival Undergraduate Database. Maurice Leblanc and Laura Pasckiewicz provided extremely capable research assistance for this paper. We take responsibility for all errors.

1 Introduction

By tradition and by charter, higher education in the United States is predominantly supplied by institutions with a non-profit mandate. Nominally, then, such institutions differ noticeably from private suppliers of other consumable services, to whom economic theory typically ascribes profit maximizing motives, by behaving as "prestige maximizers" (Bowen (1981)). As noted by Winston (2000), the competitive process in higher education is analogous to an arms race in which institutions are fighting for rank within the set of all colleges and institutions.

While the profit maximizing framework may be an inappropriate description of the non-profit institution of higher education, the fundamental nature of financial flows confronting a college president do share similarities with the financial flows confronting a chief executive officer. In fact, previous research such as Hansmann (1981) and Winston (1999, 2000) tends to emphasize only one core feature which serves to distinguish non-profit from for-profit enterprises: the "non-distribution" constraint. In a non-profit firm, revenue flows in excess of cost flows may not be redistributed to owners (where owners are defined in the conventional sense of a firm's stockholders). However, these flows obviously do exist and must be managed in a manner consistent with the goals of the institution.

One of the most important weapons institutions of higher education can accumulate in the arms race of prestige maximization, Winston observes, is the discount at which they sell their product. The overwhelming majority of colleges and universities set price below the average cost of producing education for a single student,[1] and a given school's ability to maintain or increase this subsidy hinges upon its access to non-tuition financing of all forms. Since charitable donations are obviously one source of finance in the subsidy battle (in addition to external grants and contracts, corporate gifts and the like), such donations can be a significant determinant of an institution's long-term success. If the inflow of charitable donations to a college increases, that college might increase its subsidy and enjoy the commensurate improvement in student quality and overall position within the pack of colleges.[2] Winston's analysis suggests that institutions of higher education should (and actually do) take an active interest in cultivating such flows.

[1] This observation holds for the economic costs of producing a unit of education, not necessarily for the accounting costs , see Winston (1999) and the references therein.

[2] Provided its competitor on the next rung of the ranking ladder fails to match its increase in subsidy or compensate in some other such manner.

Thus, higher education's significant and growing dependence upon donations from alumni clearly distinguishes it from other industries. As noted by Leslie and Ramey (1988), a dollar donated by alumni is critically important to an institution of higher education since it "frequently provides the margin of excellence, the element of vitality, that separates one institution from another."[3] These authors report that alumni donations were (at the time of writing) consistently the highest-ranking source of charitable support for higher education, typically claiming a 25 percent share of all donations to colleges and universities in the early 1970s and 1980s. Recent reports[4] indicate that this share has climbed from 27 percent in 1993 to 30 percent in 1998, thereby suggesting that alumni contributions to higher education are growing in importance. We further claim that such flows are somewhat distinct from other higher education revenue sources (such as tuition, book sales, etc.) in that lagged rather than contemporaneous institutional features, administrative choices, and student body characteristics are highly relevant determinants of donative flows.

Motivated by these observations, this paper explores the potential determinants of alumni giving at the institutional level in order to illustrate the crucial role that current institutional decision-making plays in future financial well being. We apply standard OLS regression techniques to a large data set of approximately 400 public and private, two and four year colleges and universities over the period 1984 to 1998, exploiting the panel nature of the data to include a thirteen year lag between measures of mean giving per alumni at the institutional level and institutional determinants of that giving. Our results indicate that lagged measures of average incoming student achievement in high school significantly impact upon alumni giving, controlling for college prestige as measured by the initial size of the endowment per student. In contrast, other indicators of aggregate student allegiance at the institutional level and college value-added, such as the presence of NCAA athletics and library quality (as measured by number of bound volumes per student), have no significant impact upon alumni generosity. Our estimates further suggest that alumni of schools with a four year functional definition are statistically more charitable to their alma mater, providing further evidence of the "liberal arts" effect documented in Clotfelter (2000). Finally, to the extent that student high school achievement proxies for student ability, the statistical significance of our measure of student inequality of ability is consistent with the existence of "peer effects" (Rothschild and White (1995), Goethals, Winston and Zimmerman (1999), and Winston (1999, 2000)) in the

[3] Leslie and Ramey (1988), p. 115

[4] See Anonymous (1985).

production of higher education.

These results have strong implications for the management of institutions of higher education. Current budgetary and admissions practices critically affect the long-term financial success of colleges and universities in a very dynamic context that renders standard static marginal cost and benefit analyses inappropriate. For example, one dollar of need-based financial aid imposes a cost upon an educational institution today, but may provide long term benefits through increased average alumni donations, a larger endowment, and the increased institutional policy options to partially or fully offset the initial cost.

2 Previous Research

A lengthy economics literature considers voluntary charitable giving by individual households both theoretically and empirically as one in a vector of goods over which households must choose their level of consumption given price and income constraints. These studies (see Taussig (1967), Feldstein (1975a, 1975b), Clotfelter (1985), Lakford and Wyckoff (1991), and Weisbrod (1988) for some examples) generally find positive and significant elasticity of giving with respect to tax deductibility and income elasticity of giving that is positive, statistically significant, and less than one.

A smaller body of research focusing specifically upon charitable giving to institutions of higher education has empirically examined the determinants of donative revenue flows. For non-alumni donors such as foundations and corporations, Leslie and Ramey (1988) find a positive and significant elasticity of donation with respect to endowment per alumnus. However, they report that alumni donors instead rely very heavily on academic quality and prestige as evidenced through a large, positive, and statistically significant elasticity of donations with respect to the Gourman rating.

Subsequent research has added various student-life variables which proxy for student allegiance and satisfaction to the list of determinants of donative flows. Harrison, Mitchell and Peterson (1995) discover that in analyzing their sample of 18 schools pooled over three years, an increase in the percentage of students participating in social fraternities is associated with a statistically significant increase in alumni donations attributed by the authors to “fond memories” which serve to encourage subsequent donation. Bruggink and Siddiqui (1995) confirm this result using cross-sectional micro-level data from one liberal arts college.[5] They also find that income, age, and proximity to the alma mater vary directly with donations, thereby supporting the well-documented existence of life-cycle alumni giving (Okunade, Wunnava and Walsh (1994)).

In addition, Bade and Sundberg (1996) utilize a large national database of both public and private institutions to address average alumni giving at the institutional level as a function of contemporaneous student and institutional quality and the intensity of alumni solicitation efforts. Using instrumental variables techniques to control for the potential endogeneity of student quality, they find a positive and statistically significant impact of measured average student quality on giving in private institutions.

Finally, Clotfelter (2000) explores a rich set of data consisting of individual survey responses from two alumni cohorts of 14 highly selective private colleges and universities. Clotfelter seeks to empirically assess the impact on donations of former students' personal satisfaction with their alma mater's social and educational offerings. Clotfelter concludes "the regression equations explaining alumni giving clearly show the importance of two factors: income and an overall good opinion of one's alma mater."[6] Specifically, a dummy variable taking on the value 1 if an alumni reports being "very satisfied" with the education s/he received at their school of first enrollment obtains a large, positive, statistically significant coefficient in Clotfelter's Tobit regressions.

This paper contributes to the literature by utilizing a large (approximately 400 observations) and diverse sample of schools of higher education with significant cross-sectional variation in selectivity, institutional type (private and public, two year, four year, university) and endowment per student. Further, we exploit the panel nature of the data to include a thirteen year lag between measures of the determinants of alumni giving and average donation per alumnus in order to at least partially address the life cycle aspect of donative behavior and the potential endogeneity of measured student achievement. Finally, we include a broad array of measures of school quality, student academic achievement, student allegiance, educational value added and financial aid generosity in our list of variables which drive charitable giving.

Notably absent from this list of giving determinants are measures of family resources and wealth, which are unavailable due to data constraints. Research by Graham and Husted (1993) and others has demonstrated a high correlation between families' socio-economic status and our measure of student academic achievement. Thus,

[5] The results are also consistent with the idea that membership affects giving through its correlation with socio-economic status.
[6] Clotfelter (2000), p. 12

our empirical estimates could be capturing both the joint effect of academic achievement and familial wealth on giving. In terms of policy applications, however, this issue is less problematic as subsequently reported results indicate that our measures of quality do appear to explain aggregate donative behavior, regardless of the causal mechanism by which they operate.

3 Theoretical Motivation for Empirical Model

3.1 Theoretical Motivation

Although our empirical model examines the determinants of average alumni giving aggregated to the institutional level, we begin by assuming that standard consumer theory can generate a mapping from alumni budget constraints and preference parameters to demand for charitable giving. As is the case with most goods, this distilled demand function will have the following form:

$$donation_{ij} = z\left(p_{ij}, Y_{ij}, \overrightarrow{\tau}_{ij}, \rho_j\right) \quad (1)$$

where i and j serve as an index for alumnus i who attended school j, p_{ij}[7] represents the relative price of charity, Y_{ij} is individual i's income,[8] $\overrightarrow{\tau}_{ij}$ is a vector of parameters summarizing individual i's "taste" for giving, and r_j is school j's reputation. The specification in (1) is consistent with prior theoretical treatments of an alumnus' decision to donate to his / her alma mater.

Assuming the existence of an educational wage premium (see Murphy and Welsch (1992), Bartel and Sicherman (1999), and Brewer, Eide and Ehrenberg (1999)), alumni income becomes:

$$Y_{ij} = g\left(education_{ij}\right) + q\left(\overrightarrow{\sigma}_{ij}, \omega_{ij}\right) \quad (2)$$

[7]In our empirical specification, data availability prevents us from controlling for cross-sectional variation in tax policy which may affect an individual's price of giving. However, indirect controls for alumni wealth (e. g. lagged need based financial aid) may begin to capture variation in aggregated individual marginal tax rates. The relationship is not systematic, and should not be interpreted as such.

[8]This is not entirely appropriate since household wealth (for which there is almost never a perfect measure) provides an upper bound on consumption behavior. The literature on giving has been forced to rely upon income as the proper measure of a household's financial resources due to data constraints.

with $g' > 0$ and the function q capturing the effect on income of variables such as race, gender and occupation that are contained in the vector $\vec{\sigma}$ and of family wealth, ω, which could act through intergenerational transfers and / or preferred employment opportunities.

Following Hanushek (1986) and more recently Goethals et al. (1999) among others, we assume the existence of an educational production function, h, whereby an alumnus' quality as a student, θ_{ij}, his / her family wealth ω_{ij} (operating through post-secondary school choice and admission), and a vector of determinants of a school's ability to add educational value, $\vec{\nu}_{ij}, \omega_{ij}$, combine to produce the education which the alumnus brings to market:

$$education_i = h\left(\theta_{ij}, \omega_{ij}, \vec{\nu}_{ij}\right). \tag{3}$$

By assumption, $h_\theta, h_\omega, h_\nu > 0$.

Imposing additive separability on z in (1) and combining (1) through (3) we obtain:

$$donation_{ij} = f^p(p) + f^{wp}\left(\theta_{ij}, \omega_{ij}, \vec{\nu}_{ij}\right) + f^\tau\left(\vec{\tau}_{ij}\right) + f^{wps}\left(\vec{\sigma}_{ij}, \omega_{ij}\right) + f^\rho\left(\rho_j\right) \tag{4}$$

The second term on the RHS of (4) bears emphasis, for it is this term which is one of the unique components to our approach.

This wage premium mapping is actually the composition of the donation mapping, z, the primitive wage premium mapping, g, and the educational production function, mapping, h so that $f^{wp} \equiv z \circ g \circ h \circ$. Given the assumptions on the underlying functions of which f is composed, we conclude that donations from an alumnus should be positively associated with his / her quality level as a student, his / her family weath, as well as those institutional features which enhance a school's ability to add educational value to its students: $f^{wp}_\omega, f^{wp}_\omega, f^{wp}_\nu > 0$. We will make reference to the effects of these variables on giving, but implicitly the chain of effects is an indirect and complicated one, running from a student's educational level at graduation to the market value of that student's education (i. e. the wage) to subsequent donations as an alumnus. *Ceteris paribus*, higher mean student quality should increase average donations at the institutional level by increasing the average earnings of the alumni pool and/or the probability of a having large donors in the alumni pool. Both Bade and Sundberg (1996) and Clotfelter (2000) have also attempted to relate measured student quality to subsequent levels of donation.

Imposing additive separability and linearity[9] on (4) and allowing for the appropriate time lag between undergraduate matriculation and alumni donation, we obtain an empirically tractable model:

$$donation_{ijt} = \beta_p p_{ijt} + \beta_\theta \theta_{ijt-k} + \beta_\omega \omega_{ijt-k} + \beta'_\nu \overrightarrow{\nu}_{ijt-k} + \beta'_\tau \overrightarrow{\tau}_{ijt-k} + \beta'_\sigma \overrightarrow{\sigma}_{ijt-k} + \beta_\rho \rho_{ijt} + \epsilon_{ijt} \tag{5}$$

As the data at our disposal are aggregated to the institutional level, our empirical analysis focuses on average alumni giving as a function of average institutional characteristics. Summing over the set of alumni in (5) and dividing by their total number, we have a specification that represents cross-sectional averages by institution (note the removal of the i subscript):

$$donation_{jt} = \beta_p p_{jt} + \beta_\theta \theta_{jt-k} + \beta_\omega \omega_{jt-k} + \beta'_\nu \overrightarrow{\nu}_{jt-k} + \beta'_\tau \overrightarrow{\tau}_{jt-k} + \beta'_\sigma \overrightarrow{\sigma}_{jt-k} + \beta_\rho \rho_{jt} + \epsilon_{jt} \tag{6}$$

where variables are now interpreted as per-alumnus averages for institution j.

As written, equation (6) fails to recognize the non-random selection process by which individuals i come to enroll at institution j. Ceteris paribus, institutions with higher academic profiles / reputation at the time of matriculation will experience a superior quality yield (as traditionally measured by SAT scores, etc.) from the pool of admitted applicants. Furthermore, if past and current aggregate measured student achievement serve as a signal of rank, high-quality institutions will attempt to maintain their profiles via selective admissions and financial aid policy (i. e. discounting) as part of the "institutional arms race" noted by Winston (2000). In addition, high-reputation schools are presumably more effective in adding educational value to their enrollees. Thus, we anticipate that three of our explanatory variables are endogenous with respect to reputation:

$$donation_{jt} = \beta_p p_{jt} + \left(\beta_\theta \theta_{jt-k} + \beta_\omega \omega_{jt-k} + \beta'_\nu \overrightarrow{\nu}_{jt-k}\right) \mid \rho_{jt-k} + \beta'_\tau \overrightarrow{\tau}_{jt-k} + \beta'_\sigma \overrightarrow{\sigma}_{jt-k} + \beta_\rho \rho_{jt} + \epsilon_{jt} \tag{7}$$

The specification in (7) implies that failure to control for the reputation of a school will compromise our estimates

[9] Although we explicitly impose linearity in our empirical modelling, our empirical results are robust to the inclusion of a number of quadratic terms. With the exception of endowment per student squared and SAT squared terms, no quadratic terms significantly enhance model fit. Interpretation of the significance of the SAT squared variable is compromised by its strong correlation with our measure of student inequality in achievement ($gini84$). Note that the linear coefficient on endowment per student estimated in the absence of a quadratic term represents a conservative lower bound.

if schools' reputation typically fails to vary with the progression of time.

One of the key features of Winston's arms race model of institutional competition is the invariance of reputational rankings over time, despite significant attempts on the part of institutions to improve their profile. This suggests that reputation should exhibit significant serial correlation, and a failure to control for reputation will induce an upward bias in our estimates of $\beta_\theta, \beta_\omega,$ and β'_ν from (7).[10] However, the postulated time-series correlation of reputation[11] is exploitable. Estimates of the structural relationship:

$$donation_{jt} = \beta_p p_{jt} + \beta_\theta \theta_{jt-k} + \beta_\omega \omega_{jt-k} + \beta'_\nu \vec{\nu}_{jt-k} + \beta'_\tau \vec{\tau}_{jt-k} + \beta'_\sigma \vec{\sigma}_{jt-k} + \beta_\rho \rho_{jt-s} + \epsilon_{jt} \tag{8}$$

with $s < k$ will adequately control for the joint effects of reputation on donative behavior and our explanatory variables $\sigma, \omega,$ and ν.

3.2 Empirical Model

Our results are obtained through estimation of a series of standard OLS regressions using the following linear equation:

$$donation_{jt} = \beta_A A_{jt-k} + \beta'_\nu \vec{\nu}_{jt-k} + \beta'_\tau \vec{\tau}_{jt-k} + \beta'_\sigma \vec{\sigma}_{jt-k} + \beta_e endwps_{jt-s} + \epsilon_{jt} \tag{9}$$

Note two differences between the theoretical reduced form (8) and empirical (9) specifications. First, we rely upon endowment per student (*endwps*) as an adequate proxy for reputation. Second, given data constraints on student family wealth and the inherent immeasurability of student quality, we include measures of mean high school achievement (A_{jt-k}) to proxy for the joint effects of student quality and socio-economic status on giving. Assuming the absence of any systematic measurement error, β_A provides an unbiased estimate of the combined impact of mean student wealth and academic quality at time $t-k$ on the subsequent flow of donations from the alumni pool to the institution. Admittedly, we cannot identify the individual impacts of these variables and thus the causal mechanism by which student achievement affects donations at the institutional level. We can,

[10] Empirical results to be discussed later indicate that coefficients are biased by endogeneity when endowment per student, our proxy for reputation, is excluded from estimation.

[11] Institutions of higher education display significant invariance in ranking (see Winston (2000)). In our sample, endowment per student, our proxy for reputation, is consistent with time-invariant reputational rankings. A fixed-effects regression of the annual growth rate of endowment per student over the years 1989 - 1998 fails to reject the joint insignificance of school specific fixed effects. No school in our sample exhibits a statistically significant deviation from an 8 percent annual growth rate of endowment per student.

however, explore the relationship between measurable characteristics available to college administrators, such as SAT scores, and subsequent aggregate donative behavior at the institutional level.

The first two regressions apply differing measures of student high school achievement to test the robustness of our results. The third and fourth models add controls for inequality of student achievement to address the impact of peer effects on educational value-added. The fifth final model re-runs the first regression while omitting controls for institutional profile in order to illustrate the impact of endogeneity bias on the findings.

4 Data and Variables

4.1 The Data

Our information on charitable giving, student body characteristics, and institutional features comes from two sources. The first is a database collected and maintained by the Council for Aid to Education (CAE). The Voluntary Support of Education Database contains survey data on alumni number, donations, and soliciting from 892 public and private institutions in the United States. All schools for which we could calculate the average real (1998 base) annual dollar value of donations per alumnus over the period 1996 to 1998 were initially included in our sample. We averaged this variable over three years in order to use a more structural measure of alumni behavior and minimize the impact of cyclical annual fluctuations in giving.[12,13]

The second source of information is a proprietary database maintained by Peterson's Higher Education Research Division.[14] Their Archival Undergraduate Database contains survey results on various institutional / student body characteristics from over 3,900 colleges and universities over the 1984 - 1997 period. Merging of the Peterson's database with our sample drawn from the CAE yielded 549 common observations. Our final sample of 415 institutions represents all observations for which we have complete information on alumni giving and institutional characteristics.[15]

[12] Related work in progress (Ficano and Cunningham (2001)) examines the parallel question of the impact of student quality and school characteristics on the percentage of alumni donating to their *alma mater*.

[13] For a discussion of the impact of business cycle fluctuations on aggregate giving to higher education, see Leslie (1983). Our results are robust to averaging over a larger period of time that better captures cyclical fluctuations. We present the shorter averaging as it provides a larger sample of institutions.

[14] We thank Mark Zidzik , Director of Research Development, of Peterson's, a Thomson Learning Company, for his generous provision of the data.

[15] We have also restricted our sample to accredited schools.

4.2 The Variables

Our analysis utilizes a number of quantitative measures of the conceptually defined causal variables described in the sections above. In order to capture the lagged effects of these variables on giving, as is consistent with (9), all explanatory variables, with the exception of endowment per student and institutional solicitation of donations are measured in the year 1984.[16,17] This introduces at least a 13 year lag between the majority of our explanatory variables and the data used to construct our dependent variable, thereby reducing the effects of contemporaneous reverse causation on our results. Further, we rely upon endowment per student (*endwps*) as an adequate proxy for reputation.

Note that many of our measures may proxy for more than one causal variable. For example, the mean SAT of a school's entering class provides information on the average high school achievement of students enrolled at a college. However, a student body with a high mean SAT score may also enjoy the educational experience more, and hence may also have a stronger taste for giving (i. e. a higher $\vec{\tau}$). Moreover, since data constraints prevent us from including in our analysis direct measures of parental wealth or socio-economic status, our measure of high school achievement is, in all likelihood, partially proxying for the impact of these factors on giving. Where appropriate, we note instances in which multiple causal relationships are likely to be involved. We urge the use of caution in interpreting our results.

A brief explanation of each group of variables follows. For a more detailed description of the variables and their summary statistics, please refer to the discussion beginning on page 22.

Student Quality(θ): To proxy for the average quality of the student body attending an institution, we utilize measures of high school scholastic achievement. We include the fraction of a college's entering class which graduated in the top 10 percent of their high school class ($fr1084$) and the percentage of the entering class who were national merit scholars ($frnms84$) in all estimated equations. In addition, we employ either a test-based, more objective measure of student achievement ($sat84$) or an index of the entrance difficulty level of the school as

[16] Solicitation is averaged over the period 1996-1998. Endowment per student is measured in 1987, the earliest period for which we have data. As virtually no cross-section variation in endowment growth rates exists in our sample, our use of 1987 rather than an earlier measure should pose no problem.

[17] Early models included measures of contemporaneous as well as lagged financial aid behavior. Collinearity between the two that confounded the interpretation of the slope coefficients as well as a relatively weak theoretical justification for inclusion of the contemporaneous variables prompted their removal from the final models.

reported by its administrators ($entdif84$).[18] As mentioned previously, data constraints prevent us from including measures of parental wealth or socio-economic status that are likely to be correlated with both student high school achievement and subsequent giving. Results on student achievement measures are thus likely to be driven by both actual student quality and family wealth. The distinction is not crucial for policy application of our results.

The exact manner in which the variable $sat84$ was constructed is reported in the discussion beginning on page 22. In brief, the value of this variable is determined by three conditions. If a school fails to report any test-based (SAT or ACT) student quality measures, $sat84$ takes on its mean value as calculated from the set of colleges which have reported test-based measures and a missing value indicator is assigned a value of one following standard empirical procedures (Greene (1993)). If SAT data is reported, $sat84$ takes on the average SAT value of a college's entering class. If SAT data is not reported by a college, but ACT testing outcomes for its entering class are reported, we follow the procedure outlined in Langston and Watkins (1980) and convert those ACT score to SAT values.[19] The resulting average of converted SAT data is entered as the value of $sat84$.

If we had not followed this ACT conversion procedure, our sample would have been reduced by approximately 48 percent. Alternative measures of student achievement available in our data set indicate that schools which do not require SAT scores for admission appear to admit, on average, lower quality students than those which do ($entdif84$ of 1.35 vs 1.99). Further, analysis of endowment size per student in the full data set indicates that schools which do not report alumni contributions are likely to experience lower levels of giving than those which do (mean of 9.56 vs 24.92). Given this and the facts that 1) mean alumni giving conditional upon SAT reporting is statistically higher than giving conditional upon non-reporting (158.29 vs. 64.60), and 2) mean SAT conditional upon reporting of alumni giving is statistically higher than SAT conditional upon non-reporting (982.52 vs 906.37),[20] results obtained from a smaller sample of only SAT-reporting schools represent a conservative lower bound on the true effect of student quality on alumni giving. Our conversion of ACT data averts this problem.[21]

As described in the discussion beginning on page 22, $sat84$ is essentially nested within the $entdif84$ measure.

[18] Early models also included SAT growth rates to proxy for change in student quality. These variables were consistently insignificant and therefore dropped from subsequent specifications.

[19] We thank Ron Ehrenberg for informing us of these conversion procedures

[20] These results are available upon request. Note that conclusions presented in this paper are robust to the sample size reduction.

[21] In order to minimize the impact of the ACT conversion on inference, we include a dummy variable, *cacts*, which takes on the value 1 if ACT-converted data has been used for a particular school. This variable obtains statistical significance in only one of our estimation frameworks, column (1) of Table 1. In addition, we interact $sat84$ with this dummy variable in order to control for possible structural differences in schools which have reported only ACT data. The estimated parameters on the resulting variable, *satcacts*, are never statistically significant at the 10 percent level.

For this reason, we avoid near collinearity problems in estimation by swapping these variables for one another. The measure of student quality, $entdif84$, does have an advantage over $sat84$ since the latter is directly reported by colleges and does not contain data which pass through our test score conversion procedure. The downside risk of employing this measure is the inherent vagueness involved in its collection. Administrators following Peterson's survey guidelines might choose to emphasize different measures in their determination of student quality. This could inject measurement noise into $entdif84$ and compromise our results.

We anticipate that each of the measures of student quality should be positively associated with subsequent alumni donations.

Institutional Value Added $\left(\vec{\nu}\right)$: We employ three direct variables to measure an institution's ability to add educational value to its students, namely the faculty-student ratio, the percentage of full-time faculty with a doctorate, and the number of bound volumes in the library per student. The last variable serves as a proxy for educational resources that are made available to students. We anticipate that these variables should exhibit positive effects on giving.

We also include a Gini coefficient for scholarly achievement, $gini84$, calculated from the raw SAT data in Peterson's database, and its interaction with SAT, $ginsat84$, in order to quantify the effects of inequality in scholarly ability (as measured by high school achievement) within a student body on the subsequent donative behavior of that body.[22,23] This measure captures a number of potential causal relationships. First, Rothschild and White (1995), Goethals et al. (1999), and Winston (1999, 2000) have described the potential presence of "peer effects" in educational endeavors whereby one student's ability level effects another student's educational experience. If such effects are at play, the inequality of ability in a student body has implications for the overall potential for value-added learning in that body.[24] Second, a substantial literature (Spence (1973) pioneered the work in this area) addresses the signaling effects of higher education on wages. An institution with a less diverse student body in terms of measured academic performance may provide a less noisy signal to potential employers that translates into better employment options and enhanced earnings upon graduation.

[22] For a detailed description of the construction of $gini84$, see page 25.

[23] For reasons identical to those cited in footnote 21 above, we include in estimation an indicator of insufficient data for the calculation of $gini84$ ($mvgin84$) as well as a dummy variable taking on the value of 1 if converted ACT data was used in the construction of $gini84$ ($cactg$). In addition, we include $gincactg$ and $gscactg$; terms respectively interacting $gini84$ and $ginsat84$ with $cactg$.

[24] See also Rothschild and White (1993), p. 18, for a discussion of the "benefits of homogeneity."

Alumni Taste for Giving $\left(\vec{\tau}\right)$: To measure the extent to which a pool of alumni has an enhanced or compromised taste for giving, we include institutional features such as the alma mater's participation in a wider institutional system ($sys84$) and whether the school is functionally defined as a two-year college ($twoyr84$), four year undergraduate institution ($fouryr84$), or university with undergraduate and graduate offerings ($univ84$). A graduate from a campus of a wider system might hesitate to donate to their alma mater since donations may not ultimately remain in the intended campus.[25] We anticipate a negative coefficient on this variable. The $fouryr84$ variable is included in light of Clotfelter (2000) observation that alumni of liberal arts schools exhibit a statistically stronger proclivity for giving, possibly because such alumni have a greater allegiance to their schools. We anticipate a positive coefficient on this variable.

The $univ84$ variable is meant to control for three distinguishing aspects of the alumni of universities. First, the set of alumni from universities is unique in that it includes graduate student alumni who may exhibit a weaker taste for giving. Secondly, research in Leslie and Ramey (1988) and Okunade (1996) suggests that alumni may reduce their contributions to schools with a significant amount of public financing. The transfer of tax receipts to the coffers of public institutions is potentially a non-voluntary substitute for private giving. Institutions which receive a large amount of state support are typically large universities. Finally, Brewer et al. (1999) provide evidence that elite private institutions may generate a higher wage premia than their public counterparts, even when controlling for college selection. Hence, our prior impression is that $univ84$ will exhibit an inverse relationship with alumni donations.

In addition, in the spirit of Harrison et al. (1995), we include two explanatory variables to control for the effect of an institutional commitment to sports on alumni taste for giving and subsequent alumni donations. If an institution is a member of the NCAA at some level, $NCAA84$ takes on the value 1. Moreover, to allow for an independent effect of high-profile athletics on students' educational experience and subsequent donations, we include $divI84$. This variable takes on the value 1 if an institution participates in the NCAA at the division one level. We anticipate the sign of both coefficients to be positive.[26]

[25] Even if UC- Berkeley, say, assures its alumni that their donations will stay with Berkeley, a reduction in Berkeley's budgetary allocation from the UC system which matches the volume of alumni donations and subsequent reallocation of those funds to UCSD, say, implies that those alumni donations have essentially accrued to another campus.

[26] We recognize the inherent weakness of our measure of school athletic prominence. It remains in the model because stronger alternative objective measures were not available. We prefer our measure to the existing subjective alternatives.

Our variable, *relig*84, indicates if a school maintains some type of religious affiliation. Donations to a school with a religious affiliation may yield multiple sources of utility for its graduates, so we would anticipate a positive coefficient on this variable. To address the impact that direct solicitation efforts from an alumni office have on giving, we have calculated an average, over the three years 1996 - 98, of the percentage of alumni of recorded solicited by an institution: *sol*3. Again, we anticipate a positive coefficient for this variable.

Finally, institutions of higher education routinely offer a number of financial packages in order to assist a student with the cost of financing an undergraduate education; they are free to manipulate their discount. The three variables, *discnd*84, *disc*84, and *laid*84 measure the percentage of the cost of full-time attendance which is rebated to a student via need based scholarships, non-need based scholarships, and student loans made available from college funds. We believe that the aggregate pool of alumni might acknowledge institutional assistance in meeting the cost of attendance and / or surmounting any credit market imperfections which limit students' access to private sources of credit by "giving back" to the school.[27] Among non-recipients of aid, tuition rebating may increase alumni generosity by highlighting the school's commitment to a larger social obligation. We anticipate that scholarship - based financial aid, as "free" money, should exhibit a more significant positive effect on subsequent giving, relative to loan-based aid. Note that these variables also measure student/parental financial position and may proxy for future student budget constraints upon giving as well.

Wage Shifters $\left(\vec{\sigma}\right)$: We include *upwm*84, a measure of the percentage of enrolled undergraduates who are female, and *upmin*84, a measure of the percentage of enrolled undergraduates who belong to minority groups, to control for potential sub-par wage payments to these groups post-graduation. If an institution's student body and alumni pool is experiencing poor wage payments, ceteris paribus, that institution might also receive lower contributions from alumni.[28] Finally, we account for wage premia associated with alumni pursuit of graduate degrees by including as explanatory variables the percentage of graduates who pursued post-graduate study of business, dentistry, engineering, arts and sciences, law, medicine, theology, and veterinary medicine.

[27] There is probably little cross-sectional variation in schools' provision of credit to students. The national Perkins and Stafford programs impose significant uniformity on lending behavior in the higher education market.

[28] This effect is not necessarily predominant. Other things may not be equal in this case since alumni of schools which have made a noticeable commitment to "disadvantaged" groups may engender allegiance, and greater donations, from their alumni pool as a sign of gratitude.

5 Empirical Results

Our results indicate that an institution's average donation per alumni increases by between \$61 and \$87 for every standard deviation (120 point) increase in lagged mean SAT score[29] and by between \$17 and \$33 for every standard deviation (.02 point) increase in the lagged faculty student ratio. Alumni from schools that send many students to business school have lower donations per alumni (between \$12 and \$16), as do schools that are part of a larger system and universities. We find strong evidence in support of the "liberal arts" effect described by Clotfelter (2000) in that functionally-defined "four-year" institutions receive between \$38 and \$49 more in average donations per alumni than do other institutions. Notable for their lack of statistical significance in our sample are soliciting efforts, the profile of sports on campus, religious affiliation, and percentage of enrolled graduates who are female / minority. A more detailed discussion of the results listed in Table 1 follows. Note that all standard errors used to calculate the p-values listed in Table 1 are robust to heteroscedasticity.

5.1 Models Excluding Controls for Inequality of Student Ability

The first two columns of Table 1 present coefficient estimates from the model summarized by equation (9) using the alternative student achievement measures $sat84$ and $entdif84$ and including all variables described above with the exception of $gini84$ and $ginisat84$. Of our measures of school profile, endowment per student significantly increases subsequent alumni giving from the institutional alumni pool as evidenced by coefficients of 1.32 and 1.44 respectively and p-values below .01. The percent of students who reside within the state ($upsr84$) obtains the theoretically-consistent and significant negative sign.

With respect to measures of student high school achievement (proxies for both student quality and student wealth), both mean SAT and self-reported entrance difficulty are positive and statistically significant (coefficients of .49 and 30.34 in columns (1) and (2) respectively), while percentage of freshmen graduating in the top ten percent of their high school class is positive in both regressions (coefficient of .78 and 1.37 respectively) and significant in column (2). This conforms with our prior that a student body with higher mean levels of academic achievement in high school, as measured by mean SAT scores and rank in class, will donate more, on average, to its alma mater, through either enhanced giving by all members of the student body or an increased probability

[29] This impact is relevant for schools which report SAT scores to Peterson's, see Table 2, columns (4)* and (5)*.

of a few large gifts. It is likely that the weaker performance of the $fr1084$ variable is due to a lack of correlation between that variable and student quality / socio-economic status in the presence of significant cross-section variation in the rigor, quality and wealth of high school programs, see Selingo (2000). Surprisingly the measure of national merit scholars attending an institution consistently obtains a negative (albeit insignificant) coefficient. One possible explanation for this counter-theoretical result might be national merit scholar's pursuit of more academic occupations that restrict their financial ability to give.

Of the measures of institutional value added, only a high faculty / student ratio significantly increases the aggregate flow of voluntary giving from former students as evidenced by coefficients of 768 (p-value of .04) and 781 (p-value of .05) in columns (1) and (2) respectively. We believe that subsequent results imply this relationship is attributable to increased educational value added in an intimate academic setting.

With respect to the measures of alumni "taste" for giving, we do find evidence of the "liberal arts" effect as similarly noted in Clotfelter (2000) through statistically significant coefficients of 41.29 (p-value of .01) and 91 (p-value of .07) on the $fouryr84$ variable in columns (1) and (2). As anticipated by previous research, the statistically significant negative coefficients on $sys84$ and $univ84$ suggests that the average donations from alumni of schools which participate in wider systems and graduates of universities are lower than the average donation experienced by independent schools or schools with other functional definitions. Moreover, schools with large flows of alumni to business programs experience lower voluntary donations with the passage of time, as demonstrated by the statistically significant negative coefficients on $epbs84$.[30] These variables may proxy for the taste for charity of those who select into these fields of study or the increased debt burden associated with these fields.

Finally, institutions that provide large rebates of tuition dollars in the form of need based scholarships experience higher subsequent donations from their alma mater as evidenced by statistically significant coefficients of 92.84 (p-value of .07) and 91 (p-value of .07). One dollar of need-based aid seems to contains an element of "seed money" that engenders larger donations from the pool of alumni. The population of need based aid recipients may be expressing gratitude as alumni while the population of all alumni may be positively responding to a discounting school's commitment to its larger social obligation. In stark contrast to the need-based aid results and consistent with the above interpretation, our results suggest that non-need based scholarships are pure cost

[30] Interestingly, Clotfelter (2000) reports the opposite pattern of behavior with respect to business school graduates. Since our samples are noticeably different, this outcome might be expected.

to an institution of higher education and do not significantly impact upon subsequent donative behavior.

5.2 Models Controlling for Student Inequality of Achievement

Columns (3) and (4) of Table 1 display coefficient estimates once our measure of student skill inequality, $gini84$, and its interaction with student quality, $ginisat84$, are included in estimation. By itself, our measure of inequality of achievement fails to exhibit a statistically significant effect on giving, as witnessed by the p-value of .89 for $gini84$'s coefficient estimate reported in column (3). However, once the interaction term is included in the regression, the coefficients on both $gini84$ (76.95) and ginsat84 (-0.08) are statistically significant at conventional levels and the R^2 of the model increases to from .60 to .61. Since $gincactg$ and $gscactg$ exhibit coefficients which are respectively opposite in sign to $gini84$ and $ginsat84$, we conclude that the effect of inequality is weaker in schools which report only ACT scores to Peterson's (i. e. with an entry of 1 for $cactg$).

Interestingly, with the introduction of $gini84$ and $satgin84$ in column (4), the coefficient on the faculty - student ratio increases in magnitude, from 768 to 802. This result suggests that the impact of faculty accessibility on giving at the institutional level was biased downward by the omission of inequality as a conditioning variable. Given the negative sign on the interaction term and the positive coefficient on the faculty - student ratio, the observed bias suggests that faculty-student ratios and the gini-SAT interaction variable are positively correlated. In other words, colleges may employ a faculty - intensive production technology in the presence of high inequality of measured aptitude in the student body, perhaps to counteract the negative effects of such inequality.[31]

Note that all other results presented previously are robust to the inclusion of student inequality of achievement with the exception of $discnd84$, which obtains significance at the 11 percent level of confidence.

5.3 Endogeneity Discussion

The final column of Table 1 presents coefficient estimates when endowment per student and percent of the student body who are state residents are omitted from the regression. A comparison of these results with those of column (2) illustrate the endogeneity bias induced by omission of proper measures of the academic reputation of the schools in our sample and underscore the effectiveness of our measures of school reputation in at least partially

[31] As informal evidence of this, the correlation of $fsrat84$ and $gini84$ is .19 and a bivariate regression with $fsrat84$ as the dependent variable generates a positive coefficient on $gini84$ with a p-value of .00.

addressing such a bias. The pattern which emerges as a result of the inclusion of $endwps89$ and $upsr84$ in our estimation framework as well as an increase in adjusted R^2 from .57 to .61 indicates that these variables serve their purpose.

If reputation matters for the determination of both giving and our explanatory variables, the coefficients we estimate will be unreliable. For example, we hypothesize that a school with a strong reputation will (on average) attract a pool of high-SAT students as well as large subsequent donations from alumni. By failing to sufficiently control for the reputation of a school, our coefficient on $sat84$ becomes inflated (from 1.3 in column (4) to 1.87 in column (5)). This effect is present across all of the measures of student quality as evidenced by a pattern of increase in both the magnitude and precision of the coefficient estimates on $sat84$, $fr1084$,and $frnms84$ between column (4) and column (5).

5.4 Differences Between Public and Private Institutions

The results presented above on the full sample are largely consistent with results obtained from separate subsamples of private ($N = 326$) and public ($N = 86$) institutions. Specifically, higher endowment per student, higher faculty student ratios, and enhanced high school achievement are correlated with higher alumni giving in both types of institutions, although mean SAT scores are relevant for private institutions while the percent of students graduating in the top ten percent of their high school class is relevant for public institutions. The liberal arts effect and the effect of student inequality of achievement on giving at the institutional level are evident in the private but not the public subsample.

Statically significant evidence linking aggregate measured student achievement at the institutional level to the subsequent flow of donative revenue back to a college or university is present across all school types. However, the cursory evidence cited here hints at important differences in giving at public *vis a vis* private institutions of higher education, differences in need of further theoretical and empirical examination.

5.5 Magnitude of Results

To illustrate the policy implications of our results, Table 2 multiplies the coefficients from columns (2), (4), and (5) of Table 1 by a representative one standard deviation increase in the explanatory variables employed in their estimation.[32] Thus, the values listed in Table 2 represent the per - alumnus increase in (constant 1998) dollars donated when a given explanatory variable increases by one standard deviation.[33] These results should be interpreted in light of the average size of the alumni pool in our sample: approximately 26,000. Statistically significant changes in average dollar donations are in boldface.

The most economically meaningful stimulant to average alumni donations is mean student achievement in high school, which proxies for the combination of student wealth and quality. The $62 increase in donations per alumnus for SAT-reporting schools turns into approximately $1.6 million of gross contributions from all alumni on an annual basis when mean SAT increases by one standard deviation or 115 points. This effect is even larger for schools which report only ACT data to Peterson's (a $3.35 million increase in gross contributions for a standard deviation increase in student quality). The second largest positive impact on average donations is caused by a representative standard deviation increase ($42.70) in endowment per student, at $52 per alumnus. In addition, a standard deviation increase in the faculty-student ratio (two additional faculty per one hundred students) is associated with a $17 increase in contributions per alumnus or $442,000 from all alumni annually.

A representative increase in inequality of achievement within the student body is not associated with a statistically significant change in alumni giving for the median SAT or ACT-only reporting school in our sample. However, inequality is a statistically relevant determinant of giving on the extremes of the student quality distribution. For SAT-reporting schools, a standard deviation increase in students' scholastic inequality is associated with a statistically significant drop in giving when $sat84$ is at or above 1115.[34] For schools at the lower end of the student quality distribution (with an entering class average SAT below 890) a standard deviation increase in inequality is associated with larger average donations per alumnus.[35] Thus, inequality of ability enhances alumni giving for schools which have low average scholastic aptitude and compromises giving in schools with a high-quality student body.[36]

In the absence of further analysis, the results detailed above should not be interpreted as evidence that a certain set of actions, such as increasing the faculty - student ratio, will necessarily improve the financial status

[32] Note that, the numbers in Table 2, column (5) corresponding to the rows labelled y (where $y = gini84, sat84$) are calculated according to $\beta^{y}(1s.d.ofy)+(samplemedianofx)(1s.d.ofy)\beta^{ginsat84}$ where $x = gini84$ when $y = sat84$ and $x = sat84$ when $y = gini84$.

[33] The numbers have little meaning for categorical variables

[34] The magnitude of this drop is $171 per alumnus.

[35] The magnitude of this increase is $125 per alumnus.

[36] For ACT-only reporting schools, inequality is never associated with decreased giving in a statistically significant manner but exhibits a positive impact on giving for colleges with a value of $sat84$ below 550.

of a given school. Said results are only indicators of the gross flow of donations induced by certain changes at the institutional level, flows which must be adjusted to reflect the cost of institutional changes in order to arrive at their net financial benefit.

Employing the relationships whose derivation begins on page 27, we conclude that a change in the need - based discount rate will not yield a net financial benefit to an institution of higher education if gross average revenues from students are higher than \$581.94 per student.[37,38] Similarly, if the annual salary and benefits package for the average faculty member exceeds \$6,902, an increase in the faculty - student ratio will not result in a positive net accumulation of funds.[39] Thus, the results we have obtained seem to indicate that for these two statistically significant drivers of donative behavior, the average institution of higher education in our sample was not ignoring an opportunity to change its characteristics and enjoy a net income windfall.

Unfortunately, the economic costs associated with changing all of the other statistically significant drivers of gross donative revenues in this paper are not easily quantified. For instance, the cost associated with a one-point increase in the average SAT score of an entering class could only be ascertained with substantial admissions modelling and data. Future research in this vein may uncover institutional features which have potential to improve the net financial standing of the average institution of higher education.

6 Conclusion

This paper presents compelling evidence that an important and growing source of finance for institutions of higher education is, in the long run, sensitive to a variety of the unique features of that institution. In particular, an institution's academic reputation, the measured scholastic aptitude of its enrolled student population, its faculty - student ratio, its function and structure, and the vocational choices of its graduates critically affect subsequent flows of charitable giving from former "customers". These observations have relevance for previous treatments of the economics of higher education.

Numerous researchers, such as Rothschild and White (1993, 1995), Goethals et al. (1999) and Winston (1999, 2000) have attributed the pursuit of high-quality students and shunning of lower-quality students to the unique

[37] This result holds for the average school in our sample, assuming $r = .08$
[38] 1998 dollars
[39] Again, in 1998 dollars

"customer - input" technology involved in the production of education. The presence of peer effects in and out of the classroom implies that an institution of higher education can sell a better product to its customers when its customers are of a certain type,[40] namely, scholastically advanced. Attempts to empirically assess the magnitude and behavior of such peer effects have met with mixed results, see Zimmerman (1999).

While we do find evidence of such peer effects, our results suggest an additional explanation for the pursuit of a student body of high academic quality, an explanation which is entirely compatible with the "customer - input" model. Other things equal, a scholastically high performing student body should earn a higher wage and, as evinced by our empirical results, in aggregate send more dollars back to its alma mater either through enhanced giving by all or through a few large gifts. Thus, it serves the financial self-interest of an institution of higher education to attract a scholastically skilled student body as measured by student high school achievement.

Moreover, our evidence that initiatives to add educational value by, say, increasing the faculty - student ratio or reducing inequality in the classroom, will also result in larger donative flows from a given alumni pool has normative implications for the non-profit status of most higher education suppliers. Hansmann (1981) and, later, Rothschild and White (1993) suggest that the production of educational services by a for-profit firm would be plagued by "contract failure." Under their assumption of imperfect information regarding the quality of a school's undergraduate degree, a world populated by for-profit colleges might be marked by low-quality production of higher education since managers would face an incentive to cut corners in their production of educational services in order to maximize the return to schools' private owners.

To the extent that our results may be interpreted as evidence of a feedback link between the educational experience and the long-term financial well-being of the institution, the "contract failure" problem may be less severe empirically than had been anticipated theoretically. The incentive to produce "lemon" undergraduate degrees would be at least partially offset by the opportunity to enhance donative flows by maximizing the educational product, and hence wage premium, earned by alumni. An administrator who compromises the quality of the current educational product puts at risk future donative revenue flows.In general, our results suggest that economists should tread lightly when mapping conventional theoretical concepts, such as marginal revenue, to the higher education sector. What is marginal revenue when current administrative choices have statistically

[40]This might also be referred to as Studio 54 production technology.

significant effects on aggregate voluntary giving from alumni many years later?

7 Detailed Descriptions

7.1 The Data

From the CAE's Voluntary Support of Education Database, we obtained the following variables:

$avdon3$ - Description: average donation per alumnus per year. Construction: for each of the years 1996, 97 and 98 we divided each institution's total donations from alumni, measured in constant 1998 dollars, by the number of alumni of record. We then averaged each of these annual observations across the three years.

$endwps89$ - Description: dollar value of endowment per student, thousands of dollars. Construction: the market value of the endowment in 1989, in 1998 dollars, is divided by undergraduate enrollment (reported by Peterson's) in 1989.

$sol3$ - Description: average percentage of alumni of record solicited per year. Construction: for each institution in our database, and for each of the years 1996, 97, and 98, we divided the number of alumni solicited by the number of alumni of record. This yields the average percentage of alumni solicited over the 97 - 98 period.

The overwhelming majority of our explanatory variables have been constructed from basis variables available in Peterson's Archival Undergraduate Database. Unless otherwise noted, all observations apply to the year 1984.

$bvps84$ - Description: bound book volumes per student. Construction: the number of bound volumes in libraries divided by total undergraduate enrollment.

$cactg$ - Description: dummy variable taking on the value of 1 if a school reports only ACT test scores which were converted and used in the calculation of $gini84$.

$cacts$ - Description: dummy variable taking on the value of 1 if a school reports only ACT test scores for its entering class.

$disc84$ - Description: the percentage of a college's cost of attendance which is discounted, or rebated, in the form of non-need-based scholarships for the average student. Construction: average non-need-based scholarship is divided by the cost of attendance. For construction of cost of attendance see discnd84 below.

$discnd84$ - Description: the percentage of a college's cost of attendance which is discounted, or rebated, in the form of need-based scholarships for the average student. Construction: average need-based scholarship is divided by the cost of attendance. To arrive at the cost of attendance, we first sum mandatory fees, room and board, and full time tuition. This dollar value is constructed for three categories of students by residence: area, state/territory/Canadian, or nonresident. The first two categories of costs of attendance are averaged for a measure of resident cost of attendance. The final cost of attendance is a weighted average of the resident and non-resident cost of attendance, with the weights determined by the percentage of undergraduate enrollees who are state residents.

$div184$ - Description: indicator of significant commitment to organized athletics. Construction: takes on the value 1 if the college is a division I member of the NCAA.

entdif84 - Description: an index for the entrance difficulty level of the school. Construction: this variable corresponds to 5 minus the survey response of a school's administrator. The survey methodology is as follows, see Peterson's Archival Database Record Layout, 2000:

"Each college was asked to select the difficulty level that most closely corresponds to its entrance difficulty, according to the guidelines below.

Specialized schools of art and music, upper-level schools, and other institutions for which high school class rank and / or standardized test scores do not apply as admissions criteria were asked to select the level that best indicates their entrance difficulty as compared to other institutions of the same type that use similar admissions criteria.

The five levels of entrance difficulty are as follows:

1 = Most difficult: more than 75 percent of the freshmen were in the top 10 percent of their high school class and scored over 1250 in the SAT 1 (verbal and mathematical combined) or over 29 on the ACT (composite); about 30percent or fewer of the applicants were accepted.

2 = Very difficult: more than 50 percent of the freshmen were in the top 10 percent of their high school class and scored over 1150 on the SAT 1 or over 26 on the ACT; about 60 percent or fewer of the applicants were accepted.

3 = moderately difficult: More than 75 percent of the freshmen were in the top half of their high school class and scored over 900 on the SAT 1 or over 18 on the ACT; about 85 percent or fewer of the applicants were accepted.

4 = Minimally difficult: Most freshmen were not in the top half of their high school class and scored somewhat below 900 on the SAT 1 or below 19 on the ACT; up to 95 percent of the applicants were accepted.

5 = Noncompetitive: virtually all applicants were accepted regardless of high school rank or test scores."

epbs84, *epdn84*, *epeg84*, *epas84*, *eplw84*, *epmd84*, *epvm84* - Description: the percentage of graduate who went on to graduate programs in business, dentistry, engineering, arts and social sciences, law, medicine, theology, and veterinary medicine, respectively. Construction: as reported by Peterson's.

fcdoc84 - Description: the percentage of faculty with a doctorate. Construction: as reported by Peterson's.

fr1084 - Description: percentage of freshmen who were in the top 10 percent of their high school class. Construction: as reported by Peterson's.

frnms84 - Description: percentage of freshmen who were national merit scholars. Construction: 100 multiplied by the number of national merit scholars in the entering class over the number of entering freshmen.

fsrat84 - Description: faculty student ratio. Construction: the number of full-time faculty divided by total undergraduate enrollment.

ginactg - Description: the interaction of *gini84* with *cactg*. Construction: gini84 multiplied by *cactg*.

gini84 - Description: a measure of inequality in student skill level of entering class. Construction: see page 25.

ginisat84 - Description: an interaction term of sat84 and gini84. Construction: *sat84* times *gini84*.

gscactg - Description: the interaction of *ginsat84* with *cactg*. Construction: *ginsat84* multiplied by *cactg*.

laid84 - Description: the percentage of a college's cost of attendance which might be funded by loan aid made available by the college. Construction: average short-term and long-term loans offered from college funds are summed. The average loan grant is then divided by the cost of attendance. For construction of cost of attendance see *discnd84* above.

mvgin84 - Description: dummy variable taking on the value of 1 if a school fails to report any test-based student quality measures which can be used in the construction of *gini84*, zero otherwise.

$mvsat84$ - Description: dummy variable taking on the value of 1 if a school fails to report any test-based student quality measures, zero otherwise.

$NCAA84$ - Description: indicator of some type of dedication to organized athletics. Construction: takes on the value 1 if the college is a division I, II, III, or men's I women's II member of the NCAA.

$relig84$ - Description: indicator of some type of religious affiliation. Construction: takes on the value 1 if the college is affiliated with one of 119 churches.

$sat84$ - Description: average SAT of entering class. Construction: the archival database provides information on the percentage of a school's entering class which falls within 6 bins, each with a width of 100 SAT points, beginning at 200 (i. e. 200 - 299, 300 - 399, etc.) for each of the SAT exam categories: verbal and math. We simply multiply these frequencies by the midpoint of the bin (rounded up) for each of the categories, verbal and math. We then sum the result. Note that certain schools did not report their entering class's distribution of SAT score across the score support, but they did report the verbal and math means. For those schools, $sat84$ takes on mean value reported by the school.

There is a subset of all schools which do not report SAT scores, but do report ACT scores. For this subset, we employ the SAT score equivalents of ACT scores reported by Langston and Watkins (1980) to convert ACT data into SAT measurements. The resulting SAT scores are averaged for each school and entered as values of $sat84$.

For the remaining set of school who fail to report any test-based measure of its entering class' quality, $sat84$ takes on its mean value, as calculated from the set of reporting schools.

$satacts$ - Description: the interaction of $sat84$ with $cacts$. Construction: $sat84$ multiplied by $acts$.

$sys84$ - Description: indicator variable of institutions participation in a system (1 if yes, zero otherwise). Construction: as reported by Peterson's.

$twoyr84$, $fouryr84$, $univ84$ - Description: indicator variable if the institution is a two-year college, a four-year college, or a university, respectively. Construction: the raw data reports a categorical variable with values 1 through 6 according to the functional definition of the college.

The variable $twoyr84$ takes on the value 1 if the school's functional definition is 1 ("awards associate degrees and / or offers two years of work acceptable toward bachelor degree programs") 0 otherwise. The variable $fouryr84$ takes on the value 1 if the school's function definition is 2 ("awards bachelor's degrees but no graduate degrees; may also award associate degrees") 0 otherwise. The variable $univ84$ takes on the value 1 if the school's functional definition is 6 ("offers four years of undergraduate work plus graduate degrees through the doctorate in more than two fields").

The omitted category for these three variables is the set of upper-level and five year school. An institution in these categories either "offer(s) the last two years of bachelor's degree program; may also award graduate degrees" or "awards bachelor's and may also award associate degrees; offers graduate programs primarily at the master's, specialist's, or professional level - not more than two doctoral programs."

$upmin84$ - Description: the percentage of enrolled undergraduates who fall into a minority category. Construction: the percentage or undergraduates who are categorized as African Americans, Hispanics, and Asian American are summed.

$upsr84$ - Description: the percentage of enrolled undergraduates who residents of the same state as the institution of attendance. Construction: as reported by Peterson's.

$upwm84$ - Description: the percentage of enrolled undergraduates who are female. Construction: as reported by Peterson's.

7.2 Student Skill Level Gini Coefficient Construction

For each of the verbal and math sections of the SAT exam, Peterson's Archival Undergraduate Database provides data on the percentage of an entering class' students falling within six SAT bins, each with a width of 100 SAT points beginning with a minimum SAT score of 200. The variable

$$\tilde{p}^x \ , \ x = 250, 350, ...750 \tag{10}$$

will be used to represent these percentages. The values of x in (A2.1), corresponds to the midpoint of the six SAT bins. It will also be convenient to adopt p as the cumulative percentages in the student body, so that

$$p^y = \sum_{j=2}^{\frac{y-50}{100}} \tilde{p}^{100j+50} \ , \ y = 250, 350, ..., 750 \tag{11}$$

We will make a number of stylistic assumptions to motivate our Gini measure and simplify its calculation. First, if $\tilde{p}^{250} = .35$ for a particular school, we will describe that school as having 35 incoming students, each of whom bring 250 units of SAT to the school. Thus, the total stock of SAT brought into a school by a student body is

$$m = 100 \sum_{j=2}^{7} \tilde{p}^{100j+50}(100j + 50). \tag{12}$$

The Peterson's data implies that there is a ranking index, i, of the normalized "100" incoming students for each school with

$$\begin{aligned} SAT^i &= 250 \text{ for } i = 1, 2, ..., p^{250} \\ SAT^i &= 350 \text{ for } i = p^{250} + 1, p^{250} + 2, ..., p^{350} \\ SAT^i &= 450 \text{ for } i = p^{350} + 1, p^{350} + 2, ..., p^{450}, \text{ etc.} \end{aligned} \tag{13}$$

With this index, we begin to see one of the cornerstones of any Gini statistic. In our sample, the bottom 6 students in the normalized entering class will bring in $6(250)/m$ percent of the total stock of SAT (assuming

$p^{250} > .06$). This is one point on the Lorenz curve. In a school setting with perfect equality of ability, these bottom six would bring in 6% of the SAT stock, since they are ranked in a virtual body of 100 students. The deviation of $6(250)/m$ from 6% is a measure of the deviation from perfect equality at this particular point on the Lorenze curve.

Given this ranking, we can now define

$$m^{100k+50} = 100\sum_{j=2}^{k}\tilde{p}^{100j+50}(100j+50), k = 2,3,...,7 \tag{14}$$

as the mass of SAT brought into the school by the bottom $p^{100k+50}$ percent of the student quality distribution.

Thus, the data explicitly provide six points on the Lorenz curve described by the Cartesian pairs $\left(m^{100k+50}, p^{100k+50}\right)$. However, we do not observe the actual Lorenz curve itself. In order to caculate the area under the Lorenz curve, we use an approximating technique. We calculate the area of six "left" rectangles which will overestimate the area under the unobserved Lorenz curve. These six left areas are calculated according to

$$\begin{aligned} AL^k &= \left(p^{100(k+1)+50} - p^{100k+50}\right)\left(m^{100(k+1)+50}/m\right), k = 2,3...,6 \\ AL^k &= p^{100(k+1)50}\left(m^{100(k+1)+50}/m\right), k = 1 \end{aligned} \tag{15}$$

Next, we calculate the area of six "right" rectangles which will underestimate the area under the Lorenz curve

$$\begin{aligned} AR^k &= \left(p^{100(k+1)+50} - p^{100k+50}\right)\left(m^{100k+50}/m\right), k = 2,3...,6 \\ AR^k &= 0, k = 1 \end{aligned} \tag{16}$$

Finally, we average the overestimated left area and underestimated right area to obtain six discreate measures of the area under the Lorenze curve, which themselves are summed to obtain the total area under the Lorenz curve

$$A^k = \frac{AL^k + AR^k}{2}, k = 1,2,...,6 \tag{17}$$

$$A = \sum_{k=1}^{k} A^k \tag{18}$$

To arrive at our Gini series, we subtract A from the area under the curve of perfect equality and divide this result by the area under the curve of perfect equality

$$gini\ m, v = (.5 - A)/.5 \tag{19}$$

We take the respective math (m) and verbal (v) Gini measures and average them to arrive at our final re-scaled series: $gini84 = 100(ginim + giniv)/2$.

A similar procedure is followed with SAT data which has been obtained from converted ACT scores (for such data, the only difference is the width and number of bins). Finally, if a school has not reported sufficient information in order to calculate its value of $gini84$ we set $gini84$ equal to its mean as calculated from the set of schools which have reported sufficient data.

7.3 Cost-Benefit Calculations

Consider the gross revenue from a student body at a point 13 years in the past, denoted R_{t-13} while $discnd_{t-13}$ is the percentage of the cost of attendance discounted on a need basis to the student body as a whole in the same year. The current value of the lost net revenue (which also accrues as lost endowment contributions) from changing the attendance discount rate in a given year is $r^{13} \cdot R_{t-12} \cdot \Delta discnd_{t-13}$ where Δ indicates a change in the attendance discount rate in a given year while r is the rate at which an institution discounts funds over time.

Our results indicate that 13 years later, the institution benefits through an increase in giving of magnitude $\Delta giving_t = alum_t \cdot \beta^{discnd84} \cdot \Delta discnd_{t-13}$ where $\beta^{discnd84}$ represents the estimated coefficient on the $discnd84$ variable and $alum_t$ is the size of the alumni pool in year t.

Finally, there are two secondary effects driven by the observation that, *ceteris parabis*, our results suggest that any changes in revenue or cost flows will effect endowments, reputation, and giving with a lag. Thus, funding $\Delta discnd_{t-13}$ has a depressing effect on an endowment, subsequently reducing giving by an amount $r^4 \cdot alum_t \cdot \beta^{endwps89}/stud_t \cdot R_{t-13} \cdot \Delta discnd_{t-13}$. However, the amount $\Delta giving_t$ induced by the tuition discount change accrues to an institution's endowment in yeat t, which enhances an institution's reputation and giving 9 years later. The current value of this secondary benefit is $r^{-9} \cdot alum_t \cdot \beta^{endwps89}/stud_t \cdot \Delta giving_t$. Thus, the net financial benefit of a change in the need-based discount rate is

$$[(1 + r^{-9} \cdot alum_t \cdot \beta^{endwps89}/stud_t) \cdot alum_t \cdot \beta^{discnd84} - \\ -(r^4 \cdot alum_t \cdot \beta^{endwps89} + r^{13}) \cdot R_{t-13}] \cdot \Delta discnd_{t-13} \quad (20)$$

The sign of this net benefit critically hinges upon the parameter estimates and the gross revenue derived from a given student body, that is, R_{t-13}.

A similar argument will demonstrate that the net benefit derived from a change in the faculty / student ratio is:

$$[(1 + r^{-9} \cdot alum_t \cdot \beta^{endwps89}/ stud_t) \cdot alum_t \cdot \beta^{fsrat84}/stud_t - \\ -(r^4 \cdot alum_t \cdot \beta^{endwps89}/stud_t + r^{13}) \cdot ben_{t-13}] \cdot \Delta fac_{t-13} \quad (21)$$

Table 1: Dependent Variable: Average Donation Per Alum, 1996 - 1998

	(1)	(2)	(3)	(4)	(5)
$constant$	-402 (.03)	-5 (.99)	-384 (.91)	-1213 (.00)	1891 (02)
$endwps89$	1.38 (.00)	1.44 (.00)	6.32 (.00)	1.52 (.00)	-
$upsr84$	-0.98 (.01)	-1.05 (.00)	-5.94 (.01)	-0.78 (.02)	-
$sat84$	0.49 (.90)	-	0.48 (.00)	1.80 (.00)	1.87 (.00)
$entdif85$	-	30.34 (.03)	-	-	-
$fr1084$	0.78 (.25)	8.37 (.93)	0.78 (.20)	0.54 (.41)	0.62 (.30)
$frnms74$	-17.74 (.14)	-12.10 (.25)	-14.71 (.16)	-14.66 (.14)	-7.12 (.38)
$gini84$	-	-	-0.57 (.89)	6.95 (.01)	114.3 (.50)
$ginsat84$	-	-	-	0.08 (.01)	-0.11 (.00)
$fsrat84$	768 (.00)	781 (.05)	779 (.04)	823 (.04)	1208 (.00)
$fcdoc84$	0.13 (.83)	0.40 (.40)	0.11 (.83)	0.12 (.79)	0.50 (.38)
$bvps84$	0.01 (.55)	0.01 (.48)	0.01 (.55)	0.01 (.49)	0.01 (.36)
$sys84$	-25.63 (.06)	-24.42 (.25)	-26.50 (.05)	-09.60 (.03)	-48.15 (.00)
$twoyr84$	93.41 (.00)	78.19 (.02)	94.23 (.00)	52.09 (.15)	50.83 (.47)
$fouryr34$	41.29 (.01)	37.84 (.03)	40.89 (.02)	41.59 (.21)	48.55 (.01)
$univ89$	-55.50 (.00)	-49.82 (.01)	-55.32 (.70)	-56.79 (.00)	-77.24 (.00)
$NCAA84$	16.84 (.21)	18.24 (.17)	16.80 (.21)	16.02 (.42)	17.25 (.19)
$divI84$	12.95 (.41)	12.93 (.42)	12.99 (.43)	9.99 (.54)	4.99 (.78)
$relig84$	-5.01 (.78)	-10.79 (.54)	-5.27 (.77)	-3.67 (.84)	-5.92 (.74)
$discnd84$	92.84 (.07)	91.00 (.07)	93.64 (.08)	83.83 (.11)	115.76 (.04)
$disc84$	-30.14 (.32)	-28.44 (.37)	-30.75 (.31)	-13.25 (.65)	-19.63 (.53)

Table 1: Continued

	(1)	(2)	(3)	(4)	(5)
laid84	86.61 (.17)	94.79 (.14)	86.38 (.18)	74.72 (.25)	73.04 (.27)
sol3	−10.31 (.78)	−8.66 (.82)	−9.97 (.79)	−5.59 (.89)	−15.28 (.74)
upwm84	−0.18 (.77)	−0.28 (.65)	−0.18 (.77)	−0.08 (.90)	0.06 (.92)
upmin84	0.05 (.93)	−0.58 (.36)	0.10 (.88)	−0.13 (.83)	0.13 (.84)
epbs84	−2.63 (.11)	−3.45 (.04)	−2.62 (.12)	−2.52 (.14)	−3.52 (.04)
epdn84	−10.96 (.14)	−8.75 (.24)	−10.99 (.14)	−9.04 (.22)	−11.37 (.15)
epeg84	−4.43 (.40)	−1.93 (.72)	−4.48 (.40)	−4.89 (.36)	−3.59 (.43)
epas84	2.43 (.25)	2.35 (.27)	2.38 (.27)	2.21 (.30)	2.22 (.31)
eplw84	3.01 (.41)	4.40 (.24)	2.94 (.43)	2.41 (.51)	2.88 (.43)
epmd84	2.21 (.50)	2.39 (.49)	2.20 (.51)	1.70 (.60)	3.46 (.32)
epvm84	−2.38 (.87)	−4.63 (.76)	−2.08 (.89)	−0.25 (.99)	1.52 (.92)
mvsat84	−21.94 (.17)	-	−12.54 (.58)	6.52 (.80)	2.36 (.92)
mvgin84	-	-	−7.11 (.82)	−31.36 (.28)	−44.09 (.17)
cacts	258 (.09)	-	222 (.18)	99 (.77)	91 (.81)
cactg	-	-	−79.16 (.61)	40.68 (.80)	77.07 (.69)
satcacts	−0.23 (.20)	-	−0.18 (.33)	−0.08 (.84)	−0.08 (.85)
gincactg	-	-	1.87 (.71)	−60.43 (.01)	−87.70 (.00)
gscactg	-	-	-	0.06 (.01)	0.09 (.00)
R^2	0.60	0.59	0.60	0.61	0.57
F	13.62	13.78	12.59	12.05	11.48
nobs	415	415	415	415	415

Notes:
(1) p - values in parentheses.
(2) standard errors calculated with White's heteroscedastic standard errors.

Table 2: Impact of 1 Standard Deviation Increase in Explanatory Variable on Giving

	(2)	(4)*	(4)◇	(5)*	(5)◇
$endwps84$9 → $endwps89$	**61.57**	**52.26**	**52.26**	-	-
$sat84$	-	**61.64**	**125.15**	**86.59**	**180.46**
$entdif84$	**19.34**	-	-	-	-
$fr1084$	**24.06**	9.50	9.50	12.69	12.69
$frnms84$	-15.21	-18.42	-18.42	-8.95	-8.95
$gini84$	-	32.66	-1.39	20.73	-14.84
$fsrat84$	**17.15**	**17.62**	**17.62**	**33.12**	**33.12**
$fcdoc84$	7.30	2.19	2.19	7.37	7.37
$bvps84$	10.25	10.11	10.11	16.33	16.33
$sys84$	**-9.85**	**-10.63**	**-10.63**	**-17.30**	**-17.30**
$twoyr84$	**7.65**	5.10	5.10	5.66	5.66
$fouryr84$	**18.46**	**20.29**	**20.29**	**23.69**	**23.69**
$univ84$	**-17.90**	**-20.40**	**-20.40**	**-27.75**	**-27.75**
$NCAA84$	8.19	7.27	7.27	7.83	7.83
$divI84$	5.18	4.00	4.00	2.00	2.00
$relig84$	-4.07	-1.38	-1.38	-2.23	-2.23
$discnd84$	**13.97**	12.87	12.87	**17.77**	**17.77**
$disc84$	-5.11	-2.38	-2.38	-3.53	-3.53
$laid84$	9.59	7.56	7.56	7.39	7.39
$sol3$	-1.19	-0.77	-0.77	-2.10	-2.10
$upwm84$	-4.51	-1.28	-1.28	0.99	0.99
$upmin84$	-4.58	-1.04	-1.04	1.07	1.07
$epbs84$	**-15.87**	-11.56	-11.56	**-16.20**	**-16.20**
$epdn84$	-10.07	-10.40	-10.40	-13.08	-13.08
$epeg84$	-2.73	-6.91	-6.91	-5.07	-5.07
$epas84$	14.90	14.01	14.01	14.09	14.09
$eplw84$	17.75	9.73	9.73	11.61	11.61
$epmd84$	7.86	5.61	5.61	11.38	11.38
$epvm84$	-2.52	-0.13	-0.13	0.83	0.83

Notes:
(1) Impact measured in constant 1998 dollars.
(2) Bold items are statistically significant at a 10 percent confidence level.
(3) * the impact is relevant for a school which reports SAT data to Peterson's.
◇ the impact is relevant for a school which reports only ACT data to Peterson's.

References

Anonymous, *Voluntary Support of Education, 1998*, Chicago: Council for Aid to Education, 1985.

Bade, Robert A. and Jeffrey O. Sundberg, "What Determines Alumni Generosity?," *Economics of Education Review*, February 1996, *15* (1), 75–81.

Bartel, Ann and Nachum Sicherman, "Technological Change and Wages: an Interindustry Analysis," *Journal of Political Economy*, April 1999, *107* (2), 285–325.

Bowen, Howard R., "Observations on the Costs of Higher Education," *Quarterly Review of Economics and Business*, Spring 1981, *21* (1), 47–5.

Brewer, Dominic J., Eric R. Eide, and Ronald G. Ehrenberg, "Does it Pay to Attend an Elite Private College? Cross-Cohort Evidence of College Type on Earnings," *Journal of Human Resources*, Winter 1999, *34* (1), 104–123.

Bruggink, Thomas H. and Kamran Siddiqui, "An Econometric Model of Alumni Giving: a Case Study for a Liberal Arts College," *American Economist*, Fall 1995, *39* (2), 53–60.

Clotfelter, Charles T., *Federal Tax Policy and Charitable Giving*, Chicago: University of Chicago Press, 1985.

___ , "Alumni Giving to Elite Private Colleges and Universities," Working Paper, Duke University April 2000.

Feldstein, Martin, "The Income Tax and Charitable Contributions: Part I - Aggregate and Distributional Effects," *National Tax Journal*, March 1975, *28* (1), 81–99.

___ , "The Income Tax and Charitable Contributions: Part II - The Impact on Religious, Educational, and Other Organizations," *National Tax Journal*, June 1975, *28* (2), 209–226.

Ficano, Carlena Cochi and Brendan M. Cunningham, "The Alumni Giving Lottery," unpublished manuscript December 2001.

Goethals, George, Gordon Winston, and David Zimmerman, "Students Educating Students: the Emerging Role of Peer Effects in Higher Education," Discussion Paper 50, Williams Project on the Economics of Higher Education March 1999.

Graham, Amy E. and Thomas A. Husted, "Understanding State Variations in SAT Scores," *Economics of Education Review*, September 1993, *12* (3), 197–202.

Greene, William H., *Econometric Analysis*, Englewood Cliffs, New Jersey: Macmillan Publishing Company, 1993.

Hansmann, Henry, "The Rationale for Exempting Nonprofit Organizations from Corporate Income Taxation," *Yale Law Journal*, November 1981, *91* (1), 54–100.

Hanushek, Eric A., "The Economics of Schooling: Production Efficiency in Public Schools," *Journal of Economic Literature*, September 1986, *24* (3), 1141–1177.

Harrison, William B., Shannon K. Mitchell, and Steven P. Peterson, "Alumni Donations and Colleges' Development Expenditures: Does Spending Matter?," *American Journal of Economics and Sociology*, October 1995, *54* (4), 397–412.

Lakford, R. Hamilton and James H. Wyckoff, "Modeling Charitable Giving Using a Box-Cox Standard Tobit Model," *Review of Economics and Statistics*, August 1991, *73* (3), 460–470.

Langston, I. and T. Watkins, "SAT-ACT Equivalents," Research Memorandum 80-5, University of Illinois November 1980.

Leslie, Larry L., "Factors Accounting for Variations Over Time in Voluntary Support for Colleges and Universities," *Journal of Education Finance*, Fall 1983, *9*, 213–225.

___ **and Gary Ramey**, "Donor Behavior and Voluntary Support for Higher Education Institutions," *Journal of Higher Education*, March / April 1988, *59* (2), 115–132.

Murphy, Kevin and Finnis Welsch, "The Structure of Wages," *Quarterly Journal of Economics*, February 1992, *107* (1), 285–326.

Okunade, Albert A., Phanindra V. Wunnava, and Raymond Walsh, "Charitable Giving of Alumni: Micro-data Evidence from a Large Public University," *American Journal of Economics and Sociology*, January 1994, *53* (1), 73–84.

Okunade, Albert Ade, "Graduate School Alumni Donations to Academic Funds: Micro-data Evidence," *American Journal of Economics and Sociology*, April 1996, *55* (2), 213–225.

Rothschild, Michael and Lawrence J. White, "The University in the Marketplace," in Charles T. Clotfelter and Michael Rothschild, eds., *Studies of Supply and Demand in Higher Education*, University of Chicago Press, 1993, pp. 11–37.

—— **and** —— , "The Analytics of the Pricing of Higher Education and Other Services in Which the Customers are Inputs," *Journal of Political Economy*, June 1995, *103* (3), 573–586.

Selingo, Jeffrey, "What States Aren't Saying About the 'X-Percent Solution'," *Chronicle of Higher Education*, June 2 2000, *XLVI* (39), A31–A34.

Spence, Michael, "Job Market Signaling," *Quarterly Journal of Economics*, August 1973, *87* (3), 205–221.

Taussig, Michael, "Economic Aspects of the Personal Income Tax Treatment of Charitable Contributions," *National Tax Journal*, March 1967, *20*, 1–19.

Weisbrod, Burton A., *The Nonproft Economy*, Cambridge: Harvard University Press, 1988.

Winston, Gordon C., "Subsidies, Hierarchies and Peers: the Awkward Economics of Higher Education," *Journal of Economic Perspectives*, Winter 1999, *13* (1), 1–19.

—— , "The Positional Arms Race in Higher Education," Discussion Paper 54, Williams Project on the Economics of Higher Education April 2000.

Zimmerman, David J., "Peer Effects in Academic Outcomes: Evidence from a Natural Experiment," Discussion Paper 53, Williams Project on the Economics of Higher Education November 1999.