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The Anatomy of a Likely Donor: Econometric Evidence on Philanthropy to Higher Education

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Abstract

In 2006, philanthropic giving to higher education institutions totaled $28 billion, with the top school receiving just under a billion dollars. Roughly fifteen percent of those funds came from alumni donations. This paper builds upon existing economic models to create an econometric model predicting the ever-more important pattern of alumni giving. We test the model using data from over 22 000 alumni at a private liberal arts college, and report on the probable profiles for annual fund donors and alumni willing and able to give major gifts.

Keywords: philanthropy, alum, donations, education financing

JEL codes: I22, Z13

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1. Introduction

Alumni giving plays a significant role in both public and private higher education institutions. Federal funding for such organizations has steadily and significantly declined over the past decades, leaving public institutions particularly hungry for generous donors (Council for Aid to Education, 2006). A strong linkage can be drawn between the steady decrease in federal funding for higher education and the increase in philanthropic giving towards colleges and universities. In 2006, giving to higher education institutions rose by 9.4%, totaling $28 billion with the leading institution (Stanford) receiving nearly a billion dollars in donations (Kaplan, 2007). Of the total, fifty percent was given by individual donors while the remainder was divided amongst foundations, corporations, religious and other organizations. Of individual donors, thirty percent were alumni who gave to their alma mater, making them responsible for roughly fifteen percent of all private funding. Yet a pattern of giving has emerged by which the alumni participation rate has been declining but those who make donations give greater amounts. In sum, the total amount of alumni giving is still increasing (Kaplan, 2007). However, the large variance in amounts given, where the bulk of donors give low amounts with a few major donors inflating the total dollar amount received, means that finding the right potential donors is increasingly important.

Furthermore, higher education as an industry thrives on competition between institutions to offer the best educational experience to students, with competition playing a significant role in driving the need for donations. Winston (1999) describes that, as

non-profit organizations, higher education institutions seek to maximize prestige rather than profits. Schools compete annually to increase their standings in the U.S. News and World Report "Best Colleges" issue perhaps because maintaining prestige means maintaining a certain caliber of student applicant pool. Naturally, the cost of tuition plays an important role in where students choose to attend college, and frequently the ability of the school to assist in lessening the burden is the deciding factor. Who can offer the best education at the lowest cost? This sort of question has encouraged some institutions to lower tuition rates *below* actual costs and has further necessitated other forms of income to cover the gap between the price and cost of higher education. Over the years, philanthropic giving has become one source of additional income that is used to fill this gap, leading donation solicitation to become critical to many institutions.

Given these pressures, it is not surprising that there has been a great deal of academic modeling of alumni giving or that, of late, several companies have created subsidiaries devoted entirely towards tailored predictive models for specific institutions' alumni pools (e.g. Blackbaud Analytics and DonorCast both offer data enrichment and predictive modeling for academic institutions). It is the focus of this paper to bridge the gap between the predictive modeling of outside consultants (sparsely discussed in non-economic journals) and academic research, in order to build an academically sound econometric model capable of predicting patterns of alumni giving. We present coefficient estimates of our model as estimated using the alumni database of a small nationally-ranked liberal arts college, Colorado College, along with in-sample predictions and diagnostic discussion of future improvements to the model.

Two central goals of this paper can be outlined. First, colleges often seek outside assistance in analyzing alumni data because data enrichment, especially with regards to wealth and income information, is absolutely necessary and is not gathered by most colleges. For that reason, in this analysis, only data packages already purchased by Colorado College for academic purposes will be utilized, so that practitioners may use our methodology without expensive data acquisition. Second, while the analysis can yield patterns that are significant in their own right, it is the goal of this analysis to have predictive power. Therefore, two separate models will be tested for predictive rather than descriptive power, with results predicting potential annual fund and major giving donors.

After a review of the literature in Section 2, we build a model in Section 3 and describe our data in Section 4. Results of both models are presented in Section 5 with overall conclusions offered in the final section.

2. Literature review

At least five distinct theories have historically been used to explain why individuals can simultaneously be self-interested by nature while giving to philanthropic causes. While each focuses on a different aspect of altruism, they all attempt to explain how individuals benefit, at least partially, from philanthropic giving. First, Barro's (1974) dynastic model of family asserts that individuals appear to act altruistically by passing wealth to their children; however, this philanthropic act is in reality a lateral shift within the family if one considers the smallest significant unit to be the family rather than the individual. Second, Andreoni (1989) argues that along with demanding more of a public good towards which an individual gives altruistically, the same individual also receives a private good, a "warm-glow" feeling, from his or her gift. Third, Clotfelter

and Steuerle (1981) illustrated that income taxes have a negative effect on the amount individuals contribute philanthropically, and that deductibility serves to partially counteract this tax discouragement. The result is that individuals are willing to make donations only if the price of giving is low enough. Fourth, Asheim (1991) asserts that private consumption of goods is done in conjunction with altruistic giving such that individuals will only choose a level of private consumption that is "just" (meaning one that takes into consideration the necessity of altruism). Rose-Ackerman (1996) has made an argument similar to Andreoni's in the separation of public and private goods, theorizing that individuals give altruistically in order to receive, as a private good, greater social capital in return. Naturally, this is neither an exhaustive nor a mutually exclusive list of possible motivations.

This paper serves as a bridge between academic and corporate research on the topic. Academic research at the institutional level generally has a single descriptive focus such as the effects on giving of financial aid (Marr et al., 2005) or the possibility of an alumnus' child attending their alma mater (Meer and Rosen, 2007). Others have described overall patterns in alumni giving (Bruggink and Siddiqui,1995; Okunade et al., 1994; Wunnava and Lauze, 2001). Academic research on the multi-institutional level has aimed at finding descriptive variables that might be applicable to a large number of schools (Clotfelter, 2003; Cunningham and Cochi-Ficano, 2002; Monks, 2002). In general, models are developed from the demand function for consumer theory (that individual consumption is a function of their income among other things) or the life-cycle hypothesis (that as individuals become older they increasingly consume a greater share of their income, even dis-saving at times) (Blomberg et al, 2007).

All models use time-series or panel data; however a wide variety of regressive models are utilized including OLS, GLS, probit, logit, and tobit models, all with and without the recognition of sample selection bias. While there is a fairly even mixture of OLS and probit/logit/tobit models, the use of OLS has been shown in several studies to be inadequate in analyzing alumni donations given the large number of zero values (see for example, Forbes and Zampelli, 1997). The arguments against OLS are generally that the method 1) lacks predictive power, and (2) does not adequately estimate the informational power of "not giving." Forbes and Zampelli (1997) ran the same model to estimate differences in Protestant and Catholic giving behavior using both OLS and tobit. They conclude that when the respondents were not first analyzed along lines of "giving" and "not giving" that false results were yielded. In this particular instance, a larger number of Catholics give but at lower amounts on average than Protestants. When zero values were assumed to lack analytical power, Protestants seemed to be better givers; however the opposite results were only found when zero values were taken into consideration.

Variables tested at the institutional level shown to have either descriptive or predictive power have included age, gender, ethnicity, martial status, major, involvement in college sports, GPA, affiliation with a fraternity or sorority, certain kinds of financial aid, time since graduation, number of relatives at one's alma mater, reunion years, willingness to share contact information with the college, response to college surveys, highest degree attained, participation in student government, induction into honorary societies, participation in activities both while attending school and after graduation, and distance from school were all found to be significant factors either changing the

likelihood that an individual would give to their alma mater or the amount at which an alumnus estimated to have made a donation.

In every model we reviewed, income was an important factor analyzing patterns in alumni giving. A large number of analyses were on surveys data containing self-reported income values, however a limited number of analyses developed income instruments bearing particular significance to the scope and goals of our model. Meer and Rosen (2007) tested the proxy power of information on alumni occupations and permanent income, finding that other coefficients in the model were sensitive to the inclusion of occupation and field, but not to the inclusion of permanent income. Cunningham and Cochi-Ficano (2002) proxy wealth rather than income using students' family socioeconomic status as indicated on the student's application for initial admittance to the college. This was found to be problematic because it was highly correlated with the student's high school academic achievement.

There is also much to be learned from consultants and others in the non-profit sector who have attempted to model philanthropic giving. In general there are four different kinds of analyses conducted by consultants, including (1) identification of major donors, (2) identification of annual fund donors, (3) identification of planned giving donors, and (4) creation of suggested asking amounts based upon likely alumni donor profiles. Consulting firms focus on using predictive modeling and offer data enrichment (particularly of income and wealth variables) along with modeling. Variables used by consulting firms are generally a subset of those used in academic research with a focus on enriched data such as income, wealth scores, and credit card balances. Lindahl and Winship (1992) outlines these processes, and while they do not develop a theoretical

model, they create a model specifically for predicting likely annual fund and major donors from an alumni pool. For the purposes of the model developed and discussed here, the Lindahl and Winship approach serves as the skeletal structure, while we have added new support from economic theory as well as additional variables as suggested by descriptive academic models.

3. The model

In order to develop a model that could have both predictive power and the capability to single out individuals likely to make certain kinds of donations (annual fund or major gifts), we postulate a demand function from consumer theory, then create a logistic probability function using Heckman's two-step estimation process. Ultimately then, this model will yield the estimated probability that any given alumnus fits into an annual fund or major gift category, regardless of their current donation status.

Since the economic theory of philanthropic giving is based on the assumption that something is received in return (whether a "warm glow" or a tax deduction), a utility function can be postulated to include that gain to the individual. We propose a specialized form of the demand function from consumer theory.

(1) $G = f(Y, P, \vec{Z})$

where G is philanthropic giving, Y is income, P is the price of giving (based on marginal federal tax rates), and $\vec{Z}$ is a vector containing any other explanatory variables that describe giving.

The estimable demand function can be written as follows:

(2) $g_i^* = X_i\beta + \varepsilon_i$

where g_i* denotes the dollar amount given by an alumnus, where there is an additive error term at the end, but each of the explanatory variables

(3) $$X_i = f(Y_i, P_i, \vec{B}_i, \vec{A}_i)$$

is associated with a regression coefficient β. Notice that vector $\vec{Z}$ has now been split into student attributes gathered before graduation, $\vec{B}$, and after graduation, $\vec{A}$. "Before graduation" vector variables include characteristics observable during the individual's college experience, while "after graduation" variables include indicators that the individual has maintained a strong or weak affiliation with the college after leaving the campus.

In addition, g_i* is linked to the observed binary variable g_i by:

(4) $$g_i = \begin{cases} 1 \; if \; g_i^* \geq \tau \\ 0 \; if \; g_i^* < \tau \end{cases}$$

where τ is the threshold of alumni giving over three years. In other words, g_i will take on a value of 1 if the amount donated (g_i*) by an individual alumnus i is greater than or equal to a certain threshold (τ), but if the amount donated is less than the threshold then g_i* will take on a value of 0. We will vary the critical threshold to model annual versus major donors (defined as having given $50 000 or more over the preceding three years).

For annual donors, it is only significant to the college that an individual has given $0.01. Within the higher education industry, the annual alumni giving percentage is significant in determining school rankings; therefore, it does not matter how much an alumnus gives, only that they have given at all. In this scenario using Heckman's two step estimation will provide a significant improvement on Lindahl and Winship's (1992)

model, as it will incorporate all of the information contained in the observations of those individuals who gave no contribution to the institution.

The logistic probability function can now be written as

$$(5) \qquad g_i = \frac{1}{1+e^{-[X_i\beta+\varepsilon_i]}}$$

This expands out to a more practical and testable version of the same function:

$$(6) \qquad \ln\left(\frac{g_i}{1-g_i}\right) = X_i\beta + \varepsilon_i = \beta_0 + \beta_1 Y_i + \beta_2 P_i + \beta_3 \vec{Z}_i + \varepsilon_i$$

if we accept linearization of the terms and include a linearization error into the error term. Since the reasons that alumni chose to give no contribution are also worthy of modeling, we use the Heckman (1979) method of including the inverse Mill's ratio

$$(7) \qquad E\left\{\frac{g^*}{1-g^*} \mid g=1\right\} = X_i\beta + E\{\varepsilon \mid g=1\}$$

$$= \beta_0 + \beta_1 Y_i + \beta_2 P_i + \beta_3 \vec{Z}_i + \rho\sigma_\varepsilon \lambda(\beta_0 + \beta_1 Y_i + \beta_2 P_i + \beta_3 \vec{Z}_i)$$

where ρ is the correlation between μ and ε, σ_ε is the standard deviation of ε, and $\lambda(X\beta)$ is the inverse Mill's ratio.

Given the data available, the following empirical specification was derived from the theoretical reduced form (7) which takes into consideration the inverse Mill's ratio:

$$(8) \qquad \ln\left(\frac{g_i}{1-g_i}\right) = \beta_0 + \beta_1 \theta_i + \beta_2 \vec{a}_i + \beta_3 \vec{b}_i + \rho\sigma_\varepsilon \lambda(\beta_0 + \beta_1 \vec{\theta}_i + \beta_2 \vec{a}_i + \beta_3 \vec{b}_i)$$

A proxy income variable, θ, has taken the place of income, *Y*, because the actual income of each individual alumnus was unavailable, a data problem for most institutions. The creation of this proxy variable, based on the assumption that individuals with similar incomes live in geographically clustered neighborhoods, is described in the next section.

Second, the price of charity, *P*, variable has been removed from the empirical model in part because it would depend on very accurate measures of income (which are unavailable). Because the goal of the research is not to estimate the effects of tax policies on total donations, we feel comfortable removing this variable from the model. There is good precedent in the literature for this omission in the estimation stage of a model (see for example Cunningham and Cochi-Ficano, 2002; Burggink and Siddiqui, 1995).

4. The data

Thanks to the generosity of the Advancement division of Colorado College, data on 27 632 alumni were provided to us in raw form. We formatted variables gathered about individuals before graduating from Colorado College[1], $\vec{b}$, and after graduation, $\vec{a}$, to proxy the loyalty of an alumnus to the college. Variables gathered before graduation include age, gender, their choice of major, their choice to have a double or triple major, involvement in college sports, student government, sororities or fraternities, as well as the recorded number of activities attended as a student. Along with the brief descriptions of each variable that can be found in Table 1, several variables require additional explanation.

There were 69 distinct departmental or programmatic majors identified in the dataset, thirteen of which had fewer than ten alumni across all years. Thus, we incorporate 56 separate dummy variables to capture the field-specific effects of all majors with more than ten subscribers, although they are not listed in Table 1. No single major represented more than 7.6 % of the total (English), but some were as small as 0.04

[1] For our purposes, we include students who entered degree-granting programs, whether or not they graduated with a diploma. "Before graduation" simply refers to their time at the college, while "after" refers to the time after their departure.

Table 1
"Before Graduation" Variables

Continuous variables						
Variable	Description	Expected Influence	Min.	Max.	Mean	Standard Deviation
age	Age as indicated in college records, or estimated based on graduation year	+	19	102	47.45	17.17
varsity	Number of varsity sports played	+	0	4	0.24	0.53
intramrl	Number of intramural sports played	+	0	4	0.01	0.09
honors	Number of collegiate honors or awards received	+	0	2	0.02	0.13
actvstud	Number of student activities	+	0	6	0.27	0.58
Dummy variables						
Variable	Description	Expected Influence	Frequency			
			1	0		
gender	Value of 1 if male	?	13 121	14 501		
double	Value of 1 if dual major	+	288	27 344		
triple	Value of 1 if triple major	+	5	27 627		
hockey	Value of 1 if alumnus played on the men's varsity hockey team	+	375	27 257		
officer	Value of 1 if alumnus was a class officer	+	193	27 439		
greek	Value of 1 if alumnus was a member of a fraternity/sorority	+	8 021	19 611		
firstgen	Value of 1 if alumnus was the first in their family to attend college	+	461	27 171		

percent of the total (Environmental Chemistry, with 11 majors). In part, these numbers vary widely due to the introduction or occasional dissolution of a major program.

Wunnava and Lauze (2001) indicated that alumni who played sports while attending college were more likely to give to the alma mater, so we included three variables to capture this effect. Not only do we include the number of varsity and intramural sports, but we also separate the men's varsity hockey team for study as it is a nationally-ranked Division I competitor at this institution, distinct from virtually all other sports activities on campus. Players on the men's varsity hockey team are highly recruited, and may have reason to make donations to their alma mater in a different way or amount than individuals involved in other college sports.

Since student activities have not historically been recorded in the college's database but is available for recent alumni only, this variable has been included within the model only with age as an interaction term. This enables the model to utilize the predictive power of the variable for younger alumni (for whom the data are accurate) while at the same time taking into consideration the inaccuracy of the data among older alumni.

Table 2 presents information on the variables gathered about alumni after graduation, including their marital status, whether they are married to an alumnus, their physical distance from campus, highest degree attained, number of activities attended as an alumnus, number of relatives who have attended Colorado College, and income as calculated using a proxy variable.

Table 2
"After Graduation" Variables

Continuous variables						
Variable	Description	Expected Influence	Min.	Max.	Mean	Standard Deviation
Distance	Distance in miles from alum's home or zip code to campus	-	0	3 421	743.81	619.64
Actvalum	Number of alum activities as participant	+	0	23	2.65	1.98
Reltvalum	Number of relatives who are have attended same college (does not include spouse if he/she is an alum).	+	0	14	0.56	1.15
Y	*Income as estimated by proxy*	+	$0	$201 498	$55 868	$27 421
Dummy variables						
Variable	Description	Expected Influence	Frequency		Mean	Standard Deviation
			1	0		
Single	Value of 1 if single	-	7 974	19 658	0.29	0.45
Widowed	Value of 1 if widowed	+	609	27 023	0.02	0.15
Spouse	Value of 1 if married to a Colorado College alum	+	3 024	24 608	0.11	0.31
Masters	Value of 1 if master's degree is highest attained	+	5 208	22 424	0.19	0.39
Doctorate	Value of 1 if doctorate is highest attained	+	2 699	24 933	0.10	0.30

Physical distance was measured using Geographic Information Systems software to measure either point-to-point distance from the alumna's home to campus or from their zip code to campus if the precise address was unavailable or unmappable. Notice that the average distance from campus is quite large, meaning that the average alumni no longer lives in the same state (or perhaps even a contiguous state), despite the large size of states in the Rocky Mountain region.

Using 2005 data estimates based on the 2000 U.S. Census (provided by GeoLytics), median household income estimates for seven separate age ranges were gathered for every census tract in the United States. The median household income corresponding with each alumnus' census tract and age range were used to estimate that alumnus' income. The information provided for 4 769 individuals was insufficient to assign a census tract to these individuals, so no income could be estimated for those alumni.

5. Econometric results

5.1. Annual giving model

Donations above $50 000 (totaling only 0.3% of all observations) significantly skewed the results so that the assumption of normally distributed errors was compromised. As a result, donations greater than $50 000 were excluded from the annual fund model; we leave those activities for the model which follows in Section 5.2.

Estimated coefficients of a two-stage Heckman-style regression on equation (8) are presented in Table 3 for both the initial probit results (indicating the probability of giving annually in any amount) alongside the predicted amount of annual giving which takes into account the inverse Mills ratio from the preceding stage. The right-most

columns of Table 3 can be read as financial amounts, since they are measuring the impact of continuous and dummy variables on annual giving in dollar terms.

Table 3
Annual Giving Estimation Results

	Probit Results		Two-stage Results	
Variable	Coefficient	Robust Std Error	Coefficient	Robust Std Error
log(*distnce*)	-8.29×10^{-3}	(4.98×10^{-3})*	-32.62	(17.54)*
log(*income*)	1.12×10^{-1}	(1.64×10^{-2})**	568.95	(105.18)**
Single	-2.54×10^{-1}	(2.24×10^{-2})**	-622.25	(177.24)**
Widowed	1.90×10^{-2}	(6.23×10^{-2})	-305.60	(214.91)
Age	4.99×10^{-3}	(7.17×10^{-4})**	35.38	(4.02)**
Gender	-2.56×10^{-2}	(1.97×10^{-2})	208.09	(68.72)**
Actvalum	2.00×10^{-1}	(6.39×10^{-3})**	605.78	(110.79)**
Actvstud	-7.17×10^{-5}	(4.37×10^{-3})	-2.58	(1.28)**
Greek	9.46×10^{-2}	(2.17×10^{-2})**	335.59	(95.57)**
Firstgen	-9.02×10^{-2}	(7.74×10^{-2})	-89.65	(268.97)
Reltvcnt	3.25×10^{-2}	(8.70×10^{-3})**	202.18	(42.98)**
Spouse	3.94×10^{-1}	(2.86×10^{-2})**	1 170.16	(258.49)**
Masters	2.32×10^{-1}	(2.30×10^{-2})**	584.68	(171.38)**
Doctorate	3.24×10^{-1}	(3.04×10^{-2})**	781.04	(221.18)**
Honors	1.28×10^{-1}	(8.45×10^{-2})	385.04	(214.15)*
Almawrd	-2.40×10^{-2}	(1.02×10^{-1})	943.71	(518.75)*
Varsity	-1.50×10^{-3}	(1.91×10^{-2})**	-358.12	(106.19)**
Intramrl	-1.16×10^{-3}	(9.40×10^{-2})	-355.00	(309.31)
Hockey	-3.04×10^{-3}	(7.77×10^{-2})	-577.36	(261.60)**
Officer	2.00×10^{-3}	(1.19×10^{-2})*	99.10	(365.54)
Double	-4.08×10^{-3}	(9.70×10^{-1})**	-1 186.30	(281.72)**
Triple	-4.27×10^{-3}	(5.33×10^{-1})	550.64	(1551.80)
Mills ratio	---	---	3 710.00	(940.74)**
Constant	-2.76×10^{0}	(1.89×10^{-1})**	-14 333.26	(2645.73)**
Adjusted R^2		0.14		0.07
F-statistic		50.65		6.70

** indicates a significance level of 5%, * indicates a significance level of 10%.

The income-related results largely accord with intuition. High-income individuals are more likely to give, and are more generous in the gifts given (notice that this is nice support for our constructed proxy variable).

Single alumni are less likely to give, and give an average of $622.25 less than married alums when they do give. This contradicts the findings of Bruggink and Siddiqui (1995) and Monks (2002) who found single individuals to give more to their alma mater. Widows and widowers are more likely to give, but give $350.60 less than their peers when they contribute.

The probability of giving increases with age, as does the size of the donation (at a rate of $35.38 per year, making the 10-year reunion class average $354 more in donations per capita than the more recently minted alums do. Men give less often than women do, but they give an average of over $200 more per person when they decide to give. This finding may add additional clarity to previous research which, on the whole, has found gender to be an insignificant determinant in alumni giving.

Individuals living farther from campus were less likely to give to the annual fund, and when they did, they gave less than their peers. To our knowledge, this variable has not discussed in previous economic analyses of alumni giving, but has shown itself here to be significant in predicting annual fund giving patterns.

More active alums are more likely to give, and give more generously. Members of fraternities and sororities were similarly more likely to give, and give generously. Individuals with other family connections to the college, including notably their spouses, were unsurprisingly more likely to give, and in the case of spouses in particular, to increase their donations markedly over their peers (by $1 170). Subsequent education led to more giving, and larger gifts as well. Honors while at the college or afterward were both correlated with larger annual gifts.

Curiously, while previous literature linked involvement in college sports to future alumni giving (Wunnava and Lauze, 2001), we find precisely the opposite effect for annual giving. Varsity athletes are less likely to give than their peers are, and both varsity and hockey players in particular are likely to give smaller amounts than their peers to the annual fund.

First generation students, and students engaged in many activities while on campus, are neither more nor less likely to donate, nor do their average donations vary much from the mean of their peers. While first generation students had not been isolated in previous research, discussions with Colorado College staff suggested that such alumni might have stronger bonds with their alma mater than other alumni. This proved not to be the case, however.

Similar to the isolation of first generation students, campus staff were interested in discovering if holding a student office was indicatory of strong bonds with the College, though the variable was untested in previous research. In this instance, college officers were found to be more likely to participate in annual giving campaigns; however, the amount that they give is statistically insignificant from that of non-officers. Perhaps they merely understand the importance of participation in the annual campaign.

Finally, double majors are not truly less likely to give than are single majors. While the coefficients (first-stage probability and second-stage amounts) are both negative for double majors, they almost precisely counteract the average impact that the two dummy variables (one for each major) have on their giving. Perhaps more interesting then, is the fact that triple majors do not show negative coefficients, implying

that they actually give more often, and in larger amounts, than their single or double majored peers give.

We choose not to report the long list of majors by department here. However, there does not appear to be an obvious trend toward fine arts majors donating more or less than natural science majors. For example, majors in dance, environmental science, neuroscience, and philosophy/political science on average give more readily to the annual fund than do their colleagues in classics, education, or environmental biology. We find the low probability of donations from education majors especially provocative, particularly since we control for the ability to donate (via our income proxy) separately. However, our results on major gifts below allay those fears substantially.

The largest average annual donations came from a variety of majors as well, but tended toward the natural and mathematical sciences, ranging from Mathematical Economics to Neuroscience to Geology to Zoology. The lone outlier in the list of large donation majors is Dance.

To test the primary purpose of this paper, to act as a predictive model, we performed in-sample predictions using 2004-06 as our sample period to predict annual giving in 2007. The model predicted actual individual annual fund donors with a surprisingly high 91 percent accuracy rate, and their precise financial contributions with 92 percent accuracy. Both of these findings lead us to conclude that the model, while it clearly has room for improvement, is a strong predictive tool.

We used logarithmic values of the income proxy and distance variables in order to combat persistent evidence that we have a mis-specified functional form using the Ramsey RESET test. While we made every effort to find the root cause of

misspecification without compromising the model's theoretical foundation, no changes have adequately corrected this error. Given the potentially infinite number of motivations for giving to the college, it is quite possible that an assortment of omitted variables is the source of misspecification. We remain cautiously optimistic only due to the robust performance of our in-sample predictions.

5.2. Major gift model

Estimated probit coefficients of equation (8) for major gifts alone (those measuring $50 000 or more over a three-year period) are presented in Table 4.

Along with some intuitive results, there are some intriguing patterns to the major gifts analysis. Unsurprisingly, higher-income, older alumni with more relatives who have attended the same college are more likely to give large gifts, as are alumni who are active in more alumni activities.

Interestingly, alumni living farther from campus are more likely to give major gifts (contrast this with alumni living closer to campus being more likely to give to the annual fund). It appears that two conflicting idioms are at play here--- where annual fund giving seems to follow an "out of sight, out of mind" motivation for philanthropic giving, major donations seem to follow the rule that "distance makes the heart grow fonder."

One possible reason for this contrast could be the geographic location of wealth; while Colorado College is located in the center of the United States, major metropolitan and urban centers (the major locations of wealth in the United States) are located on eastern and western coasts where a greater concentration of wealthy alumni are likely to reside.

Table 4
Major Gift Estimation Results

	Probit Results	
Variable	Coefficient	Robust Std Error
log(*distnce*)	8.80×10^{-2}	(2.90×10^{-2})**
log(*income*)	2.75×10^{-1}	(1.30×10^{-1})**
Single	---	---
Widowed	-1.30×10^{-1}	(3.05×10^{-1})
Age	1.40×10^{-2}	(4.95×10^{-3})**
Gender	1.83×10^{-1}	(1.28×10^{-1})
Actvalum	1.75×10^{-1}	(2.16×10^{-2})**
Actvstud	-8.17×10^{-3}	(2.93×10^{-3})**
Greek	-1.43×10^{-1}	(1.27×10^{-1})
Firstgen	---	---
Reltvcnt	1.36×10^{-1}	(2.39×10^{-2})**
Spouse	9.25×10^{-2}	(1.35×10^{-1})
Masters	2.53×10^{-2}	(1.25×10^{-1})
Doctorate	-5.09×10^{-1}	(2.10×10^{-1})**
Honors	---	---
Almawrd	1.27×10^{-1}	(1.86×10^{-1})
Varsity	-1.69×10^{-1}	(9.82×10^{-2})*
Intramrl	---	---
Hockey	1.09×10^{-1}	(2.87×10^{-1})
Officer	---	---
Double	---	---
Triple	---	---
Constant	---	---
Adjusted R^2		0.26
F-statistic		150.32

** indicates a significance level of 5%, * indicates a significance level of 10%.

Three intriguing categories of individuals are less likely to give major donations: alumni who played on varsity sports teams while a student, students who participated in more activities while on campus, and alumni who have earned a doctorate. The varsity sports effect parallels the negative effect seen for annual giving as well (suggesting perhaps that the college should charge a substantial program fee to participate in varsity sports, since participants are less likely to donate in the future in any form). More

engaged students showed no significant leanings toward or away from annual giving, but this is likely due to the fact that younger alumni (for whom accurate student activity information is available) are less likely to make major donations. Finally, alumni with a doctorate presumably have divided allegiances to at least one other academic institution, so perhaps they are less likely to consider large gifts to Colorado College simply because they on average divide their donations between their undergraduate and graduate schools.

One choice of undergraduate major is particularly comforting in its sign and size: students who chose to major in education are far more likely than any other major to make a major gift. This serves as counterpoint to the lower annual giving amounts of members of that same group. No other major shows a significant difference from the mean, either positive or negative.

There are a relatively small number of major gift donors (55 with adequate information to be used within the model) and therefore the results of this analysis are presumably not as robust as was the annual giving model; however, this is likely to occur at any given college or university when attempting to predict major donors. Because the major donor pool is, by definition, the top tier of giving, modeling major donations is an analysis of philanthropic giving outliers.

Because only a small number of donations is received by the College in any given three year period with long-term solicitation methods in place, a check of the model's strength using backdated information is highly unlikely to yield insightful results regarding the model's true ability to predict major gifts. Rather, upon completion of the analysis, those alumni who had high probabilities of being major donors over the next

three year period were assessed by the College and confirmed, using more traditional assessment methods, to have strong potential for making large contributions.

6. Conclusions

There are seven variables which were statistically significant for both annual giving and major gifts, including an alum's distance from campus, income, age, marital status, number of relatives who have attended Colorado College, participation in varsity sports, attainment of a doctorate degree, and participation in alumni events. However, not all coefficients were similar in sign for annual versus major gifts, and some appeared in counterintuitive directions (even countering the existing literature). We had a surprising degree of success with in-sample predictions, so hope exists that this model will serve other institutions similarly well.

Given the results of this model, we have provided estimated probabilities of annual giving and major gifts for each of the alumni in the Colorado College dataset. A summary of those predictions is presented in Table 5.

Table 5
Distribution of Giving Probabilities

	Very High	High	Mid	Low	Total
Annual Fund Donations					
Predicted	1555	5149	9351	5703	21758
Predicted to give but have not previously	308	1965	5794	4687	12754
Major Donations					
Predicted	1	1	10	40	52
Predicted to give but have not previously	0	1	3	36	40

Note: Probabilities are 0.75+ for Very High, 0.50-0.75 for High, 0.25-0.50 for Mid and 0.10-0.25 for Low)

It is our hope that we have identified high-probability prospective alumni donors for Advancement to approach, a result which is efficiency-enhancing as it reduces efforts

to search out and target prospective donors while giving alumni who are most able and inclined to participate an easier chance to do so. Even if we consider only those who have a very high predicted probability (greater than 75 percent) of giving annually but have not, we have identified 1 247 potential participants in a pool containing 27 632 (that is, 4.5% of the entire pool). If we calculate the expected value of this research for Colorado College, as the sum of the predicted gifts weighted by predicted probabilities, the college should expect $5.1 million in additional philanthropic gifts from the identified alumni. Even if only ten percent of that is realized, the benefits are substantial for an institution of this size.

We hope to have formed a bridge between the academic and non-academic literatures on this topic by grounding the model in a portfolio of economic research and building upon that foundation with the skeletal structure of a previously successful predictive model. Most importantly, we believe that this paper now reflects the best of academic modeling with the practical constraints faced by the institutions of higher education that can use this model to greatest effect.

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