

Bryant University

HONORS THESIS



Predictive Modeling of Alumni Donor Behavior

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ABSTRACT

In recent years, college and universities have relied increasingly upon the charitable contributions of its previous graduates; as the costs of tuition rise substantially, development offices are facing the challenge of creating annual fund campaigns that are minimally expensive while providing the maximum potential for return. This study addresses the available constituent database at one University in particular in an effort to identify what criteria are the strongest predictors of donor response at a small, private university located within New England. The analysis utilized predictive modeling and data-mining largely within the software program Rapid Insight to build several models in an effort to streamline the soliciting process and identify constituents with the highest propensity to donate at a variety of levels.

The analysis includes statistical models intended to identify which characteristics make an individual likely to transition from non-donor to donor status, what ask techniques are most successful for a philanthropic campaign, which individuals are most likely to provide large donations, and which individuals will give consecutive gifts over several years. Statistical modeling builds on current research within the field of university development office data mining; it serves as an evaluation of several studies that indicate that a negative growth rate in giving occurs around the retirement age; this does not appear to be the case at this particular institution. In addition, it builds upon evidence suggesting which majors at predominantly business colleges have the strongest likelihood of providing large gifts to their alma mater. Several models within the study suggest which solicit techniques have the strongest success rate for a philanthropic campaign, including the use of telefund calls, direct mail solicits, e-mail solicits, and several other possibilities.

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Disclaimer

The model and conclusions produced in conjunction with this thesis exist for academic purposes based upon the author's understanding of available data, and in some cases will be subject to the further analysis of Bryant University's development office in the future.

INTRODUCTION

As the cost of education at both public and private universities increases substantially, philanthropic giving and successful capital fundraising is becoming paramount in the futures of individual institutions. Universities cannot feasibly cover the costs of staff and faculty salaries, operating expenses, university advancement, construction, and initiatives, as well as the overall cost of educating attending students through tuition alone. As a result, much more emphasis recently within development focuses on the importance of alumni contributions to the operation of colleges and universities. Development offices increasingly rely on the generosity of alumni, organizations, and friends of the University in order to cover ordinary operating costs every year through an annual fund, as well as to provide the necessary capital in order to pursue various other planning initiatives. In 2006 alone, charitable giving to U.S. institutions of higher education surpassed \$25 billion; on average, these contributions support ten percent of the costs incurred by an institution in a given year (Marcus 2006). Given the expansive alumni networks that exist for most large colleges, learning to capitalize on potential donors and communicate effectively with alumni can provide a meaningful addition to endowment funds, lifting the burden of the cost of education.

Because the extensive numbers of graduates that identify with a particular college or university is so large, the cost of targeting alumni for yearly contributions to an annual fund can become substantial. Marketing endeavors through direct mail, telephone and regional alumni events are incredibly costly if the institution chooses to focus on every graduate in hopes of contribution. As a result, much recent work in university development offices uses a different strategy. Rather than sending mass mailings to large groups of graduates, institutions are developing smarter means of reaching alumni. Through a variety of techniques, schools are working to identify those individuals in their alumni networks with the highest potential and likelihood of giving. By focusing on this select group of potential donors, schools can

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reduce the costs of fundraising while at the same time increasing the overall response rate of selected alumni. Through the utilization of statistical analysis, this study serves to provide a comprehensive model for Bryant University in order to identify what factors drive donations and thus create a more effective appeal for alumni contributions in the future.

LITERATURE REVIEW

The process of recognizing more direct methods of contacting potential donors is a field that has received much acclaim over the past twenty years. The work has substantial implications far beyond that of higher education; non-profit organizations, religious institutions, as well as other associations rely on fundraising in order to accomplish goals. Although a variety of work exists concerning the factors that affect donor behavior, much early research focused on the psychological and sociological components of giving behavior. Researchers have only recently turned to the consideration of individual institutions; due to the extensive information available through University databases on alumni, this arena of study is one of the most conclusive techniques for analyzing the specific factors that may influence the likelihood of philanthropy. Researchers that have considered philanthropic behavior within the realm of higher education have ordinarily focused on several key characteristics including: the psychological factors that influence giving, the importance of athletic program success in broad donor support, individual state and federal tax treatment of charitable donations, and the impact of an individual's life stage and capacity to give.

Within the psychological component of the philanthropic process, recent studies have indicated that alumni are more likely to support their alma maters due heavily to exchange theory and self-interest motives, based more upon cost-benefit analyses than overall goodwill. People consistently appear to participate in a charitable campaign if there is available recognition and the perception of prestige through donating. In a broad study of the motivations for charitable giving by Anil Mather (1996), results demonstrate that a large factor that encourages donations from older generations is the promise of social interaction. This age group will give more often if constituents believe it will provide an outlet for communication; for example, many institutions utilize luncheons, phone calls of gratitude,

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and consistent mail communication to its largest supporters. Mather proposes that these elderly populations contribute to campaigns to satisfy their necessary social needs through these donor luncheons. The study claims that the reason why people, particularly in older age brackets, donate to philanthropic campaigns, is largely due to the personal benefits they derive from the act of giving. Thus, donations are less likely to be the manifestation of a selfless act of giving, and instead depend heavily on the perceived rewards a donor will garner through his or her philanthropy.

In a similar study that focuses on the psychological components of donations from successful lawyers to their alma mater, William Harbaugh identifies the “prestige benefit” as a necessary criterion in considering philanthropy (1998). He observes the relative insignificance of anonymous donations to a variety of institutions, proposing that people give mainly because they want recognition for their actions. By altering reporting techniques of alumni donations, Harbaugh is able to prove that, as more people are recognized and rewarded by giving levels, the overall level of giving by each individual increases. Thus, the motivations behind giving are a powerful component in increasing alumni support. By simply increasing the reporting of high-level donors, an institution can increase overall responses. In addition to these two studies, several other authors such as Frank, Panas, and Clotfeller have addressed the motivational components of giving; many researchers indicate that people are more likely to donate to their alma mater simply because they remain in contact with their peers who are known contributors. Likewise, Stutler and Calvario assert that the individual satisfaction level of a graduate can affect his or her gift to the school; those with a more positive experience with the university will give more. This is consistent with the psychological and motivational studies of other researchers because these donors are more likely to feel as though they received positive utility from the institution. Through these individual studies, it is evident that the seemingly selfless act of philanthropy has persistent origins in the self-interested motivations of alumni.

While there is a breadth of information regarding the psychological component of giving, much of this research is broad-based. It provides a foundation for identifying why individuals donate, but cannot be fully utilized by development officers in order to target specific

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individuals for donations. It is difficult to identify through databases alone which graduates may be triggered by reward mechanisms and recognition, and which cannot. As a result, a new category of research addresses many of the same characteristics this study endeavors to solve, by considering the real data available to universities and what particular alumni and school characteristics can be highlighted to create a target donor group. A significant portion of this research is attributable to the importance of athletic programs and successful sports in garnering donations during winning seasons. O'Neil and Schenke address the participants of athletic programs in particular; for large Division I institutions, graduates from athletic programs continue on to professional sports, giving them the financial ability to support their alma mater (2007). However, the phenomenal trend shows that alumni with collegiate athletic participation tend to donate less than their peers to the institution. This is attributed to the fact that athlete alumni giving behavior depends on two characteristics: the quality of the athletic program, and the extent to which the athlete feels as though he or she already provided substantial contribution to the university by playing sports (O'Neil and Schenke).

In addition to this study, several other researchers have addressed the role of athletics in giving behavior including Shulman & Brown, and Tucker. These studies have typically indicated that winning seasons and athletic success are not correlated with the giving behavior during a certain year, which also reflects an observation by O'Neil and Schenke. The Shulman and Brown study addressed the winning records at a variety of institutions and the magnitude of giving during that winning season, finding no relationship between athletic success and alumni donor participation. In contrast, Tucker's study based solely on football and basketball program performances suggest that football success and alumni response rates are correlated. The impact of athletic programs on giving does not seem entirely substantial; however, the contradictory results of Tucker do indicate the necessity of additional research in this realm. As a result, this study will consider the impact of the transition from Division II to Division I athletics within Bryant University, in order to postulate further on the importance of athletics.

In addition to this arena of research, prominent higher education researchers have also addressed the importance of tax treatment of charitable contributions on an individual's

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giving behavior. Because initial studies had difficulty in obtaining intricate data from universities, early analysis focused heavily on taxation. Jessica Holmes performed one of the most comprehensive studies addressing higher education philanthropy on data from Middlebury College, a private liberal arts institution. This study indicates that those alumni that reside in states with favorable tax treatment are more likely donor candidates than their peers in other states. However, she observes that this result is only important among alumni within the highest income bracket. This is consistent with Clotfeller (1985), who identified that charitable contributions are highly sensitive to tax subsidization. The Middlebury College study is especially important because it addresses many characteristics beyond taxation, including the importance of athletic and academic success; her findings indicate that an institution's successful athletic performance is more important than high academic standards in generating donations. Universities with athletic programs that perform well are more likely to generate widespread donations than universities that utilize stringent academic standards for admittance; this suggest that athletic reputation is more important than academic reputation in the realm of alumni giving.

Similar to studies addressing tax issues for charitable behavior, new investigators are attempting to study the impact of student debt and scholarships on giving (Christou & Halassios, Baum & O'Malley). These studies indicate that substantial student debt negatively impacts giving in future years. Other factors that have received consistent analysis include the importance of an individual's age and level of income; the vast majority of studies on these characteristics are consistent with logical expectations. Individuals that are older and in higher income brackets have more capacity to donate, and are more likely to do so. However, the age at which alumni begin to reduce contributions is inconclusive. According to Olsen, Smith, and Wunnova, the likelihood of giving increases until retirement, at which point growth becomes negative. In contrast, Grant and Lindauer identify the threshold for growth to be inconsistent with retirement age, with negative growth developing a few years prior to retirement.

It is evident that the study of philanthropy among college and university alumni is a growing field. Although there is considerable research that exists on the subject, there is much that still allows for discussion and debate within the field. For example, there are apparent

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dissimilarities in data concerning the importance of athletic success, and the impact of age and retirement on donations. Likewise, most studies address limited information through alumni surveys or public information, rather than the detailed records available to university development offices. Most studies have been conducted on either large public institutions, or private liberal arts colleges; few studies consider charitable giving at historically business-oriented institutions. One study performed by Okunade and Berl addresses charitable giving at a business college; their research details the conclusion that business graduates within the field of finance, insurance, or real estate give more and examines the impact of matching gift accounts, as well as the impact of marriage to another alumnus. However, their results determine which factors are likely to illicit any donation from graduates, rather than which individuals and characteristics will generate sizable donations. Philanthropic research is a growing field, and as a result, much information has yet to be discovered, particularly within the realm of a small, private business institution.

Because the particular data available for this study will detail the behavior of alumni from Bryant University, the unique characteristics of this school present additional avenues of research; this study will endeavor to consider the factors addressed by previous research to identify if trends for large public schools are consistently accurate for a small private college. In addition, the transition of Bryant to the more prominent NCAA Division I athletic tier provides an arena to discuss how important prestigious athletics and program success are in the magnitude of donations in a given year. This study will build upon the findings of Okunade and Berl, to serve as a verification of business school results as well as to provide an indication of which factors are more important when considering the amount of individual donations. As stated previously, Okunade and Berl identified whether an individual donated, rather than how much he or she was willing to contribute. Lastly, through several unique characteristics specific to Bryant, research will address the importance of previously untested categories, such as giving behavior of international students.

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METHODOLOGY

In an effort to develop the most comprehensive and accurate models concerning alumni donor behavior, predictive modeling was accomplished in two separate phases utilizing different modeling packages: Rapid Insight and SAS Enterprise Miner. This technique was important for several reasons, most notably because it allows accurate comparisons of software applications for possible implementation in the future; complete results of this software evaluation are detailed within the results and extensively within Appendix A. Variables for analysis included on an initial dataset were obtained through the development office at Bryant University intended for modeling use. The sample included 69700 individuals, including both donors and non-donors. The data was composed of approximately 52% donors and 48% non-donors. The spreadsheet contained approximately 150 variables, including the individual's graduation year, degree, major, availability of current home and work address information, and previous donation behavior. A complete description of variables is available in Appendix B. The standard deviation of lifetime total giving for the database is \$25481. As a result, it is immediately evident that the potential range of donation level is extreme, validating the necessity to develop refined strategies for targeting those individuals within a very high lifetime giving range, as well as those individuals with a high potential of reaching the status of a high-level donor.

The majority of alumni currently reside in Connecticut, Massachusetts, Rhode Island, and New York. Among the entire cohort, the average graduation year was 1982, and the average age on record was forty-six. Several other categorical variables existed in the dataset that, given prior research, were integral in evaluating the likelihood of individuals with various majors and degrees supporting their alma mater. The majority of alumni in the entire cohort represent the following degrees: Associate in Science, Bachelor of Science in Business Administration, general Bachelor of Science, and Master of Business Administration. Among declared majors, the possible values on record varied significantly due to changing identification and evolving programs at the university; the majority of alumni indicated graduation with a major in accounting, finance, management, marketing, computer information system, business administration, and executive secretary. These results are consistent with the historical focus of Bryant University as a business institution; the majority

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of alumni within the database had a graduation year prior to the addition of the liberal arts college. The substantial magnitude of alumni within the executive secretary degree represent a previous major at the institution that existed in the past; given how many alumni exist in the category and the possible increased capacity to donate as the cohort ages, this statistic indicates the potential importance of targeting this major specifically.

Prior to model development, data refinement was necessary in order to make optimal usage of the variables involved in the analysis. This portion of the study was performed significantly within Rapid Insight's Data Integration tool. The dataset contained text fields requiring binary coding in order to be beneficial in the analysis; this adjustment was performed on fields concerning an individual's work and home address, phone number availability, e-mail address, and event attendance throughout available alumni history. Thus, the binary coding allowed the variables to indicate the importance of the existence of that type of field within an individual's record for his or her donation level. The newly formed variables were designed to return a 1 if the alumni supplied the information or attended the described alumni event, and a 0 if he or she did not. These revised variables as well as other categorical and numerical variables were analyzed initially for their relationship with lifetime gifts greater than \$1000, in an effort to understand the impact of these variables on the potential of giving at this defined amount. This descriptive study of variables served to identify segments of the dataset that promoted the largest donor response prior to regression modeling.

As a result of this analysis, the importance of age and years since graduation is immediately evident; as expected, the probability of lifetime gifts greater than \$1000 for an individual increased substantially with older age groups (Appendix C). This reflects this group's probable financial security and increased capacity to donate; this result is logical because due to its definition based upon lifetime giving and the additive effect of each additional annual gift that may occur. Current donor targeting techniques at Bryant University do not definitively reflect this age variable; this descriptive analysis indicates the importance of considering age in requesting donations from university alumni. In addition, research indicated that among degrees, individuals with a Master of Taxation, Bachelor of Science in Secretarial, Honorary Doctorates, and Master of Business Administration, had the highest

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propensity to donate among all degree categories. Likewise, individuals with a declared major of taxation, business administration, accounting, entrepreneurship, public administration, and advertising, were most likely to donate more than \$1000 over their lifetime. The majors of advertising and public administration represent a 50% and 30% likelihood of reaching a lifetime \$1000 gift level respectively; however, it is important to note that these categories contain substantially fewer alumni than other majors. Only two individuals in the entire cohort represent a public administration major, indicating a miniscule sample size; it is possible to conclude that the public administration and advertising majors may exist as consistent outliers throughout analysis. As a result, it may be necessary to target these individuals separately while focusing predictive modeling on majors with a higher percentage of alumni.

Predictive modeling was accomplished within Rapid Insight's Analytics software, a statistical data-mining tool that is highly functional for alumni development offices and other philanthropic organizations. Several models were developed in an effort to provide a comprehensive solution for the Alumni Relations office, as well as to consider the hypotheses initially discussed concerning the importance of athletic programs, the age at which individuals tend to reach negative growth in gift-giving, and the impact of international student identity upon donor likelihood. These models are fully described within the results, and endeavor to answer the following questions:

- Who among the non-donors is likely to reach donor status?
- What individuals are likely to become lifetime givers greater than \$1000?
- What asking techniques have the strongest relationship with donor behavior and response to donation requests?
- What impact does athletic success, athletic participation, and transition to Division I have upon philanthropy?
- Do students of international origin donate based on the same factors as U.S. alumni, or should they be targeted in a different manner?

RESULTS

In an effort to fully address the proposed topics described within the methodology, several distinct models were established; these models provide an accurate depiction of the asking techniques and alumni characteristics that result in a high propensity to donate to the institution under evaluation. An initial model, intended to identify which individuals in the non-donor cohort are most likely to respond to future donation requests, will be discussed. For this model, the result did not address the magnitude of the donation provided, but rather whether the individual would respond to a request with a donation of any amount. As a result, the necessary target variable was defined as a binary variable, returning a 1 if the individual ever donated to the institution, and a 0 if he or she did not; this represents the probability that an individual will respond to the institution, and will be consistently referred to as the response rate. Rapid Insight provides a tool that performs an initial, immediate data-mining process; based upon this variable definition, the program identified 73 variables related to an individual's response rate at a significance level of $p=.01$. Among these 73 variables, considerable information on donations given through the past nine years was included, such as both hard and soft gifts during various fiscal years (soft gifts represent matching gift contributions by organizations). Because this study was concerned with donors who have not given anything and yet still match the characteristics of a typical donor, these annual giving variables were not considered in analysis. A multivariate analysis of the variables under consideration and their relationship to the target was also performed.

The effect of an individual's age on his or her likelihood to respond to the institution provided interesting results; a complete graph of this variable's relationship to the dependent variable is located within Appendix D. As expected, the individual's likelihood to provide any type of donation increases at a fairly uniform rate until between ages forty-five and fifty. At approximately age 22-25, it appears that the likelihood to donate has a sudden slight increase. This can be attributed to the fact that that age falls slightly after the time of the individual's graduation, which may provide an increased incentive to donate; recent alumni may have a strong inclination to give back to the institution and are simultaneously gaining the financial security to do so. After age 50, donations appear to fall off somewhat suddenly; this may be

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due to an increased donation at age 50 due to another reunion year; however, growth continues to be fairly slow beyond that age. This allows an initial conclusion that, among graduates of Bryant University, the most positive growth in donor response appears to be before the individual reaches age fifty. While graduates still respond after that age, the overall growth in response is much less significant. This result is considerably different from previous studies, which indicated negative growth hovering either slightly before or slightly after the normal retirement age. Furthermore, the sudden increases in response rate during ages that tend to coincide with a reunion year suggest that perhaps higher education institutions should utilize different targeting strategies for classes that are during a ten-year, twenty-five year, or fifty-year reunion year.

After evaluation of variables graphically based upon their relationship to the response rate, a logistic regression was performed in order to generate an accurate model predicting donor response. The regression was completed at a significance level of $p=.01$. The complete model including variable coefficients and individual p-values is located within the adjacent table.

From this analysis, it is evident which variables have the strongest effect on whether an individual will ever provide a donation to the institution. For example, individuals who provide their phone information and a preferred e-mail address have a higher propensity to donate than those individuals in the database that do not. Likewise, individuals that reside in Connecticut have a higher likelihood to donate, while those who work in

<u>Variable</u>	<u>Coef</u>	<u>p-value</u>
PR_PHONE	0.2683	0
PREFERRED_EMAIL	0.6261	0
WK_PHONE	0.2157	0
TELEFUND_SOLICIT_08	-9.333	0
PR_LINE1_BIN	0.2587	0
UNHON_PLEDGE_BIN	0.9835	0
LOG10(AGE)	4.059	0
Binary(DEGREE,Bach. of Sci. in Bus. Admin.)	-0.318	0
Binary(DEGREE,Bachelor of Arts)	-0.3696	0.1118
Cube(DIRECT_MAIL_SOLICIT_08)	0.01534	0
Binary(DONR_2,EMPF)	1.462	0
Binary(DONR_2,EMPL)	1.019	0.0034
Binary(DONR_2,PRNF)	0.7085	0
Binary(DONR_2,TRSF)	1.94	0.0008
LOG10(EMAIL_SOLICIT_08)	16.18	0
LOGe(Grand Total)	0.523	0
Binary(MAJOR,Criminal Justice)	-0.3853	0.0007
Binary(PR_NATION,INDIA)	-1.584	0.003
Binary(PR_ST,CT)	0.2342	0
Binary(PR_ST,ME)	-0.3678	0.0003
Binary(PRIM_DONR_CODE,ALUG)	0.844	0
Binary(PRIM_DONR_CODE,EMPL)	0.6793	0
Binary(PRIM_DONR_CODE,FRND)	5.516	0
Binary(PRIM_DONR_CODE,PRNF)	2.008	0
Binary(PRIM_DONR_CODE,PRNG)	-0.7823	0.0022
Binary(PRIM_DONR_CODE,PRNT)	-0.1565	0.0065
LOG10(TOTAL_PERSONAL_CONTACT)	0.9414	0
Binary(WK_ST,PA)	-0.3003	0.0397
Binary(WK_ST,VT)	-0.4928	0.0043

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Pennsylvania and Vermont appear to have a decreased likelihood to donate. Interestingly, graduates from the state of Maine are less likely to donate as well. This may be attributed to the proximity of Connecticut graduates to the institution, relative to other potential states within the analysis. Another important detail that this model suggests is the success of a variety of different asking techniques; within this model, the telefund solicit technique is statistically significant to the response rate. The variable has a coefficient of -9.333 and an odds-ratio of .0001 (Appendix E). This indicates the possibility that telefund solicits may be detrimental to generating donation responses from constituents. However, this variable result may be due to the method of analysis. Because the target variable addresses whether an individual will respond to the institution, and does not take into account the size of the donation, it is likely that because the telefund method contacts such a large number of constituents that the response rate is low, while the magnitude of donations is high. The successes of various ask techniques utilized at Bryant University are analyzed in more detail within a later model.

Because this model was developed utilizing the entire database, any effort to identify non-donors that match these characteristics and return a high response to the target variable can be identified through the development of a scoring model. Within Rapid Insight, the analysis tool provides a method to utilize the current logistic regression equation to the entire dataset. Using the software's scoring program, the regression was applied to all individuals within the database and then filtered for those individuals who do not currently donate and have a high likelihood to respond based upon the indicated model. The program provides a scoring system, which ranks all individuals in the database between 1 and 10 to describe their likelihood of giving. Based upon this model and the scored dataset, the model returned approximately 524 current non-donors within the first decile, indicating the highest propensity to donate. This model was developed using fifty percent of the available database and subsequently tested for accuracy on remaining individuals. This resulted in a 77.38% concordance rate, indicating that the model is a reasonably accurate predictor. The concordance rate measures the fit of the model; percentages close to 100% indicate a nearly perfect model match to the data available. Because this model intends to predict new donors, a concordance rate of 77.38% is successful because it provides enough flexibility to allow

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current non-donors to fit the model, while at the same time accurately conveying important variable relationships.

While this model was immediately very successful in recognizing which characteristics are the strongest predictors of a donor group, additional models were developed in order to address which asking techniques the alumni relations office should be utilizing in order to create the best overall response. This model specialized more in addressing which ask technique variables have the strongest relationship to giving, and as a result, its utility is not within a scored dataset, but within the developed model itself. The target variable for this analysis was defined based upon whether an individual responded to a donation request during fiscal year 2008. Due to the nature of available data, soliciting information necessitated the focus of the study on one individual year; as a result, the analysis will be concerned with which techniques used during the course of that year garnered a response from the targeted individual in that same year; the office provides accurate record of each type of solicit and the number of each solicit for the constituent; these are evaluated based upon the impact of a single year's solicits and then subsequent individual donations during that year. After an automated data-mining process performed within Rapid Insight's analytics tools, 98 variables were identified to be related to the response rate of an individual during fiscal year 2008, at a significance level of $p=.01$. Based upon a multivariate analysis, the importance of certain asking methods was immediately recognized. As an example, the alumni relations office at the university sent out between one and eight direct mailings to constituents over the year. Based upon variable analysis, it is evident that sending one mailing alone led to an approximately 26% likelihood of donation; this likelihood decreased significantly for two mailings, and remained consistently below the success rate for one mailing. When the office sent eight mailings to a particular constituent over the year, the response rate was extremely high, at exactly 100%; however, it is important to note that sending eight mailings to each constituent will become extremely costly over time. Additionally, only three individuals in the entire database received this attention during the year. Because the sample is so small, it is possible to rule out the advantage of sending that many mailings to an individual during the year. A graphical analysis of this variable is detailed within the Appendix G.

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Multivariate analysis in this model was followed by the development of a logistic regression within Rapid Insight, at a significance level of $p=.01$. The complete model with variable coefficients and related p-values follows below. Soliciting variables of importance are highlighted.

Variable	Coef	p-value
PR_CITY	0.7735	0
PREFERRED_EMAIL	0.1572	0.0038
TOTAL_NO_GIFTS	0.05434	0
WK_LINE2	0.231	0.0001
TELEFUND_SOLICIT_08	4.691	0
EMAIL_SOLICIT_08	-2.037	0
SRKOA_08_BIN	-4.041	0
XHOMA_08_BIN	0.9879	0
MONTHS_SINCE_LAST	-0.02546	0
Cube(CAMP_CAMPAIGN_SOLICIT_08)	-0.417	0
Binary(CORRESPONDENCE_08,Y)	1.566	0
Binary(DIRECT_MAIL_SOLICIT_08,1)	1.821	0
Binary(DIRECT_MAIL_SOLICIT_08,2)	0.1517	0.0145
LOG10(MONTHS_SINCE_LAST)	-1.364	0
LOGe(MOST_RECENT_GIFT_AMT)	0.0942	0.0004
Binary(PR_ST,WA)	1.302	0.0035
Binary(PRIM_DONR_CODE,EMPF)	-1.725	0.0003
Square(YEARS_SINCE_GRAD)	0.000052	0.0618

In this analysis, it is evident that contact methods such as telefund solicit, direct mail, and personal correspondence are highly successful in generating donations during any given year. These results are significant beyond Bryant University; this result appeared consistently throughout a wide variety of predictive models tested at this institution for this study, and it may indicate areas of strength in many philanthropic campaigns that use these strategies. Other institutions may wish to employ these methods in the future in order to obtain positive results. Outsourcing telefund calls or hiring additional staff to perform this function may be costly; however, this analysis indicates that these supplementary costs may be worthwhile for institutions due to increased donations. The email solicit coefficient, -2.037, suggests that rather than being simply unimportant to alumni giving, the variable may be slightly disadvantageous to generating response. This is also true for the campus campaign solicit used by the institution, although the effect is not nearly as substantial; this solicit technique is

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utilized on a very small segment of the population, which may cause the negative coefficient for response rate. The impact of the campus campaign solicits, when considered relative to all other ask techniques and potential donors in the database, is fairly minimal; this may be attributed to the significantly smaller cohort, because this model addressed overall response. The use of personal correspondence between a giving officer and a constituent appears to improve response; as discussed previously, the effect of direct mail solicits suggests that one mailing may be the most effective in generating response; reducing the number of mailings during each year lowers the cost of targeting constituents, with a minimal impact on giving behavior.

A separate multivariate analysis was utilized on various contact variables in an effort to isolate their individual effects and response rate probabilities, specifically for contact strategies not statistically significant in the previous model. As a result, it became clearer which strategies have best probability of response, particularly within categories with multiple solicits each year; this provides the ability to identify the optimal number of each solicit. Based upon a multivariate analysis of e-mail solicits to donor response, it appeared that the use of two e-mails during the year yielded a response probability of 4%, while one email led to a response probability of 1%. The correspondence in the above model involved written communication between the constituent and the officer. Interestingly, written correspondence was statistically significant to the response rate, while personal contact between the university and the alumni was not. In an isolated analysis of the relationship between correspondence and response, it appears that individuals with correspondence are much more likely to donate any amount during that year; the response rate between individuals with correspondence and without correspondence differs by 21%.

The conversation variable, in which a university giving officer engages in personal conversation with alumni, was not related to the model at a significance level to be included. Multivariate analysis of response rates for personal contact yielded a response probability of 34% for no personal contact, and only 19% for individuals who engaged in a conversation with the University, when analyzed at a significance level of $p=.1$. This result may be attributed to the fact that the University has the means to directly communicate with only so

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many constituents; the percentage of individuals involved in a conversation with university officers is low in relation to the entire constituent base. This may have influenced the statistical significance and results of this individual variable. Despite this fact, the use of personal contact between alumni relations officers and constituents is an extremely beneficial relationship-building technique.

In this analysis, it is clear which strategies are the most effective means of reaching alumni for charitable donations. Utilizing telefund calls, personal correspondence, and a single direct mailing during the year are phenomenally successful at generating response. These results serve to highlight the successful strategies already in place at this specific institution. This model, developed in order to address ask technique success rates, was created utilizing 50% of available data. After testing the model on the remaining constituents, the model achieved a concordance rate of 93.01%, indicating that it is in fact an accurate predictor of response during fiscal year 2008.

The use of Rapid Insight's predictive modeling tools were utilized for a model integral to the identification of constituents that meet the characteristics of large donors, rather than those constituents who simply respond. As stated previously, the average lifetime donation among all constituents is \$683. Due to the substantial magnitude of individuals in the population, it was important to focus on which individuals will provide much larger donations over the course of their lifetime or within any given year. The number of graduates that provide large donations during each individual year is considerably small, and appear through other models to be successfully targeted by Bryant University's current constituent rating system. Among 69,700 individuals, only 439 provided a donation greater than \$1000 during fiscal year 2008. Due to this small sample size, this model will look at the likelihood of an individual to donate more than \$1000 in their lifetime; approximately 2,952 individuals have provided this donation level throughout their lifetime. As a result, this model was defined with a binary target variable concerning whether an individual has reached the \$1000 lifetime threshold.

Initial data-mining was performed through Rapid Insight and revealed 80 variables that had a significant relationship with an individual's likelihood to provide a donation greater than

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\$1000 over the course of his or her lifetime. These variables were analyzed for their relationship with the target variable under consideration. While significant research exists concerning which majors are likely to respond to a request for donation among business school alumni, this model yields the potential to define which majors are likely to produce individuals that become substantial givers upon graduation. According to multivariate analysis within Rapid Insight, several majors are significantly more likely to give large donations to a business school upon graduation. Details are located within the figure below.

MAJOR	Y-variable Mean	Count
Advertising	50%	2
Public Administration	33%	3
Lib. Studies: English	25%	16
Entrepreneurship	18%	22
Legal Studies Minor	17%	6
Taxation	7%	626
Business Administration	7%	3805
Accounting	6%	5188
Teacher ED	5%	443
Office Administration	5%	193
Executive Secretary	5%	2640
Liberal Studies: Economics	4%	201
Institutional Mgmt	4%	170
Business Communication	4%	199
General	4%	200
Education	4%	76
Bus. Admin.: Marketing	4%	4993
Hotel Institution Mgmt	4%	337
Accounting-Financial	4%	739
Legal Secretary	4%	384
Health Care Management	4%	193
Bus. Admin.: Management	4%	5099
Public Management	3%	146
Transportation	3%	31
Medical Secretary	3%	353
Bus.Admin.:Computer Info. Sys.	3%	1999
Information Technology	3%	36
Bus. Admin.: Finance	3%	3190
Bus.Admin.:App. Actuarial Math	2%	261
Criminal Justice	2%	702
Bus.Admin.: Acg. Info. Systems	1%	71
Secretarial - Acctg	1%	89
Communication	1%	158
Bus. Admin.: Accounting	0%	529

This study identifies graduates within majors at a historically business-focused university predicted to donate more than \$1000 to an alma mater after graduation. It is necessary to note that several major categories are skewed as a result of a small sample size. The advertising major category appears 50% likely to provide a large donation; however, this major consists

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of only two individuals in the entire sample population. In addition, Bryant University does not have information on the declared majors of all constituents within the pool; this simply represents those individuals whom elect to provide the alumni office with that information, or individuals whom the institution obtains that information from prior to graduation. It appears as though individuals in the taxation, general business administration, accounting, executive secretary, and management or marketing concentration have the highest propensity to donate, after majors with only very few constituents are disregarded.

Majors that appeared to have the highest likelihood of donating substantial gifts upon graduation were compared to majors who were most likely to respond with any gift in any year. This response rate is concerned only with which majors will donate, disregarding the size of each donation. The chart below details the response rate percentage of majors most likely to respond, adjusted to remove all categories containing fewer than fifty constituents.

MAJOR	Y-variable Mean	Count
Health Care Management	18%	193
Taxation	15%	626
Education	14%	76
Office Administration	13%	193
Mgmt Opers & Tech	13%	53
Business Administration	13%	3805
Executive Secretary	12%	2640
Bus.Admin.:App. Actuarial Math	11%	261
Accounting	11%	5188
Communication	11%	158
Institutional Mgmt	11%	170
Teacher ED	10%	443
Liberal Studies: Economics	10%	201
Accounting-Financial	10%	739
Business Communication	10%	199
Hotel Institution Mgmt	9%	337
Medical Secretary	9%	353
Bus.Admin.:Computer Info. Sys.	9%	1999
Public Management	9%	146
Secretarial - Acctg	8%	89
Bus. Admin.: Management	8%	5099
Bus. Admin.: Marketing	8%	4993
General	8%	200

It is evident that, while the majors taxation, general business administration, accounting, executive secretary, and management or marketing concentration will likely donate the most, these graduates are not necessarily the most likely to respond to requests. The health care

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management major is most likely to respond, followed by taxation, education, and office administration. Taxation, business administration, and accounting appear to be the majors which are most likely to respond and also most likely to provide a significant lifetime donation. This information may prove vital to development offices at schools with business majors, as efforts to target constituents for various donation levels are considered. It may be more beneficial to ask for smaller amounts from individuals in majors that are likely to respond to requests, while simultaneously request larger gifts from major categories with a high propensity to donate at greater levels. This adjustment may render additional predictive modeling, in an effort to isolate individuals with large-donor group majors that will likely give that amount.

After analyzing these characteristics of the dataset, Rapid Insight was then utilized in the formation of a logistic regression, performed with a specified p-value of .01. Resulting variables, coefficients, and individual p-values are detailed below.

<u>Variable</u>	<u>Coef</u>	<u>p-value</u>
PREFERRED_EMAIL	-0.3161	0
TOTAL_NO_GIFTS	0.133	0
WK_LINE1	-0.3561	0
COR	-0.3745	0
SEC_TRANS_BIN	5.693	0
UNHON_PLEDGE_BIN	-0.3557	0.0011
Binary(AMRPRRT_RTGT_CODE,M)	1.853	0
Binary(DEGREE,Bach. of Sci. in Bus. Admin)	-3.112	0
Binary(MAJOR,Bus. Admin.: Finance)	-1.094	0
Binary(MAJOR,Bus.Admin.:Computer Info. S	-0.8582	0.0003
CubeRoot(MOST_RECENT_GIFT_AMT)	0.7867	0
Binary(OFFICER,xxxx)	0.8495	0.0058
Binary(OFFICER,xxxxx)	2.595	0
Binary(PR_ST,MA)	-0.7502	0
Binary(PR_ST,RI)	-0.215	0.0078
Binary(PRIM_DONR_CODE,EMPL)	-1.803	0
Binary(PRIM_DONR_CODE,PRNT)	-2.28	0
AGE	-0.08681	0
MONTHS_SINCE_LAST	-0.01412	0
YEARS_SINCE_GRAD	0.00756	0.0002

Note: terms Binary(OFFICER, xxxxxxxx) have been altered due to privacy concerns.

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This model serves to identify which individuals will reach the status of providing substantial donations greater than or equal to \$1000 throughout the course of their lifetime. Through this model, it is evident that certain majors may appear to have markedly poorer performance as a whole of providing large lifetime donations at the current significance level. Individuals within the Business Administration major with concentrations in either finance or computer information systems are less likely to provide large donations, as evidenced by the coefficients within the model, -1.094 and -.8582 respectively. Given this information, it is possible for the alumni relations department to explore why these graduates may appear to have a weaker relationship with their alma mater than those who identify with other majors.

The logistic regression resulting from analysis was utilized in the development of a scoring model through Rapid Insight. After applying the regression equation to the entire available dataset, individuals were scored based on their probability of donating more than \$1000 over their lifetime; the scoring model assigned each individual to a decile based upon these probabilities. As an indication of the utility of this particular regression, the scored dataset identified 3,275 individuals who have currently donated less than \$500 within the first decile. These individuals may garner additional targeting techniques by the institution's alumni relations department. As in previous analysis, logistic regression was performed using 50% of the available dataset and then subsequently tested on remaining individuals; this testing yielded a concordance rate of 87.67%, indicating substantial accuracy.

In a similar type of analysis, a model was established in an attempt to identify the factors that contribute to an individual's propensity to donate \$1000 each year over a consecutive period of years. The analysis was concerned with repeated donations at a level of \$1000 or greater during the years 2007, 2008, and 2009. Within the dataset, less than 1% of available constituents achieved this donor status; a target variable was defined as a binary term, returning a 1 if the individual reached consecutive donor status and a 0 if he or she did not. A logistic regression was applied to the dataset in order to identify the factors that most contribute to this variable, as well as in an effort to identify current donors that are not giving at this consecutive rate but may have a high propensity to do so in the future, indicating the

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potential for increased targeting by the university’s development office. The resulting model, including coefficients and significance level, is located in the following table.

Through this analysis, it is evident that alumni attendance at certain events greatly impacts consecutive annual gifts. The variable SHOFA, has a coefficient of -3.947 and represents attendance at an athletic hall of fame dinner; interestingly, individuals who do attend this event appear less likely to give consecutively; this result may be explained by the individual’s increased propensity to donate during the year of that particular event. This is consistent with

observations discussed within the literature review, focused upon the psychological factors that impact philanthropic behavior. Individuals who attend the hall of fame dinner may feel more connected to the University or more compelled to donate during that given year, while that feeling may not carry into future giving years. Likewise, the ARTCA and ANETA_BIN variables represent attendance at alumni regional events in Connecticut, and general alumni networking events in which current

Variable	Coef	p-value
PREFERRED_EMAIL	0.6024	0.0016
ARCTA	-2.482	0.0011
SHOFA	-3.947	0.0001
TOTAL_PERSONAL_CONTACT	0.2078	0
ANETA_BIN	1.942	0.0084
SEC_TRANS_BIN	1.773	0.0262
Binary(AMRPRRT_RATE_CODE,D9)	2.565	0
Binary(DIRECT_MAIL_SOLICIT_08,1)	0.9357	0
Binary(GALAA,1)	1.985	0
Binary(MAJOR,Business Administration)	-1.028	0.0125
Binary(OFFICER,xxxx)	3.812	0
Binary(OFFICER,xxxx)	6.006	0
Binary(OFFICER,xxxx)	3.124	0
Binary(OFFICER,xxxx)	4.831	0
Binary(OFFICER,xxxx)	5.078	0
Binary(OFFICER,xxxx)	5.164	0
Binary(OFFICER,xxxx)	5.05	0
Binary(PR_ST,MA)	-0.3446	0.1039
Binary(PRIM_DONR_CODE,ALUG)	-0.3604	0.0765
Binary(PRIM_DONR_CODE,FRND)	2.666	0

Figure 6

student also attend. Attendants at Connecticut alumni events have a low propensity to donate consecutively, while those who attend networking events for current students are likely to donate a substantial amount of money each year. The attendance of regional networking events may indicate a constituent’s strong ties with his or her alma mater; individuals within this category appear to have a significant interest in providing support and advice to current Bryant students, which may explain their continued interest in providing gifts to the institution.

An additional variable that appeared to have a statistically significant relationship to an individual’s propensity to donate large gifts annually to the institution involves the alum’s

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attendance at Bryant University's annual gala event. In this analysis, the attendance of one gala throughout the course of the time period had a strong positive relationship to the likelihood of donating consecutively. However, it is essential to understand that graduates who are invited to the institution's gala event are already previous donors; as a result, this group already provides evidence of a strong positive relationship to the institution. Those individuals who provide one gift and also attend a gala event are likely to continually give to the institution. Interestingly, it was not necessary for the alumni to attend gala every year in order to provide consecutive gifts; the development office should, as a result, continue to target one-time attendees in the same manner as consecutive event-goers. This model was developed utilizing a randomized 50% sample of the available dataset and, after testing the regression on the remainder of the dataset, revealed a 94.55% concordance rate, indicating its utility in predicting future consecutive donors.

Due to the unique nature of Bryant University as an institution with a strong population of international students, this study also intended to address the varying philanthropic behavior of international students, in order to determine if charitable organizations should target these constituents differently in the future. As expected, the original dataset contained a large majority of individuals that were from within the United States; only approximately 16% of constituents were from countries outside of the United States. The variety of potential categories within the nation variable included 85 possible countries. As a result, this variable was exceptionally difficult to include in previous analyses, as it is extremely unlikely that this small category would be statistically significant at the desired level. In order to identify the strongest potential giving nations or regions of the world, the variable was analyzed for its relationship to the possibility of lifetime giving greater than \$1000. Because it is likely costly to develop a new targeting method depending on the region of origin, this was the selected y variable in order to properly identify potential large donors and whether they warrant additional, or different, targeting strategies.

A full description of all potential variables, and their likelihood of generating gifts greater than \$1000, is located below. The y-variable mean column indicates the probability that a constituent from that nation will donate; the count column identifies the number of

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constituents in the entire dataset from that nation. As a result, it becomes clear that most nations have a low magnitude of constituents. Those nations with a very low count, although they may have a high probability of donation, may not require additional targeting because it may not yield substantial increases in donations in the future..

NATION	Y-variable Mean	Count	NATION	Y-variable Mean	Count
VENEZUELA	17%	12	JORDAN	0%	1
UNITED KINGDOM	16%	25	KENYA	0%	4
BERMUDA	16%	44	KOREA (SOUTH)	0%	14
GERMANY	15%	13	KUWAIT	0%	2
NETHERLANDS ANTILLES	14%	7	LAOS	0%	1
SAUDI ARABIA	11%	9	LEBANON	0%	3
CANADA	4%	47	LUXEMBOURG	0%	2
ALBANIA	0%	2	MACAU	0%	2
ARGENTINA	0%	5	MALAYSIA	0%	3
ARUBA	0%	2	MEXICO	0%	2
AUSTRALIA	0%	7	MONGOLIA	0%	1
AUSTRIA	0%	1	MOROCCO	0%	4
BAHAMAS	0%	8	MYANMAR	0%	1
BAHRAIN	0%	1	NEPAL	0%	1
BELGIUM	0%	3	NETHERLANDS	0%	6
BOLIVIA	0%	3	NEW ZEALAND	0%	4
BULGARIA	0%	3	NIGERIA	0%	6
CAYMAN ISLANDS	0%	2	NORWAY	0%	1
CHINA	0%	15	OMAN	0%	1
COLOMBIA	0%	2	PAKISTAN	0%	14
COSTA RICA	0%	3	PANAMA	0%	21
CYPRUS	0%	2	PERU	0%	5
DOMINICAN REPUBLIC	0%	8	PHILIPPINES	0%	3
ECUADOR	0%	24	ROMANIA	0%	2
EL SALVADOR	0%	4	RUSSIAN FEDERATION	0%	12
ETHIOPIA	0%	1	RWANDA	0%	2
FRANCE	0%	14	SENEGAL	0%	2
GABON	0%	1	SINGAPORE	0%	6
GHANA	0%	6	SLOVAK REPUBLIC	0%	1
GREECE	0%	8	SOUTH AFRICA	0%	5
GUATEMALA	0%	1	SPAIN	0%	16
HAITI	0%	16	SWEDEN	0%	6
HONDURAS	0%	5	SWITZERLAND	0%	8
HONG KONG	0%	16	TAIWAN	0%	4
HUNGARY	0%	2	THAILAND	0%	11
INDIA	0%	97	TURKEY	0%	34
INDONESIA	0%	11	UGANDA	0%	1
IRELAND	0%	4	UNITED ARAB EMIRATE	0%	6
ISRAEL	0%	2	UNITED STATES OF AM	0%	2
ITALY	0%	13	VIETNAM	0%	13
JAMAICA	0%	14	YUGOSLAVIA	0%	1
JAPAN	0%	10	ZAMBIA	0%	2
			ZIMBABWE	0%	4

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In this chart, it is evident that the location of international graduates is highly dispersed, resulting in low sample sizes for the majority of potential categories. This analysis reveals each nation’s relationship to a lifetime giving potential of \$1000. It appears as though, among foreign nations, constituents from Venezuela, the United Kingdom, Bermuda and Germany are most likely to provide large donations. However, the available data involves small samples that do not provide definitive answers within this study. Although Bryant University does have a growing international student population, the historical data of available constituents may diminish the relative size of this international group. The dramatic increase in international students attending the University has swelled in recent years, and the effects of this change may have yet to be seen.

When incorporated into a predictive model for lifetime gifts greater than \$1000, only Bermuda and the United Kingdom were significant at the .01 level. When re-adjusted for a broader p-value of .1, the study yielded the following results.

Nation	LIFE >1K=0	LIFE >1K=1
BERMUDA	0.001	0.002
GERMANY	0	0.001
INDIA	0.001	0
UNITED KINGDOM	0	0.001
VENEZUELA	0	0.001

This further verifies that there is no conclusive data indicating that constituents from certain foreign nations are more likely to provide charitable gifts to the institution; it appears as though graduates from Bermuda, Germany, the UK, and Venezuela have slightly increased propensity to donate, while constituents from India do not. This variable is consistent with the previously discussed lifetime giving model, in which the PR_NATION, INDIA variable yielded a coefficient of -1.584. The samples contain such small sizes and such low probabilities of donation that the results do not indicate that there is a need for Bryant University to target different international alumni through new strategies. As a final verification, a correlation analysis was performed in an effort to compare international gifts to domestic gifts. Binary variables were created, included US_BIN, which returned a 1 if the individual resides within the United States, and INTERNATIONA_BIN, which returned a 1 if the individual, resides outside of the

	INTERNATIONA_BIN	LIFE >1K	US_BIN
INTERNATIONA_BIN	1	0.0088	-1
LIFE >1K	0.0088	1	0.0546
US_BIN	-1	0.0546	1

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United States. These variables were considered based upon their correlation to a lifetime giving rate greater than \$1000. The US_BIN variable had a correlation of .0546, indicating a positive relationship to lifetime giving greater than \$1000. Likewise, the INTERNATIONA_BIN variable's correlation result was .0088, also indicating a positive relationship. While neither variable appeared to have a strong relationship with lifetime gifts greater than \$1000, the U.S. variable was slightly more correlated. This analysis serves as evidence that the nation of origin or current work residence may have no impact on an individual's propensity to donate. The results are likely skewed in favor of the United States due to the relative size of this potential donor population. Neither variable was strongly correlated to large gifts, indicating that individuals within the United States and foreign students coming to Bryant University should be targeted in a uniform fashion, and the potential nation of a constituent is not a factor in his or her likelihood to give.

An additional variable that this study intended to address was the impact of athletic participation, event attendance, and overall athletic record success for football and basketball programs on giving. The available dataset allowed the testing of variables pertaining to football and basketball game attendance, and athletic hall of fame attendance. However, in all the models built throughout the course of this analysis, these variables appeared to have no significant relationship with the overall giving rate of constituents. An analysis of the impact of athletic success and overall giving appeared to be premature, due to this institution's unique situation of recently transitioning to Division I athletics. In an effort to evaluate whether athletic event attendance was related to giving in any particular year, the variables were considered during fiscal year 2008 only; there appeared to be no significant relationship between attendance at football, basketball, or hall of fame events and giving greater than \$1000 during that particular year. The variables appeared to be significant only at the .1 level, and were not adequate to be included in model development for that given year. The figure below depicts a Rapid Insight profiling analysis for each variable, and its relationship to the binary LEADERSHIP_08 variable, which indicates whether a constituent contributed \$1000 during the year of 2008. The football attendance variable was not significant even at $p=.1$, indicating that it is not an essential or contributing factor to a constituent's propensity to donate.

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	<u>Value</u>	<u>LEADERSHIP_08=0</u>	<u>LEADERSHIP_08=1</u>
<u>BASKA_08</u>	Continuous	1.038	1.357
<u>Hall of Fame Attend</u>	0	0.999	0.975
<u>Hall of Fame Attend</u>	1	0.001	0.025

The basketball attendance variable, which records the total number of games the constituent attended during 2008, appeared to have more attendance for individuals who donate greater than \$1000 for that year. However, the difference is minimal. Likewise, individuals that did attend hall of fame events appeared slightly more likely to donate substantially, but the difference between the two values, .001 for LEADERSHIP_08=0, and .025 for LEADERSHIP_08=1, do not appear significant enough to influence large donations during this year or any given year.

In an effort to evaluate the results obtained throughout the course of model development within Rapid Insight, a separate program was used to model a similar variable to a previous analysis. For simplicity, the program was utilized to create one model similar to the previously discussed model with a y variable addressing lifetime giving greater than \$1000. This model was intended to address the validity of the results produced in Rapid Insight; if the model produced by the second program appeared comparable to the previously discussed model, the conclusion could be drawn that the Rapid Insight logistic regression method is a valid modeling technique within the field of philanthropic data mining. Using SAS Enterprise Miner, a final model was created as a decision tree determining which individuals are likely to give gifts greater than \$1000 over the course of a lifetime. Within the decision tree, significance levels were set at a level of $p=.2$ to leave an opportunity for variation between the models. Decision tree modeling was used in an effort to produce a different type of model, in order to determine whether the significant variables in a logistic regression were analogous to the variables of importance within a decision tree. The completed tree is located within Appendix J.

The results of the decision tree yielded an extremely positive correlation with a logistic regression model. Within the decision tree, the first branch depended upon the total number of gifts of the individual in question. Unlike logistic regression, the tree is split into branches based upon a person's total number of gifts currently at a level of less than 11.5 or greater

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than 11.5. As expected, individuals with greater than 11.5 total gifts thus far were extremely more likely to donate at a lifetime level of \$1000; the probability within that node was 35%, indicating that 35% of the individuals in the randomized dataset returned a 1 within a binary formula, in which a gift greater than \$1000 lifetime was defined as a 1, and a gift level lower than \$1000 was defined as a 0. This variable was also a significant factor in the logistic regression of Appendix E in which the coefficient of .133 indicates that each additional gift increases the \$1000 lifetime likelihood. The logistic regression succeeds in making the effect of each additional unit of the variable clear, whereas the decision tree split the variable into two branches, making the impact of each new gift unclear, unless it crosses the 11.5 threshold.

Additional nodes of the decision tree reflected the variables within the logistic regression of this same model; the second branch of the <11.5 total number of gifts node is split based upon the level of correspondence between the institution and the individual. This variable is defined as COR within both the regression and the decision tree. Individuals with a correspondence count of less than 3.5 over the past five years were much less likely to donate at a level of \$1000; based upon a combined analysis of this variable within both the decision tree and the regression, it appears as though an individual's likelihood may increase up to a certain level of correspondence, after which additional contact reduces likelihood. Because the COR coefficient within the regression is negative, it indicates that perhaps as the correspondence level becomes significantly higher, additional correspondence becomes less and less important. This provides an indication of the advantages of regression modeling over decision trees; the regression allows the possibility to identify the impact of each additional occurrence of a particular variable, while the decision tree creates branches that do not necessarily provide the opportunity to explore this observation intuitively.

Other variables utilized within the decision tree include the individual's identification as providing gifts through security transactions, home state, officer assignment, the existence of the individual's work address within the institution's database, and the occurrence of an un-honored donation pledge in the past. The majority of these variables were significant factors within the model located in Appendix E, predicting the same variable. Furthermore, the impact of each variable is comparable to that of Appendix E. For example, individuals that

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have elected to give gifts through security transaction are much more likely to give greater than \$1000 lifetime; this result is evident in both the decision tree and the regression model. Individuals from Connecticut, Massachusetts, and Rhode Island are also highly likely to reach this donation status, in comparison to constituents that reside in other states. A similar variable with a measureable impact that existed in both the regression and the decision tree was the occurrence of an un-honored pledge, in which the constituent offers to make a donation at a later date and fails to complete this obligation; individuals that did have an un-honored pledge in the past, those noted by the “1” branch in the decision tree, were significantly less likely to reach a donation level greater than \$1000.

In an effort to maximize donations, this institution as well as many others utilize certain staff members solely for targeting prospects, building relationships with constituents, and increasing the propensity to donate among alumni graduates. The officers within the decision tree that had the strongest effect on large lifetime giving levels were identical to the officers identified with the logistic regression. The similarities in these results solidify both the effectiveness of these staff members as well as the successful strategies currently established for targeting donors within the institution’s development office. These officers also serve as a validation for the continued importance of an individual’s current state of residence, as donors are assigned to officers largely through geographic distributions; officers with the highest propensity of large gifts are assigned to regions that are highly likely to give significant funds to the institution.

Due to the wide variety of potential majors and degrees of current constituents that have graduated from the institution under consideration, these variables did not appear within the decision tree model. The logistic regression provided a much simpler means of identifying specific majors of importance; the decision tree can split the variable into several branches, but not necessarily isolate the highest propensity donors when faced with a large number of categories within a nominal variable. Given these discrepancies, the two different models are largely congruent, indicating that the Rapid Insight method is indeed a valid strategy for obtaining new information about the strongest possible donors.

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The comparability of models produced through logistic regression and decision tree modeling suggest that the logistic regression through Rapid Insight provided a valid indication of potential donors throughout this analysis. The advantages and disadvantages of either technique are more clearly discussed within Appendix A. Due to the results of this portion of analysis, it is possible to conclude that the models developed within Rapid Insight did provide results that serve as successful models for selected y variables. Throughout the course of logistic regression modeling, all models were tested on a randomized 50% of available donors, and all models yielded optimistic concordance results, detailing their individual accuracy. The subsequent predictive model through a decision tree served as an evaluation of this method, and the Rapid Insight software, and resulted in positive conclusions about the validity of logistic regression modeling.

DISCUSSION

The use of predictive modeling has the possibility to yield extremely beneficial results to development offices at universities and philanthropic organizations. The previous analyses provide evidence that modeling can supply an institution with the resources to target effectively the best constituents, which will result in greater cost savings and a higher response rate over time. Through an objective evaluation of the current constituent database at a small, private, largely business institution in New England, it is possible to conclude that many of the factors deemed important in previous studies are effective at other institutions. A variety of models appeared to support the conclusions of Grant and Lindaeur, who indicated that individuals are likely to reach a stage of negative growth in charitable contributions several years prior to retirement. Likewise, results that include the importance of attending alumni events at Bryant University, such as gala, homecoming, or networking events for current students, coincide with many of the conclusions developed by previous researchers studying the impact of psychological factors on donations. These individuals likely have a very strong relationship with their alma mater, and subsequently are interested in providing charitable gifts. The gala event is a particular variable of importance, because constituents receive invitation after providing a gift to the institution; this complements the ideas of Anil

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Mather, who indicated that individuals have a high likelihood to donate if there is a perceived benefit in the form of social contact that can result.

In analysis of the impact of majors on large lifetime gifts at business institutions, the results of this study appear to contradict the findings of Okunade and Berl, who identified major categories such as finance, real estate, and insurance as the most likely future givers. The predictive model established to analyze the relationship between available variables and the rate of lifetime giving greater than \$1000, Bryant University graduates from majors such as management, marketing, and general business administration as individuals with the highest propensity to provide donations. This discrepancy may be due to the strategy utilized for analyzing majors. Okunade and Berl were concerned with general response rate, while this evaluated large lifetime responses only. This study serves as a suggestion of which majors have the highest propensity to become large donors to an institution under consideration.

The results concerning the effectiveness of a variety of different solicit techniques at the University are perhaps the most important result of this study. Given the fact that all philanthropic organizations must develop some strategy for targeting potential constituents, it is essential to develop an understanding of what methods will garner success and which ones may not. In this analysis, it appeared that direct mail soliciting was in fact very successful, but should be utilized sparingly. One mailing per year garnered a larger response than two mailings; this conclusion may be beneficial to many institutions and charitable organizations, which can benefit from the cost savings of reduced mailings, while not affecting their overall yearly charitable income. In contrast, e-mail solicits appears to be slightly ineffective and had an overall low probability of response for individuals within this category. Because the use of e-mail is, for the most part, something that an organization can utilize for free, it is logical to continue with e-mail soliciting. It may not be as effective as direct mailings, but will not incur large enough costs to render it less worthwhile. In contrast to direct mailings, the use of multiple e-mail solicits was more effective than a single one during a given year.

The use of telefund solicit is a technique utilized by Bryant University as well as many other philanthropic institutions. This analysis supported the general conclusion at this particular

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university that telefund solicitation is an extremely successful means of reaching alumni. Although it can be extremely costly, it appears to have the strongest relationship with an individual's response rate during any given year. The high potential for donations through the use of telefund solicits support the use of this contact method in future giving years. These results are substantial for non-profit organizations evaluating the potential of outsourcing telefund calls to a specialized organization. Although it is an expensive means of reaching constituents, it does generate the desired response.

Lastly, the alumni relations office utilizes personal contact with many constituents that are identified as high prospective donors or individuals very likely to participate in alumni organizations and events. While many of these techniques were not statistically significant to the analysis, they may be very necessary in generating the positive relationship with an institution that is essential in future donations. Much of the literature concerning donor behavior emphasizes the impact of psychological factors, and the use of personal communication between the institution and the individual is the best possibility for creating a long-lasting relationship with a potential constituent. In this analysis, it appeared that during fiscal year 2008, the use of personal correspondence was more effective than direct contact. This is a very optimistic result for the alumni relations office, as it requires much less effort to write an individual a letter, and yet it still has extremely beneficial results on possible donations.

The results of these models collectively serve as an indication of which graduates of predominantly business institutions are likely to donate in the future. Because the comparison of a logistic regression model appears to coincide with the results of decision tree modeling, it is possible to conclude that the variety of models produced through Rapid Insight are valuable tools that can be used in the future for philanthropic causes, particularly in higher education. Many of the conclusions reached in this analysis serve as supporting evidence to the conclusions drawn to recent research within this field; they simultaneously suggest the success of different strategies for donation requests, the majors, which have the strongest propensity to give, and the impact of graduation year and upcoming reunions may have upon donations. The observed importance and increased response rate around the time of an

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individual's reunions serve as an indication that the University, as well as other higher education institutes, should develop new targeting methods for this cohort during these years, in order to maximize potential gifts while an individual's propensity to give is highest.

APPLICATIONS AND LIMITATIONS

Because the dataset available for this research in particular was concerned only with graduates of Bryant University, the study has immediate utility for this institution's development office. The use of predictive modeling allowed for the discovery of key variables in generating donor response, providing information of which ask techniques are most effective, as well as which alumni characteristics and event attendances are most important in donations. In the future, these characteristics and ask techniques can be capitalized on; knowing this information can allow the development office to streamline their requests for donations, by targeting individuals who attend events that result in a high donor likelihood, or by further targeting individuals within majors that are most likely to respond. These models can also be developed into scoring systems, in which the logistic regression is applied to the entire dataset and individuals are scored based upon their probability to meet the defined y characteristic. This is especially important in creating new donors and identifying alumni who fit the criteria of certain donations levels that have yet to be realized.

Because the characteristics of Bryant University firmly represent those of small, private institutions in New England, these models can also be loosely applied to other institutions that have similar characteristics to Bryant University. The results appeared to be consistent with findings of previous studies in areas where research already existed. This is an optimistic conclusion, as it suggests that models are not only useful specific to the institution at which they were developed, but can be expanded beyond that. As a result, as more publications become available on new variables strongly associated with alumni giving, Bryant University as well as other schools can likely capitalize on that knowledge without ever building a separate model. The field of predictive modeling in philanthropic organizations is growing rapidly, and many individuals will benefit from this newfound knowledge.

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Information provided in this study concerning the impact of certain strategies for reaching constituents has applications far beyond Bryant University and higher education. All philanthropic organizations must devise a method for contacting possible donors and identifying individuals most likely to respond. The results in this analysis suggest several key strategies in creating positive support from constituents. The use of a single direct mail solicit during a year is a behavior that can be adopted by many charitable organizations, that will result in cost savings during the year while not affecting results. Likewise, e-mail solicit appeared effective but not drastically so; the most effective targeting strategy may be a combination of a single mailing, an e-mail sometime later in the year, and continued personal correspondence with an individual at the institution. Because personal contact is the most costly method of targeting donors, perhaps charitable organizations can explore strategies at fostering strong personal ties in other ways. Evidence in the literature review suggest that simply providing an individual recognition for donation and the opportunity to meet fellow supporters increases the likelihood and magnitude of donations.

The results of predictive modeling of alumni donors at Bryant University can be used extensively both within the institution and by other, similar organizations. This analysis provides unique details into which asking behaviors utilized by an organization can be most effective, which may be the most important application. While charitable organizations have no ability to control who donates, they can control their behaviors in order to generate the best possible opportunities for success. This provides evidence of the powerful role that statistical modeling can perform at institutions that rely on the charitable gifts of constituents.

There are a number of limitations that arose throughout the course of this evaluation that may provide an avenue for future research. The majority of these limitations are resolvable through new data strategies that will allow for a more comprehensive isolation of each variable in order to understand its effect. Primarily, research in the future considering the success of certain solicit strategies may be more accurate with the inclusion of the specific dates of solicit as well as the dates of the subsequent donation. While the model established in this study did suggest which techniques led to the highest response among this prospective donor database, philanthropic organizations could more successfully isolate which ask technique

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most likely created the donation by determining after which strategy constituents tend to respond. For example, if an individual received several e-mail communications, direct mailings, and personal correspondence, it is difficult to conclude which of these strategies definitively influenced donation likelihood without understanding exactly when during the fiscal year the donation took place. This analysis may also be useful using a strategy that considers a specified donation level as opposed to the response rate; this would allow the targeting methods that provide the largest donations to stand out. The campus campaign solicit technique variable was detrimental to the response rate in this study, although this result is likely due to the relatively small number of constituents targeted in this manner. Although the constituents may give consistently, it may be only a small number of the cohort giving large annual gifts; this effect may affect the results, but is preventable by isolating results for a specified target donation level.

Limitations within this research also existed within the available data utilized for analysis concerning event attendance. Variables considering event attendance focus on events attended from fiscal year 2005 to the present; although each event is attributed to the year in which it occurred, it may have been beneficial to look at a longer timeline of historical event attendance. For example, particularly for alumni that graduated many years ago, event attendance may be much lower but likelihood to donate may be very high. With historical information about the events that current large donors attended during the first few years after their graduation, it may be possible to identify recent graduates likely to give at this level many years in the future. Additional complications due to event attendance arose in evaluating the emphasis of athletic event attendance. Due to Bryant University's transition to Division I during the 2008-2009 season, it was extremely difficult to measure the impact this may have on future donations from constituents. The number of alumni consistently attending athletic events in the past was low; in addition, the transition was so recent that any increase due to Division I status, or due to successful winning records, has yet to be realized.

Future research may benefit from the inclusion of potential wealth of individuals within the donor database, in an effort to identify individuals that not only have a strong likelihood to give, but also the financial means to do so. The variables within this analysis were focused

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upon the characteristics of constituents as they pertain to this school; while the study contained information on majors, degrees, graduation year, and event attendance, it provided little insight into the details of the constituent's current life situation, such as marital status, job title, or family size. This additional information may have provided a more accurate portrait of characteristics of alumni that can be targeted in the future. This analysis provides a starting point for analysis of various ask techniques as well as an avenue for the consideration of athletic event attendance.

CONCLUSION

The use of predictive modeling to create informative, statistically supported business decisions has existed for years within many industries. Although the process has been slightly slower in adoption within the field of philanthropic giving, the plethora of research and substantial availability of modeling programs specifically for giving offices indicate that it is a beneficial tool in non-profit organizations. Within the realm of higher education, predictive modeling is a proven strategy of identifying the best donor prospects in order to streamline donation requests, to identify successful targeting methods, and to categorize a wide variety of potential donors by their likelihood of giving. Given the significant depth of information available to an educational institution about the composition of its alumni body, data analysis provides the unique ability of focusing upon giving trends that may otherwise remain unrecognized. It is reasonably simple for a college to identify its largest donor group among individuals that have already given or that are shown to have a strong financial ability to do so; the advent of predictive modeling allows organizations the ability to identify prospects that may be under-targeted that have an extremely high propensity to give. In this analysis in particular, one model identified a wide array of constituents that have never provided a donation to this institution, and yet appear to have a strong likelihood of giving based upon model development.

The logistic regressions developed throughout the course of this study indicate several important conclusions concerning the constituent database among Bryant University's potential donors. Many of the results provide further evidence of researchers concerned with

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the psychological and sociological characteristics of giving; events that are likely to indicate that the alumni has a strong positive relationship with the institution have been shown continually to have a high likelihood of donation. Among graduates of this institution in particular, individuals within the major categories of taxation, general business administration, accounting, executive secretary, and management or marketing concentration have the strongest likelihood of giving substantial lifetime donations; this conclusion may provide the evidence to experiment with new targeting strategies based upon the individual's declared major or current occupation. Many of these models also supported a rational conclusion that individuals that currently reside in states closest to the institution are most likely to give.

Results involving response rate based upon various solicit techniques utilized by Bryant University indicate the success of targeting methods that are likely to be costly to a non-profit institution. The use of telefund calls, direct mail solicits, and personal correspondence with a potential donor may initially be a large expense for an organization; however, this analysis indicates that these costs may be worthwhile due to the potential increased response rates they generate over methods such as e-mail soliciting, which is extremely inexpensive to employ. As a result, it may be necessary for non-profit philanthropic organizations as well as higher education institutions to explore the adoption of these high-cost targeting techniques.

Due to the structure of Bryant University's student body and the recent transition in athletic categorization to NCAA Division I, predictive modeling did not provide conclusive results about the impact of international origins on individual giving or athletic program success on overall giving. Because these trends are relatively new to the university in comparison to historical data, it may be necessary to evaluate these research questions in several years, after the Division I transition is fully complete. Additionally, more information is necessary to evaluate the giving behavior of international graduates; as more students graduate each year within this categorization, analysis will become much more significant. Although less noticeable, this effect may also have influenced results concerning individuals from certain majors providing donations to this institution. The recent addition of a College of Arts and Sciences, and the several new majors that have developed as a result, may simply not have a

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large enough alumni cohort in order to appear statistically significant in terms of giving. In addition, these recent graduates are presumably young, and are not at the same life stage as donors from other major categories.

The use of predictive modeling with the donor database at Bryant University provides substantial evidence of the donor characteristics of a small, private university in New England with a historical focus upon business. These results are extremely beneficial to this college in particular, and provide new considerations for colleges within the region that may match many of Bryant's characteristics; larger institutions that may have a College of Business may be able to utilize this information in an effort to develop unique strategies of targeting graduates from that particular college. Predictive modeling is a powerful tool particularly in higher education; future research will likely continue to emphasize new trends in giving data and constituent characteristics that are identifiable only through modeling, rather than by individual evaluation of donors.

APPENDICES

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Appendix A: Evaluation of Software Tools

In an effort to reach the most accurate conclusions in this study, predictive modeling was performed utilizing two different statistical packages. Because many institutions are currently considering the possibility of introducing data-mining into targeting methods, this study was also an effective tool in evaluating different software options, an assessment that may prove very important to future organizations delving into statistical modeling. The Rapid Insight program is perhaps the most user-friendly option available for individuals both with and without a background in statistics or precision model. The tool provides easy installation within a few minutes, and models can be successfully created within just a few hours. The interface is logical and takes very little adjustment or learning in order to understand how it functions. This is extremely important for development offices and philanthropic organizations looking to utilize data-mining but without the resources to employ a full-time statistician in order to create and evaluate models. The Rapid Insight Data Integration and Analytics tools can be used with minimal statistical background, due to its automated features and learning tools that are easily accessible from its Novice “Green” Mode. This application provides suggestions for the user about what applications to use next within the program, but highlighting certain options in green as the individual moves through analysis.

However, while Rapid Insight is excellent for individuals without a strong statistical background, users also have the ability to remove the Novice Mode and proceed through model development independently. Rapid Insight can build automatic models with minimal user interference, but also has the capability to allow the individual significant freedom in variable exclusion and model creation. In order to accurately address the topics proposed in this analysis, much modeling was performed either without the automated mode, or with adjustments made to the model that Rapid Insight initially produced. Furthermore, the program ensures accuracy with the feature of allowing the individual to build models using a randomized portion of the data, which can be altered by the user. That model is subsequently tested upon the remainder of the database, allowing users the ability to provide decisions that are logical, time-efficient, and accurate.

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Perhaps the greatest benefit of the Rapid Insight software system is the ease with which a user can create reports, analyze variables graphically, and export all of these results in order to create a comprehensive presentation. Nearly every potential function in Rapid Insight can create output that can be immediately viewed or reported clearly. Likewise, the final model development allows the creation of scored datasets in only a few minutes, creating meaningful output that assigns each constituent in the database a score within the model. Overall, the Rapid Insight tool is highly efficient and extremely user-friendly; the company's support services are exceptional, and any questions or concerns about program usage are resolved in an extremely timely manner.

The SAS Enterprise Miner tool functions in a manner that is significantly different from Rapid Insight; it requires a slightly more elegant understanding of statistical modeling by the user, and as a result provides more flexibility in potential results and modeling options. Within the program's options, this analysis focused upon the use of decision trees; however, the program supports regressions as well as neural networks and other evaluation tools. In comparison to Rapid Insight's model process, Enterprise Miner takes more effort to build a model and provides less intuitive results. The use of decision trees is an effective modeling route; however, regression modeling in Rapid Insight provided much more immediate insight into the effect of one additional unit of particular variables. Decision trees create a branching of variables such as direct mail soliciting, while regression modeling provides the ability to measure what effect one more mailing will have on an individual's giving likelihood. Similarly, regression modeling is more effective in evaluating categorical variables with many potential classes; logistic regressions provided an easier ability to understand which majors influenced giving, while the decision tree tool only provided the ability to split majors into several branches. Decision trees do not provide immediate functionality in isolating one singular class variable. Overall, both modeling strategies had similar results, indicating the validity of both methods; actual modeling decisions can be made almost entirely based upon the level of freedom the user wants over the modeling process, as well as the degree of functionality required by efficient results.

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Appendix B: Initial Variable Descriptions

Variable	Definition
AGE	Current age on record of constituent
ALUMNI_REG_ATTENDEE	Defines whether the individual has attended an alumni regional event in any location since 2005
AMRPRRT_RATE_CODE	Codes current utilized by development office for evaluating potential high donors
AMRPRRT_RTGT_CODE	Codes current utilized by development office for evaluating potential high donors
ANETA	Alumni Networking Event-Srs Attend
ANETA_BIN	Binary evaluation of ANETA variable (1=attendance, 0=no attendance)
APBCONS_PIDM	Identifier
APBCONS_PREF_CLAS	Graduation year
ARCTA	Alumni Regional CT Event-Attend
ARFLA	Alumni Regional FL Event-Attend
ARMAA	Alumni Regional MA Event-Attend
BIO	Research Bio Completed
CAMP_CAMPAIGN_SOLICIT_08	Campus Campaign Solicit during fiscal year 2008
CON	Conversation
COR	Correspondence
DEGREE	Graduated degree
DIRECT_MAIL_SOLICIT_08	Number of direct mail contacts during fiscal year 2008
DONR_2	Donor Code 2
DONR_3	Donor Code 3
DONR_4	Donor Code 4
DONR_5	Donor Code 5
EMAIL_SOLICIT_08	Email Contacts during fiscal year 2008
EVC	Event Encounter
EVC_BIN	Binary definition of EVC variable (1=EVC, 0=no EVC)
EVENTS_2006	Total Events Attended During Current Year
EVENTS_2007	Total Events Attended During Current Year
EVENTS_2008	Total Events Attended During Current Year
EVENTS_2009	Total Events Attended During Current Year
FISC_HARD_2001	Total given as hard gift during identified year
FISC_HARD_2002	Total given as hard gift during identified year
FISC_HARD_2003	Total given as hard gift during identified year
FISC_HARD_2004	Total given as hard gift during identified year
FISC_HARD_2005	Total given as hard gift during identified year
FISC_HARD_2006	Total given as hard gift during identified year
FISC_HARD_2007	Total given as hard gift during identified year
FISC_HARD_2008	Total given as hard gift during identified year
FISC_HARD_2009	Total soft gift (employer match) donation in identified year
FISC_MEMO_2001	Total soft gift (employer match) donation in identified year

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FISC_MEMO_2002	Total soft gift (employer match) donation in identified year
FISC_MEMO_2003	Total soft gift (employer match) donation in identified year
FISC_MEMO_2004	Total soft gift (employer match) donation in identified year
FISC_MEMO_2005	Total soft gift (employer match) donation in identified year
FISC_MEMO_2006	Total soft gift (employer match) donation in identified year
FISC_MEMO_2007	Total soft gift (employer match) donation in identified year
FISC_MEMO_2008	Total soft gift (employer match) donation in identified year
FISC_MEMO_2009	Total soft gift (employer match) donation in identified year
FISC_TOTAL_NO_MATCH_2001	Total given in identified fiscal year
FISC_TOTAL_NO_MATCH_2002	Total given in identified fiscal year
FISC_TOTAL_NO_MATCH_2003	Total given in identified fiscal year
FISC_TOTAL_NO_MATCH_2004	Total given in identified fiscal year
FISC_TOTAL_NO_MATCH_2005	Total given in identified fiscal year
FISC_TOTAL_NO_MATCH_2006	Total given in identified fiscal year
FISC_TOTAL_NO_MATCH_2007	Total given in identified fiscal year
FISC_TOTAL_NO_MATCH_2008	Total given in identified fiscal year
FISC_TOTAL_NO_MATCH_2009	Total given in identified fiscal year
GALAA	Gala Attendee
Grand Total	Total Events Attended Since 2005
HOME_EMAIL	Binary (1=email on record, 0=otherwise)
LEADA	Leadership Retreat Attendee
LIFE >1K	Binary (1=Lifetime total >\$1000, 0=otherwise)
LIFE_TOTAL_GIVING	Total life giving for constituent
MAJOR	Declared major
MONTHS_SINCE_LAST	Months since last gift
MOST_RECENT_GIFT_AMT	Amount of last gift
MOST_RECENT_GIFT_DATE	Date of last gift
NST	Next Step - DO NOT USE
NST_BIN	Binary NST variable (1=NST, 0=otherwise)
OFFICER	Assigned development officer
PR_CITY	Binary (1=city on record, 0=otherwise)
PR_LINE1	Binary (1=address line 1, 0=otherwise)
PR_LINE2	Binary (1=address line 2, 0=otherwise)
PR_LINE3	Binary (1=address line 3, 0=otherwise)
PR_NATION	Binary (1=nation on record, 0=otherwise)
PR_PHONE	Binary 1=phone on record, 0=otherwise)
PR_ST	Current state of residence
PR_ZIP	Zip code
PREFERRED_EMAIL	Binary (1=preferred email on record,0=otherwise)
PRIM_DONR_CODE	Primary Donor Code
SEC_TRANS_BIN	Security Transaction Binary Variable

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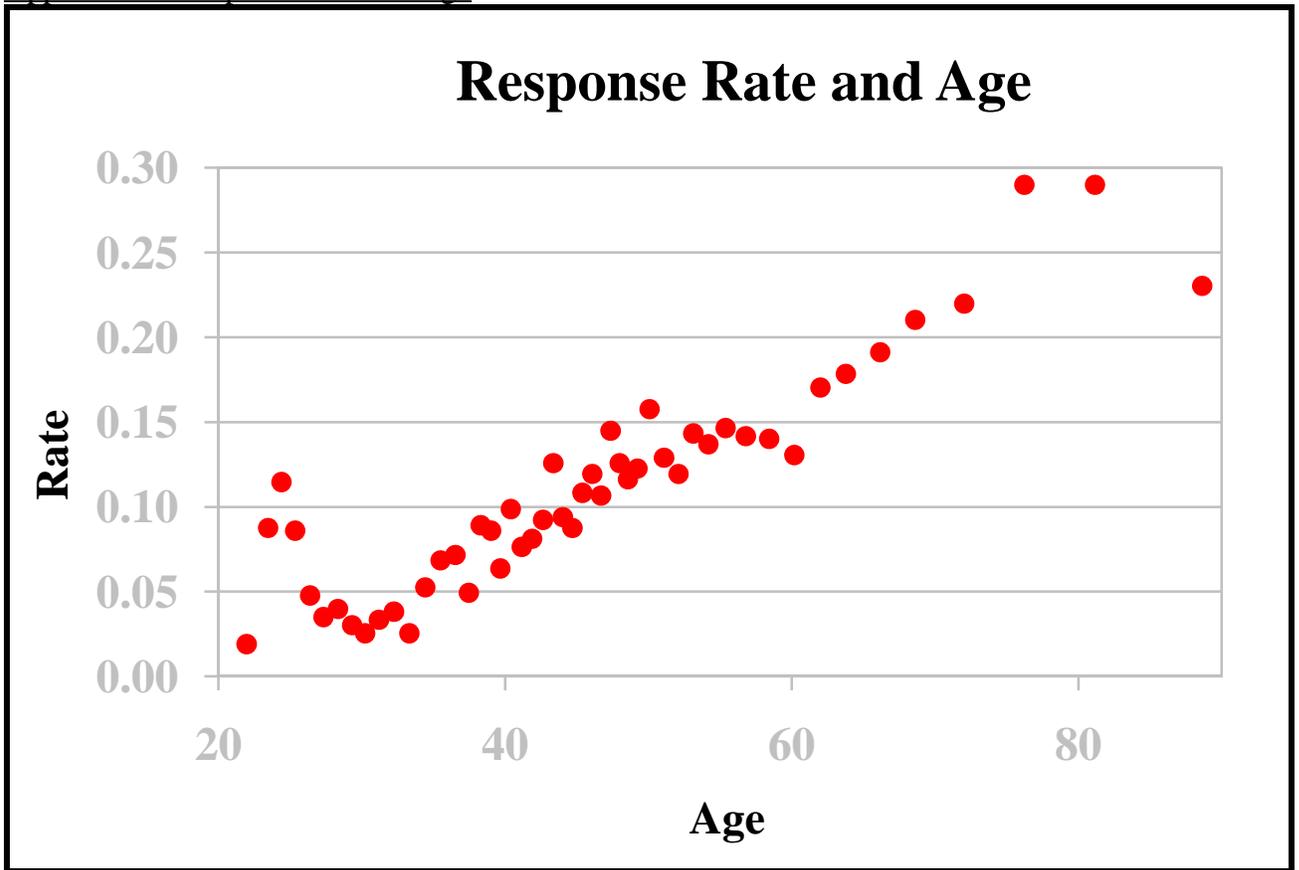
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SECURITY_TRANS	Individual elects to give in the form of security transactions
SHOFA	Athletic Hall of Fame Dinner Attendee
SPBPERS_BIRTH_DATE	Birth Date
SPRIDEN_FIRST_NAME	First Name
SPRIDEN_ID	Identifier
SPRIDEN_LAST_NAME	Last Name
STR	Strategy
TEL	Telefund Program Solicitation
TELEFUND_SOLICIT_08	Total number of telefund contacts during fiscal year 2008
TOTAL_NO_GIFTS	Lifetime number of gifts
TOTAL_PERSONAL_CONTACT	Total personal contacts since 2005
UNHON_PLEDGE_BIN	Unhonored pledge binary
UNHONORED_PLEDGE	Individual fails to complete a pledged donation
VCA	Visit - On Campus - Historical
VCU	Cultivation Visit
VDI	Discovery/Qualification Visit
VOF	Visit - Off Campus -Historical
VOT	Visit - Other
VSO	Solicitation Visit
WK_CITY	Binary (1=city on record, 0=otherwise)
WK_LINE1	Binary (1=address line 1, 0=otherwise)
WK_LINE2	Binary (1=address line 2, 0=otherwise)
WK_LINE3	Binary (1=address line 3, 0=otherwise)
WK_NATION	Binary (1=nation on record, 0=otherwise)
WK_PHONE	Binary 1=phone on record, 0=otherwise)
WK_ST	Work State
WK_ZIP	Work Zip
WORK_EMAIL	Binary (1=email on record, 0=otherwise)
XHOMA	Homecoming Attendee
XLM	Left Message-No Return Call
YEARS_SINCE_GRAD	Years Since Graduation
ZHI	Historical data of a contact
ZLD	Cancelled Visit

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Appendix C: Relationship Between Lifetime Giving and Age

Appendix D: Response Rate vs. Age



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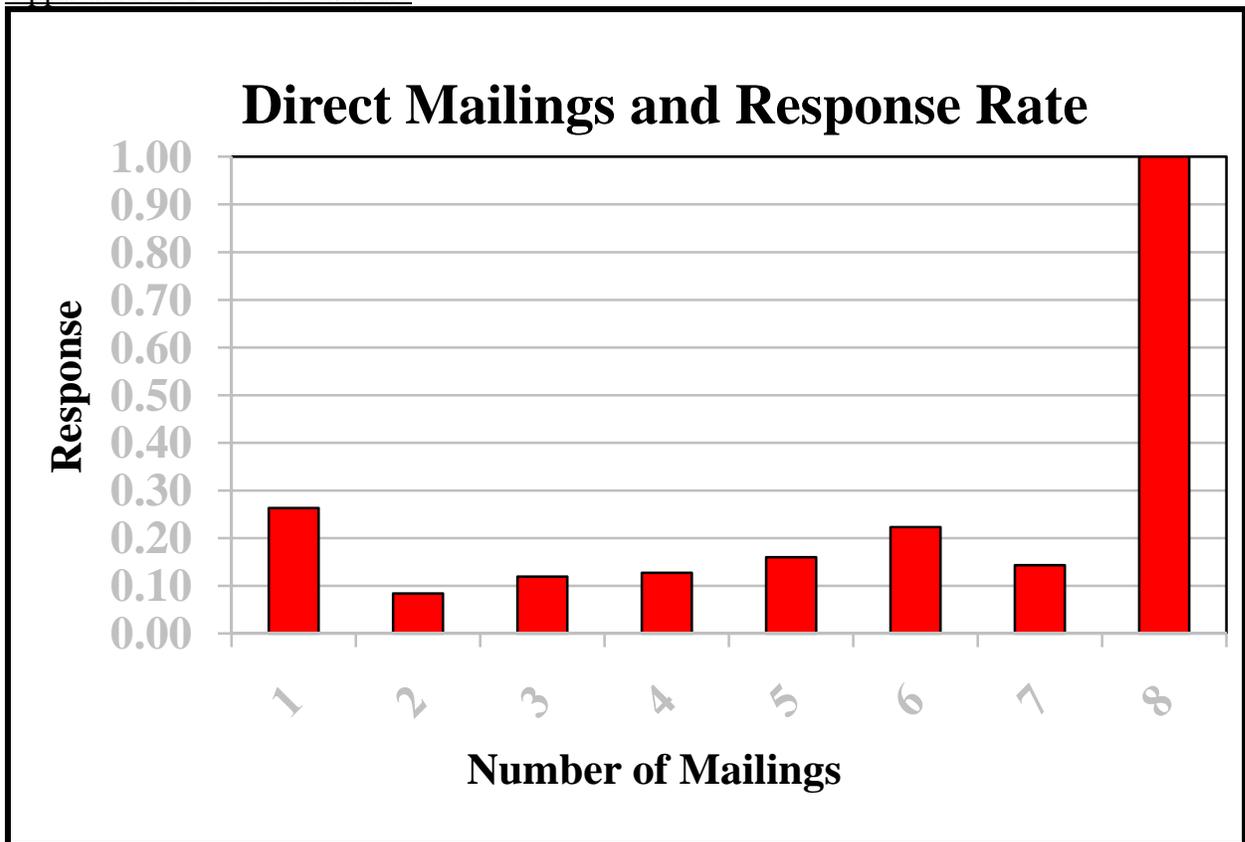
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Appendix E: Predicting Non-Donors To Donors (Response Rate)

PREDICTING NON-DONORS TO DONOR STATUS MODEL									
Maximum Likelihood					Odds-Ratios				
Variable	Coef	S.E.	Wald chi-sqr	p-value	Variable	Estimate	95% Confidence Limits-----		
PR_PHONE	0.2683	0.03354	64	0	PREFERRED_EMAIL	1.8702	1.7565	1.9913	
PREFERRED_EMAIL	0.6261	0.03199	382.88	0	WK_PHONE	1.2407	1.1789	1.3057	
WK_PHONE	0.2157	0.02605	68.53	0	TELEFUND_SOLICIT_08	0.0001	0.0001	0.0001	
TELEFUND_SOLICIT_08	-9.333	0.2655	1235.73	0	PR_LINE1_BIN	1.2953	1.1862	1.4144	
PR_LINE1_BIN	0.2587	0.04487	33.25	0	UNHON_PLEDGE_BIN	2.6738	2.4226	2.9512	
UNHON_PLEDGE_BIN	0.9835	0.05035	381.57	0	LOG10(AGE)	57.9074	42.9737	78.0307	
LOG10(AGE)	4.059	0.1522	711.44	0	Binary(DEGREE,Bach. of Sci. in Bus. Admin.)	0.7276	0.6451	0.8206	
Binary(DEGREE,Bach. of Sci. in Bus. Admin.)	-0.318	0.06138	26.85	0	Binary(DEGREE,Bachelor of Arts)	0.691	0.4382	1.0898	
Binary(DEGREE,Bachelor of Arts)	-0.3696	0.2324	2.53	0.1118	Cube(DIRECT_MAIL_SOLICIT_08)	1.0155	1.0137	1.0172	
Cube(DIRECT_MAIL_SOLICIT_08)	0.01534	0.000895	293.55	0	Binary(DONR_2,EMPF)	4.316	2.647	7.0373	
Binary(DONR_2,EMPF)	1.462	0.2494	34.37	0	Binary(DONR_2,EMPL)	2.77	1.4002	5.4797	
Binary(DONR_2,EMPL)	1.019	0.3481	8.57	0.0034	Binary(DONR_2,PRNF)	2.0308	1.6846	2.4482	
Binary(DONR_2,PRNF)	0.7085	0.09535	55.2	0	Binary(DONR_2,TRSF)	6.9594	2.2392	21.6299	
Binary(DONR_2,TRSF)	1.94	0.5786	11.24	0.0008	LOG10(EMAIL_SOLICIT_08)	>999.99	>999.99	>999.99	
LOG10(EMAIL_SOLICIT_08)	16.18	2.007	65.04	0	LOGe(Grand Total)	1.6871	1.402	2.0302	
LOGe(Grand Total)	0.523	0.09444	30.67	0	Binary(MAJOR,Criminal Justice)	0.6803	0.5446	0.8498	
Binary(MAJOR,Criminal Justice)	-0.3853	0.1135	11.52	0.0007	Binary(PR_NATION,INDIA)	0.2052	0.072	0.5849	
Binary(PR_NATION,INDIA)	-1.584	0.5343	8.78	0.003	Binary(PR_ST,CT)	1.2639	1.1725	1.3624	
Binary(PR_ST,CT)	0.2342	0.0383	37.39	0	Binary(PR_ST,ME)	0.6923	0.5676	0.8443	
Binary(PR_ST,ME)	-0.3678	0.1013	13.18	0.0003	Binary(PRIM_DONR_CODE,ALUG)	2.3256	2.1442	2.5223	
Binary(PRIM_DONR_CODE,ALUG)	0.844	0.04143	415.08	0	Binary(PRIM_DONR_CODE,EMPL)	1.9726	1.5918	2.4444	
Binary(PRIM_DONR_CODE,EMPL)	0.6793	0.1094	38.54	0	Binary(PRIM_DONR_CODE,FRND)	248.6748	169.7015	364.3996	
Binary(PRIM_DONR_CODE,FRND)	5.516	0.195	800.6	0	Binary(PRIM_DONR_CODE,PRNF)	7.4485	6.7835	8.1788	
Binary(PRIM_DONR_CODE,PRNF)	2.008	0.04771	1771.06	0	Binary(PRIM_DONR_CODE,PRNG)	0.4574	0.2773	0.7544	
Binary(PRIM_DONR_CODE,PRNG)	-0.7823	0.2553	9.39	0.0022	Binary(PRIM_DONR_CODE,PRNT)	0.8552	0.764	0.9572	
Binary(PRIM_DONR_CODE,PRNT)	-0.1565	0.05748	7.41	0.0065	LOG10(TOTAL_PERSONAL_CONTACT)	2.5637	1.8681	3.5182	
LOG10(TOTAL_PERSONAL_CONTACT)	0.9414	0.1615	33.98	0	Binary(WK_ST,PA)	0.7406	0.5563	0.9859	
Binary(WK_ST,PA)	-0.3003	0.146	4.23	0.0397	Binary(WK_ST,VT)	0.6109	0.4356	0.8568	
Binary(WK_ST,VT)	-0.4928	0.1725	8.16	0.0043					

Diagnostics					Association of Predicted Probabilities and Actual Responses			
	-2 Log L	AIC	SC	N	Percent Concordant	77.38%	Somers' D	0.553
Covariates only	38921.732	38979.732	39224.8	34568	Percent Discordant	22.07%	G-K Gamma	0.556
					Percent Tied	0.55%	Kendall's Tau-a	0.276
					Total # of Pairs	298352256	C	0.777

Appendix F: Direct Mail Solicit



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Appendix G: Solicit Technique Evaluation Model

SOLICIT TECHNIQUE MODEL									
MAXIMUM LIKELIHOOD ESTIMATES					ODDS RATIO ESTIMATES-----				
Variable	Coef	S.E.	Wald chi-sqr	p-value	Variable	Estimate	95% Confidence Limits-----		
PR_CITY	0.7735	0.1389	31	0	PREFERRED_EMAIL	1.1703	1.0519	1.3019	
PREFERRED_EMAIL	0.1572	0.05438	8.36	0.0038	TOTAL_NO_GIFTS	1.0558	1.048	1.0638	
TOTAL_NO_GIFTS	0.0543	0.00382	202.14	0	WK_LINE2	1.2598	1.1236	1.4126	
WK_LINE2	0.231	0.0584	15.64	0.0001	TELEFUND_SOLICIT_08	108.9167	39.5276	300.1155	
TELEFUND_SOLICIT_08	4.691	0.5171	82.27	0	EMAIL_SOLICIT_08	0.1304	0.0856	0.1987	
EMAIL_SOLICIT_08	-2.037	0.2149	89.84	0	SRKOA_08_BIN	0.0176	0.0039	0.08	
SRKOA_08_BIN	-4.041	0.7729	27.33	0	XHOMA_08_BIN	2.6855	1.7559	4.1071	
XHOMA_08_BIN	0.9879	0.2168	20.77	0	MONTHS_SINCE_LAST	0.9749	0.9728	0.9769	
MONTHS_SINCE_LAST	-0.025	0.00106	578.41	0	Cube(CAMP_CAMPAIGN_SOLICIT_08)	0.659	0.5701	0.7618	
Cube(CAMP_CAMPAIGN_SOLICIT_08)	-0.417	0.07397	31.78	0	Binary(CORRESPONDENCE_08,Y)	4.787	2.8573	8.0202	
Binary(CORRESPONDENCE_08,Y)	1.566	0.2633	35.37	0	Binary(DIRECT_MAIL_SOLICIT_08,1)	6.1794	5.4118	7.056	
Binary(DIRECT_MAIL_SOLICIT_08,1)	1.821	0.06768	724.15	0	Binary(DIRECT_MAIL_SOLICIT_08,2)	1.1638	1.0305	1.3144	
Binary(DIRECT_MAIL_SOLICIT_08,2)	0.1517	0.06206	5.98	0.0145	LOG10(MONTHS_SINCE_LAST)	0.2558	0.1942	0.3369	
LOG10(MONTHS_SINCE_LAST)	-1.364	0.1406	94.08	0	LOGe(MOST_RECENT_GIFT_AMT)	1.0988	1.0426	1.1579	
LOGe(MOST_RECENT_GIFT_AMT)	0.0942	0.02675	12.4	0.0004	Binary(PR_ST,WA)	3.6756	1.5336	8.8092	
Binary(PR_ST,WA)	1.302	0.446	8.52	0.0035	Binary(PRIM_DONR_CODE,EMPF)	0.1782	0.0708	0.4488	
Binary(PRIM_DONR_CODE,EMPF)	-1.725	0.4712	13.4	0.0003	Square(YEARS_SINCE_GRAD)	1.0001	1	1.0001	
Square(YEARS_SINCE_GRAD)	5E-05	0.000028	3.49	0.0618					
Diagnostics					Association of Predicted Probabilities and Actual Responses				
	-2 Log AIC	SC	N		Percent Concordant	93.01%	Somers' D	0.868	
Covariates only	11021	11056.895	11208.889	34343	Percent Discordant	6.25%	G-K Gamma	0.874	
					Percent Tied	0.74%	Kendall's Tau-a	0.151	
					Total # of Pairs	102913242	C	0.934	

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Appendix H: Lifetime >\$1000 Giving Model

MAXIMUM LIKELIHOOD ESTIMATES					ODDS RATIO ESTIMATES-----			
Variable	Coef	S.E.	Wald chi-sqr	p-value	Variable	Estimate	95% Confidence Limits-----	
PREFERRED_EMAIL	0.6024	0.1912	9.92	0.0016	ARCTA	0.0836	0.0189	0.3692
ARCTA	-2.482	0.7578	10.73	0.0011	SHOFA	0.0193	0.0028	0.1353
SHOFA	-3.947	0.993	15.8	0.0001	TOTAL_PERSONAL_CONTACT	1.231	1.1822	1.2817
TOTAL_PERSONAL_CONTACT	0.2078	0.02062	101.53	0	ANETA_BIN	6.971	1.6436	29.5654
ANETA_BIN	1.942	0.7372	6.94	0.0084	SEC_TRANS_BIN	5.8909	1.2332	28.1394
SEC_TRANS_BIN	1.773	0.7978	4.94	0.0262	Binary(AMRPRRT_RATE_CODE,D9)	13.006	5.7712	29.3103
Binary(AMRPRRT_RATE_CODE,D9)	2.565	0.4146	38.3	0	Binary(DIRECT_MAIL_SOLICIT_08,1)	2.549	1.7614	3.6887
Binary(DIRECT_MAIL_SOLICIT_08,1)	0.9357	0.1886	24.63	0	Binary(GALAA,1)	7.2825	2.966	17.8806
Binary(GALAA,1)	1.985	0.4583	18.77	0	Binary(MAJOR,Business Administration)	0.3578	0.1597	0.8013
Binary(MAJOR,Business Administration)	-1.028	0.4114	6.24	0.0125	Binary(OFFICER,xxxx)	45.2462	19.7818	103.4898
Binary(OFFICER,xxxx)	3.812	0.4221	81.56	0	Binary(OFFICER,xxxx)	405.9446	214.4397	768.4726
Binary(OFFICER,xxxx)	6.006	0.3256	340.26	0	Binary(OFFICER,xxxx)	22.7485	6.6605	77.6964
Binary(OFFICER,xxxx)	3.124	0.6267	24.86	0	Binary(OFFICER,xxxx)	125.325	73.057	214.9879
Binary(OFFICER,xxxx)	4.831	0.2753	307.83	0	Binary(OFFICER,xxxx)	160.4854	92.8414	277.4146
Binary(OFFICER,xxxx)	5.078	0.2792	330.72	0	Binary(OFFICER,xxxx)	174.8304	82.786	369.2131
Binary(OFFICER,xxxx)	5.164	0.3814	183.3	0	Binary(OFFICER,xxxx)	156.0604	94.4274	257.9215
Binary(OFFICER,xxxx)	5.05	0.2563	388.17	0	Binary(PR_ST,MA)	0.7085	0.4677	1.0733
Binary(PR_ST,MA)	-0.3446	0.2119	2.64	0.1039	Binary(PRIM_DONR_CODE,ALUG)	0.6974	0.468	1.0391
Binary(PRIM_DONR_CODE,ALUG)	-0.3604	0.2035	3.14	0.0765	Binary(PRIM_DONR_CODE,FRND)	14.3831	8.8674	23.3296
Binary(PRIM_DONR_CODE,FRND)	2.666	0.2468	116.72	0				

Diagnostics					Association of Predicted Probabilities and Actual Responses			
	-2 Log L	AIC	SC	N				
Covariates only	1281.577	1321.577	1490.509	34427	Percent Concordant	94.55%	Somers' D	0.934
					Percent Discordant	1.16%	G-K Gamma	0.976
					Percent Tied	4.29%	Kendall' s Tau-a	0.016
					Total # of Pairs	10170442	C	0.967

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Appendix I: Consistent Annual Givers >\$1000 Model

MAXIMUM LIKELIHOOD ESTIMATES						ODDS RATIO ESTIMATES-----			
Variable	Coef	S.E.	Wald chi-sqr	p-value		Variable	Estimate	95% Confidence Limits-----	
PREFERRED_EMAIL	0.6024	0.1912	9.92	0.0016		ARCTA	0.0836	0.0189	0.3692
ARCTA	-2.482	0.7578	10.73	0.0011		SHOFA	0.0193	0.0028	0.1353
SHOFA	-3.947	0.993	15.8	0.0001		TOTAL_PERSONAL_CONTACT	1.231	1.1822	1.2817
TOTAL_PERSONAL_CONTACT	0.2078	0.02062	101.53	0		ANETA_BIN	6.971	1.6436	29.5654
ANETA_BIN	1.942	0.7372	6.94	0.0084		SEC_TRANS_BIN	5.8909	1.2332	28.1394
SEC_TRANS_BIN	1.773	0.7978	4.94	0.0262		Binary(AMRPRRT_RATE_CODE,D9)	13.006	5.7712	29.3103
Binary(AMRPRRT_RATE_CODE,D9)	2.565	0.4146	38.3	0		Binary(DIRECT_MAIL_SOLICIT_08,1)	2.549	1.7614	3.6887
Binary(DIRECT_MAIL_SOLICIT_08,1)	0.9357	0.1886	24.63	0		Binary(GALAA,1)	7.2825	2.966	17.8806
Binary(GALAA,1)	1.985	0.4583	18.77	0		Binary(MAJOR,Business Administratio	0.3578	0.1597	0.8013
Binary(MAJOR,Business Administration)	-1.028	0.4114	6.24	0.0125		Binary(OFFICER,xxxx)	45.2462	19.7818	103.4898
Binary(OFFICER,xxxx)	3.812	0.4221	81.56	0		Binary(OFFICER,xxxx)	405.9446	214.4397	768.4726
Binary(OFFICER,xxxx)	6.006	0.3256	340.26	0		Binary(OFFICER,xxxx)	22.7485	6.6605	77.6964
Binary(OFFICER,xxxx)	3.124	0.6267	24.86	0		Binary(OFFICER,xxxx)	125.325	73.057	214.9879
Binary(OFFICER,xxxx)	4.831	0.2753	307.83	0		Binary(OFFICER,xxxx)	160.4854	92.8414	277.4146
Binary(OFFICER,xxxx)	5.078	0.2792	330.72	0		Binary(OFFICER,xxxx)	174.8304	82.786	369.2131
Binary(OFFICER,xxxx)	5.164	0.3814	183.3	0		Binary(OFFICER,xxxx)	156.0604	94.4274	257.9215
Binary(OFFICER,xxxx)	5.05	0.2563	388.17	0		Binary(PR_ST,MA)	0.7085	0.4677	1.0733
Binary(PR_ST,MA)	-0.3446	0.2119	2.64	0.1039		Binary(PRIM_DONR_CODE,ALUG)	0.6974	0.468	1.0391
Binary(PRIM_DONR_CODE,ALUG)	-0.3604	0.2035	3.14	0.0765		Binary(PRIM_DONR_CODE,FRND)	14.3831	8.8674	23.3296
Binary(PRIM_DONR_CODE,FRND)	2.666	0.2468	116.72	0					
Diagnostics						Association of Predicted Probabilities and Actual Responses			
	-2 Log L	AIC	SC	N		Percent Concordant	94.55%	Somers' D	0.934
Covariates only	1281.577	1321.577	1490.509	34427		Percent Discordant	1.16%	G-K Gamma	0.976
						Percent Tied	4.29%	Kendall's Tau-a	0.016
						Total # of Pairs	10170442	C	0.967

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REFERENCES

- Andreoni, J. (2006). Philanthropy. *Handbook of the economics of giving, altruism and reciprocity, Vol 2: Applications* (pp. 1201-1269). New York, NY US: Elsevier Science. Retrieved September 21, 2009, from PsycINFO database.
- Baum, S. & M. O'Malley (2003). *College on Credit: How Borrowers Perceive their Education Debt*. Boston: The Nellie Mae Corporation.
- Burnett, K. (2002). *Relationship Fundraising*. San Francisco: Jossey-Bass Inc.
- Christou, C. & M. Haliassos (2006). How do students finance human capital accumulation? The choice between borrowing and work. *Journal of Policy Modeling*, 28(1), 39-51.
- C.T. Clotfelter. (1985). *Federal tax policy and charitable giving*, University of Chicago Press, Chicago.
- Clotfelter, C. (2003, April). Alumni giving to elite private colleges and universities. *Economics of Education Review*, 22(2), 109. Retrieved September 21, 2009, doi:10.1016/S0272-7757(02)00028-6
- Cunningham, B., & Cochi-Ficano, C. (2002, Summer2002). The Determinants of Donative Revenue Flows from Alumni of Higher Education. An Empirical Inquiry. *Journal of Human Resources*, 37(3), 540-569. Retrieved September 21, 2009, from Business Source Premier database.
- Dove, K. E. (2000). *Conducting a Successful Capital Campaign*. San Francisco: Jossey-Bass Inc.
- Frank, R. (1996). Motivation, Cognition, and Charitable Giving. In J. B. Schneewind (ed.), *Giving: Western Ideas of Philanthropy*. Bloomington and Indianapolis: Indiana University Press.
- Grant, J., & Lindauer, D. (1986, April). The Economics of Charity Life-Cycle Patterns of Alumnae Contributions. *Eastern Economic Journal*, 12(2), 129-141. Retrieved September 21, 2009, from EconLit database.
- Harbaugh, W. (1998, May). The Prestige Motive for Making Charitable Transfers. *American Economic Review*, 88(2), 277-282. Retrieved September 12, 2009, from Business Source Premier database
- Holmes, J. (2009, February). Prestige, charitable deductions and other determinants of alumni giving: Evidence from a highly selective liberal arts college. *Economics of Education Review*, 28(1), 18-28. Retrieved September 21, 2009, doi:10.1016/j.econedurev.2007.10.008

Predictive Modeling of Alumni Donor Behavior
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- Lindahl, W., & Conley, A. (2002, Fall2002). Literature Review: Philanthropic Fundraising. *Nonprofit Management & Leadership*, 13(1), 90. Retrieved September 21, 2009, from Business Source Complete database.
- Marcus, J. (2006, February 24). US colleges see a growth in giving. *Times Higher Education Supplement*, Retrieved September 21, 2009, from Teacher Reference Center database.
- Mathur, A. (1996, January). Older Adults' Motivations for Gift Giving to Charitable Organizations: An Exchange Theory Perspective. *Psychology & Marketing*, 13(1), 107-123. Retrieved September 12, 2009, from Business Source Premier database.
- Okunade, A., & Berl, R. (1997, April). Determinants of Charitable Giving of Business School Alumni. *Research in Higher Education*, 38(2), 201-214. Retrieved September 21, 2009, from Academic Search Premier database.
- Olsen, K., Smith, A., & Wunnava, P. (1989, Fall89). AN EMPIRICAL STUDY OF THE LIFE-CYCLE HYPOTHESIS WITH RESPECT TO ALUMNI DONATIONS. *American Economist*, 33(2). Retrieved September 21, 2009, from Business Source Premier database.
- O'Neil, J., & Schenke, M. (2007, February). An examination of factors impacting athlete alumni donations to their alma mater: a case study of a U.S. university. *International Journal of Nonprofit & Voluntary Sector Marketing*, 12(1), 59-74. Retrieved September 12, 2009, doi:10.1002/nvsm.274
- Panas, J. (1988). *Born to Raise: What Makes a Great Fundraiser? What Makes a Fundraiser Great?* Chicago: Pluribus Press.
- Panas, J. (1984). *Megagifts: Who Gives Them, Who Gets Them*. Chicago: Pluribus Press,
- J.L. Shulman and W.G. Bowen. (2001). *The game of life: College sports and educational values*, Princeton University Press, Princeton, NJ.
- Stutler, D., & Calvario, D. (1996, November). In alumni support, satisfaction matters. *Fund Raising Management*, 27(9), 12. Retrieved September 21, 2009, from MasterFILE Premier database.
- Terry, N., & Macy, A. (2007, September). DETERMINANTS OF ALUMNI GIVING RATES. *Journal of Economics & Economic Education Research*, 8(3), 3-17. Retrieved September 21, 2009, from Business Source Complete database.
- Tucker, I. (2004, December). A reexamination of the effect of big-time football and basketball success on graduation rates and alumni giving rates. *Economics of Education Review*, 23(6), 655-661. Retrieved September 21, 2009, doi:10.1016/j.econedurev.2004.03.001
- Wunnava, P. & M. Lauze (2001). Alumni giving at a small liberal arts college: evidence from consistent and occasional donors. *Economics of Education Review*, 20(1), 533-543

Predictive Modeling of Alumni Donor Behavior
Senior Capstone Project for Lauren Prue

Wylie, P. B. (2004). *Data Mining for Fund Raisers*. New York: Council for Advancement and Support of Education.