Eastern Economic Journal, Volume No. 2, April-June 1986

THE ECONOMICS OF CHARITY
LIFE-CYCLE PATTERNS OF ALUMNAE CONTRIBUTIONS

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This paper presents charitable giving in a consumer demand framework and examines the relationship between age and personal donations. Relying on data on alumnae contributions to a four-year liberal arts college, information on the age-charitable giving profile is used to make inferences about the income elasticity of donations over the life cycle. A second aim of the paper is to discuss the economics of alumnae contributions. In addition to presenting the average life-cycle pattern of such gifts, we discuss the impact of fully anticipated reunions on the distribution of donations over the life cycle.

The results suggest that the income elasticity of alumnae giving increases with alumnae age. Significant increases in educational donations relative to the long run age-giving path are realized, which are not at the expense of lower contributions in either the immediate pre- or post-reunion years. Reunion drives also increase the number of gift givers in a manner analagous to, albeit smaller than, their impact on per capita contribution levels.

I. Received Theory

While altruistic and philanthropic motives are central to individual decisions concerning charitable contributions, such donations are also affected by economic circumstances facing contributors. Recent attempts to assess the impact of tax deductability on the level of personal donations have adopted this approach[1]. Specifically, charitable gifts have been posited to respond to both the price of giving and disposable income, where the price of giving depends upon the tax treatment of charitable donations. For example, if charitable contributions are fully tax deductible, the price of a one dollar donation will not equal one dollar, but will instead equal (1 - m) dollars, where m represents the individual's marginal tax rate. Given current U.S. tax law, an individual facing the top marginal tax rate of .50 will thus pay a net price of only 50 cents for each dollar of charitable donations.

Once charitable giving is interpreted as a special case of consumer demand for a nondurable good, it is possible to assess the impact of tax policy on voluntary donations by estimating the price and income elasticities of giving. Most cross-section studies estimate these parameters by employing equations of the following form:

$$G = AY^{\alpha}P^{\beta}e^{\phi x}\cdot e^{u} \qquad (1)$$

where G is the amount of the donation, Y and P are income and price variables respectively, x is a vector of household characteristics and u is

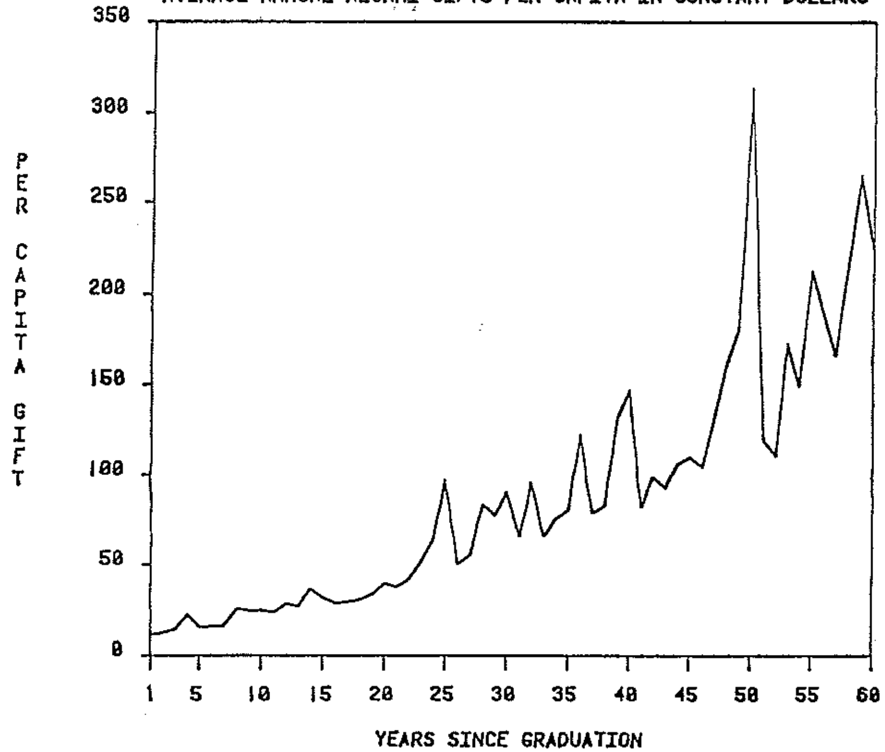
$$\bar{g}_a = \Big(\sum_{c=1951-a}^{1981-a} g_{c,a}\Big)/31, \text{ for } a = 1,\ldots,60, \tag{3}$$

are charted against years since graduation, a. A trend which generally increases is apparent, with variations from the trend being especially evident in the vicinity of the later, major reunions: 25th, 40th and 50th.

Figure 1

Year of Graduation	Calendar Year 1981	1980	1979	....	1953	1952	1951
1980	$g_{80,1}$	0	0		0	0	0
1979	$g_{79,2}$	$g_{79,1}$	0		0	0	0
1978	$g_{78,3}$	$g_{78,2}$	$g_{78,1}$		0	0	0
⋮							
1952	$g_{52,29}$	$g_{52,28}$	$g_{52,27}$		$g_{52,1}$	0	0
1951	$g_{51,30}$	$g_{51,29}$	$g_{51,28}$		$g_{51,2}$	$g_{51,1}$	0
1950	$g_{50,31}$	$g_{50,30}$	$g_{50,29}$		$g_{50,3}$	$g_{50,2}$	$g_{50,1}$
1949	$g_{49,32}$	$g_{49,31}$	$g_{49,30}$		$g_{49,4}$	$g_{49,3}$	$g_{49,2}$
⋮							
1922	$g_{22,59}$	$g_{22,58}$	$g_{22,57}$		$g_{22,31}$	$g_{22,30}$	$g_{22,29}$
1921	$g_{21,60}$	$g_{21,59}$	$g_{21,58}$		$g_{21,32}$	$g_{21,31}$	$g_{21,30}$
1920	0	$g_{20,60}$	$g_{20,59}$		$g_{20,33}$	$g_{20,32}$	$g_{20,31}$
1919	0	0	$g_{19,60}$		$g_{19,34}$	$g_{19,33}$	$g_{19,32}$
⋮							
1893	0	0	0		$g_{93,60}$	$g_{93,59}$	$g_{93,58}$
1892	0	0	0		0	$g_{92,60}$	$g_{92,59}$
1891	0	0	0		0	0	$g_{91,60}$

FIGURE 2
AVERAGE ANNUAL ALUMNI GIFTS PER CAPITA IN CONSTANT DOLLARS



III. Life-Cycle Patterns of Alumnae Giving

Since the recent literature has found that giving is positively related to income and marginal tax rates, and since these determinants of the level of charitable contributions generally rise over an individual's working life, it is not surprising that alumnae donations increase as an individual ages. However, since individual income elasticities for charity may change as the individual ages, the life-cycle patterns of alumnae giving may not parallel the individual's age-income profile. In order to accomodate the effects of rising income and tax rates, we posit a general non-linear relationship between contributions and age:

$$g_{c,a} = Ae^{B_1 a + B_2 a^2} + u_c. \tag{4}$$

If income elasticities for charitable giving change over the life cycle, the rate of growth of gifts per capita, $((dg/da)/g) = \beta_1 + 2\beta_2 a$, should diverge from the growth rate of income over the life cycle.

While equation (4) captures some of the non-linearities in the age-giving profile, it fails to account for the spacing of life-time donations due to the periodic influence of reunions.[5] The alternative specification below attempts to capture the reunion effect by defining an all reunions dummy.

$$g_{c,a} = A(1+\theta)^{R^*_{c,a}} e^{B_1 a + B_2 a^2} + u_c \tag{5}$$

$R^*_{c,a}$ equals: 1 for every fifth year from 5 to 60, and 0 otherwise; and θ can be interpreted as the mean relative effect of reunion years on trend giving.[6]

Expressing equation (5) linearly and estimating across all class-age observations using Ordinary Least Squares estimation yields (standard errors in parentheses),

$$\ln g_{c,a} = \underset{(.048)}{1.231} + \underset{(.038)}{.205}R^*_{c,a} + \underset{(.004)}{.072}a - \underset{(.00006)}{.00051}a^2 \tag{6}$$

$$R^2 = .556 \qquad F = 769.1$$

All t-ratios indicate significance at the .01 level or better. Furthermore, the rate of growth of per capita alumnae contributions is predicted to remain positive throughout the 60 year life-cycle with which we are concerned (zero growth is reached at a = 70.6). Since individual and household incomes are expected ultimately to fall over the life-cycle, the fact that estimated alumnae giving continues to grow moderately well beyond the retirement years suggests that, eventually, increasing consumption of alumnae donations takes place at the expense of other goods. The resulting interpretation of income elastic preferences for charity adds substance to a finding from earlier cross-section studies that age, **ceteris paribus**, is positively associated with the level of personal contributions.[7]

The estimates presented in equation (6) also confirm the significance of reunions. On average, reunions raise the level of per capita contributions by 22.8% above trend giving.[8] The impact of reunions on total contributions is evaluated more fully in the next section.

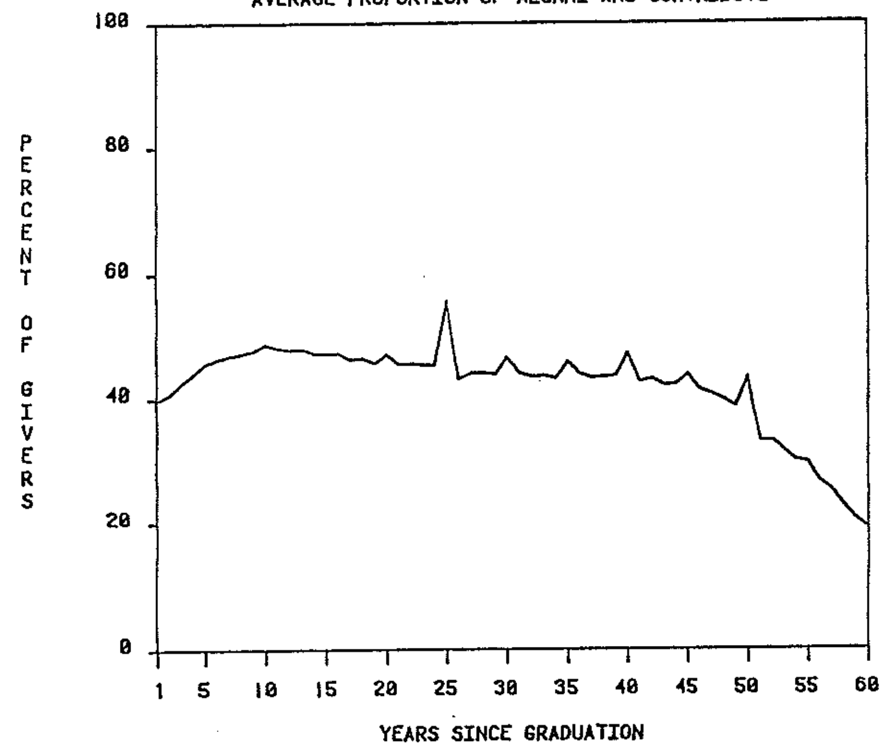
IV. The Reunion Effect

To capture the effect of reunions on total alumnae contributions it is important to examine their impact on both per capita gifts and on the number of actual givers out of the pool of potential contributors. Potential contributors can be the number of entering students in each class. A profile of the average ratio of givers to potential contributors, $n_{c,a}$, as the graduating classes age is presented as Figure 3. The profile indicates that the percent of class members who contribute rises sharply during the first decade after graduation, presumably due to the rapid growth in household income in the immediate post-college years. The percent of contributors levels off between the 10th and the 50th reunions after which it begins to fall at an increasing rate. Since alumnae average 72 years of age at their 50th reunion, mortality will begin to deplete the pool of prospective donors and account for some of this decline. Because $n_{c,a}$ is not adjusted for morality, as classes age $n_{c,a}$ understates the

actual proportion of givers from the surviving alumnae population. Life Table data suggest that this understatement only becomes serious for alumnae past the age of 65. This point will be elaborated upon below.

To evaluate the relative impact of all reunions on the number of contributors, a procedure similar to that used for per capita gifts is employed. However, given the general shape of the contributors' profile of Figure 3, with its apparent changes in slope near a=10 and a=50 years, our intent is to specify an estimating equation for the percent of alumnae who contribute which will allow its rate of change to vary as age increases. Therefore, a quadratic spline function is chosen as the appropriate specification with the splines coming at a=11 and a=51.[9] (See Appendix for derivations).

FIGURE 3
AVERAGE PROPORTION OF ALUMNI WHO CONTRIBUTE



$$(7) \qquad n_{c,a} = \gamma_0 + \gamma_1 (a-1) + \gamma_2 (a-1)^2 + \gamma_3 (a-11)^2 (D_{2,c}) + \gamma_4 (a-51)^2 (D_{3,c}) + \gamma_5 R^*_{c,a} + v_c,$$

where

$$D_{2,c} = \begin{cases} 1 \text{ if } 11 \leq a \\ 0 \text{ elsewhere,} \end{cases}$$

$$D_{3,c} = \begin{cases} 1 \text{ if } 51 \leq a \\ 0 \text{ elsewhere.} \end{cases}$$

Estimation of equation (7) by OLS with the appropriate continuity constraints (derived in the Appendix) imposed on the coefficients yeilds:

$$(8) \quad n_{c,a} = 3.593\, R^*_{c,a} + \begin{cases} 41.292 + 1.650a - 0.0706a^2, & a < 11 \\ 50.730 + 0.238a - 0.0089a^2, & 11 \leq a < 51 \\ 46.050 - 0.472a - 0.222a^2, & 51 \leq a. \end{cases}$$

The t-ratios of each estimated coefficient of equation (8) indicate significance at the .01 level or better.[10] Transforming the coefficient on $R^*_{c,a}$ into the mean relative effect of all reunions indicates a 7.9% increase in the number of contributors due to five-year reunions. This is a smaller percentage number change than the 22.8% that characterized the effect of reunions on per capita gifts.

While the coefficients on R* offer one approximation to the impact of reunions, some alternative specifications of the reunion effect should be considered in order to determine the net return to reunion events. For one, Figures 2 and 3 suggest that not all reunions have the same relative effect on either per capita gifts or on number of contributors. Both tables show relatively higher peaks beyond the 20-year reunion. In particular, the 25th, 40th, and 50th reunions appear to draw larger gifts and more givers relative to the other reunion years.

To test the notion that the effectiveness of each 5-year reunion drive may be different, alternative forms of equations (6) and (7), which include a vector of reunion year dummy variables, are estimated. Specifically, ($R_{c,a}$ for a=5,...,60, 5) is substituted for $R^*_{c,a}$. The estimated results reject the hypothesis of equality of coefficients across reunion dummies for both per capita gifts and proportion of contributors.[11]

In Table 1 we compare the relative effects of different reunion years on both giving and contributions which further establishes the importance of the 25th, 40th and 50th reunions and the generally greater impact reunions have on size versus number of gifts.[12] In columns 2 and 3, alternative estimates of the change in the proportion of the pool of potential givers who make charitable gifts during a reunion year are reported. The estimates differ in their construction of the pool of potential givers. Column 2 uses the entering class as the potential pool. This measure does not account for mortality, and eventually overestimates the reunion effect. In column 3, mortality data for white females are used to derive a mortality adjusted estimate of the pool of potential givers.[13]

Table 1

Reunion Effects

Reunion	(1) Percent Change in Per Capita Gifts	(2) Percent Change in the Proportion of the Entering Class Who Contribute[a]	(3) Percent Change in the Proportion of the Surviving Class Who Contribute[b]
5	-2.6	1.6	1.6
10	9.1	2.7	2.7
15	4.9	0.3	0.3
20	2.2	1.3	1.3
25	87.9†	22.5†	21.6†
30	20.2	5.3	5.0
35	4.2	5.7	5.3
40	40.1†	11.9†	10.3†
45	-0.6	9.1†	7.3†
50	133.1†	19.8†	13.8†
55	24.7	-1.0	-0.6
60	10.7	13.6	5.6
$R^*_{c,a}$	22.8†	7.9†	6.5†

[a] The percentage change in the number of contributors is equal to $\rho_a/(\hat{n}_{.a} - \rho_a)$ for (a=5,...,60; 5) where the ρ_a equal the coefficients on $R_{c,a}$ and, recall, $\hat{n}_{.a}$ is not adjusted for mortality trends.

[b] The percentage drop in the number of contributors is equal to $\rho_a / \left(\frac{P_{22}}{P_a} \cdot \hat{n}_{.a} - \rho_a\right)$ where $\left(\frac{P_{22}}{P_a}\right)$ is the percent of the white female population surviving to age 22 divided by the percent surviving to reunion year a. The mortality data are from Vital Statistics, 1965.

† Associated t-ratios indicate significance at the .001 level.

a randomly distributed error term. On occasion, the dependent variable is disaggregated according to type of donation, e.g., educational, religious, etc., and separate estimates are obtained for each donation category. Implicit in equation (1) is the assumption that suppliers offer infinite amounts of charity at every price; hence G is the only endogenous variable and equation (1) is identified.

The basic conclusions of empirical studies employing the consumer demand approach are that income elasticities of charitable contributions are positive and generally less than one and that price elasticities are significantly negative and range from -.04 to -1.8 depending on the specification used[2]. The studies are consistent with the view that more than either altruism or philanthropy conditions the level of charitable giving and that tax policy can significantly influence voluntary contributions.

In keeping with the consumer demand approach to charitable donations, this paper examines patterns of life cycle consumption of charity for one particular category of voluntary contributions, alumnae gifts. Before deriving our estimating equation it will prove useful to describe the data upon which this analysis is based.

II. About the Data

Panel data on alumnae gifts of the graduating classes (c) from 1891-1980 were obtained from a four-year liberal arts college.[3] For the years (t), 1951-81, both annual total alumnae gifts not including bequests (G) and the number of contributors (N) per class are known. Deflating all nominal gifts to constant (1967) dollars the real per capita gift (g) of each class according to its age (a), that is the number of years since graduation, was computed, such that:

(2) $g_{c,a} = (G_{c,t} / CPI_t) / (N_{c,t})$ where $a = t-c$, for $a = 1,\ldots,60$.

To clarify the time-series/cross-section character of those data consider the matrix presented in Figure 1 in which calendar years occupy the columns and graduation dates the rows. Each element of the matrix indicates the per capita gift of the respective class in a given calendar year. For example, the element in the 1950 row and 1980 column represents the average contributions made by the class of 1950 on their 30th reunion, i.e., in 1980. By construction, each left-to-right diagonal of the matrix contains the per capita gifts of each class for a given number of years since graduation. However, due to the time-series/cross-section character of the data, the graduating classes observed at each annual observation are different. For example, per capita gifts for the 25th and 50th reunion years are available for each of the graduating classes of 1926-56 and 1901-31, respectively. There are 1860 observations in total comprised of 31 observations for each of the 60 years in the age-giving profile.[4]

The average life-cycle pattern of alumnae giving which emerges is depicted in Figure 2 in which mean per capita gifts for each class age,

To the extent that the mortality rates of female college graduates are lower than the mortality rates of white females, column 3 underestimates the reunion effect. Columns 2 and 3 provide upper and lower bound estimates, respectively, of the effectiveness of 5-year reunions on the number of contributors. These bounds do not begin to significantly diverge until the 40th reunion year and beyond.

While reunion years, not surprisingly, tend to bring forth greater than trend donors and donations, one should be cautious in interpreting these relative increases as the net return to reunion drives. Anticipation of reunions may cause a pre-reunion decrease in gifts and donors while post-reunion responses may also produce shortfalls from trend projections. If such troughs exist, the net return to reunion drives will clearly be lower than the relative increases noted in Table 1.

Given that the lag structure in alumnae giving in response to reunion years is unknown, we simply assume that the years immediately preceding and following each reunion will experience the largest trend deviation. We add a set of pre-and post-reunion year dummy variables to the gift and contributor specifications. The F-statistics on either the pre- or post-reunion year dummies at a .05 level do not reject the hypothesis that any given set of coefficients is significantly different from zero.[14] In other words, there is no evidence of significantly negative pre- or post-reunion deviations in trend giving. If these deviations had been significant, calculation of the net return to a particular reunion (or any other periodic fund raising event) would require a comparison of the present discounted value of the flow of total gifts with the reunion versus estimates of the present discounted value of the flow without one.

Another possible effect of these fully anticipated five-year reunions is that, in the absence of organized reunions, the time trends of either per capita donations or of the number of participants would be different. (That is, reunions affect the coefficients on the aging variables of equations (5) and (7)). Equally appealing hypotheses come to mind. For example, reunions tend to lower the trend by redistributing a more or less fixed present-value of donations over the life-cycle such that larger donations occur during reunion years. Alternatively, reunions serve to increase demand for charitable donations so that the reunions' effect on trend giving is positive. However, we are not able to address these issues here; reunions occur throughout the time-series of our data.

Lastly, the time series dimension of our data permits another test of the robustness of the observed reunion effects. By estimating separate giving profiles for the following years, (1951-1960, 1961-1970, 1971-1981), it is possible to test for the stability of reunion effects across decades characterized by varying degrees of turmoil on college campuses. Employing the most general specifications, which include vectors of reunion, pre- and post-reunion dummies, F-tests on pair wise comparisons of the different decades reveal no significant differences in reunion effects across decades for either per capita giving or percentage of contributors. The robustness of tradition seems to be indicated by these results.

V. Conclusion

This paper examines the demand for charitable giving in the context of life-cycle consumption of charity. Specifically, this methodology is utilized to study the age-donation profile for educational gifts by college alumnae. The income elasticity of such donations appears to increase as alumnae age. This finding offers an explanation for the positive relationship between age and giving noted in previous studies of charitable giving. In addition, this paper explores the impact of fully anticipated reunions on the distribution of donations over the life-cycle. Reunion years are found to increase significantly the size and the number of educational gifts relative to the estimated long run trend in life-cycle giving.

Appendix

We wish to specify a function, quadratic in age, to represent the proportion of alumni contributors as the class ages, which will be flexible enough to reflect possible changes in the rate at which aging affects the proportion of contributors over the relevant range of ages. We expect the aging effects to be different along the age ranges $a_0 \leq a < a_1$, $a_1 \leq a < a_2$, and $a_2 \leq a$. We construct the function below with splines at ages a_1 and a_2 and impose constraints on the coefficients such that the function is continuous and has a first-derivative everywhere.

Let $n = f(a)$ such that:

(A1) $$n = [\gamma_0 + \gamma_1 (a - a_0) + \gamma_2 (a - a_0)^2] d_1 + [\alpha_0 + \alpha_1 (a_0 - a_1) + a_2 (a - a_1)^2] d_2 + [\beta_0 + \beta_1 (a - a_2) + \beta_2 (a - a_2)^2] d_3,$$

where $d_1 = 1;\ a_0 \leq a < a_1$
$0;$ elsewhere,

$d_2 = 1;\ a_1 \leq a < a_2$
$0;$ elsewhere,

$d_3 = 1;\ a_2 \leq a$
$0;$ elsewhere.

The continuity constraint implies:

(A2) $$\alpha_0 = \gamma_0 + \gamma_1 (a_1 - a_0) + \gamma_2 (a_1 - a_0)^2, \text{ and}$$

(A3) $$\beta_0 = \alpha_0 + \alpha_1 (a_2 - a_1) + \alpha_2 (a_2 - a_1)^2.$$

Similarly, the first-derivative constraint implies:

(A4) $$\alpha_1 = \gamma_1 + 2\gamma_2 (a_1 - a_0), \text{ and}$$

(A5) $$B_1 = \alpha_1 + 2\alpha_2 (a_2 - a_1).$$

Imposing constraints (A2) through (A5) on (A1) and recombining terms we derive:

(A6) $$n = \gamma_0 + \gamma_1 (a - a_0) + \gamma_2 (a - a_0)^2 + \gamma_3 (a - a_1)^2 D_2 + \gamma_4 (a - a_2)^2 D_3$$

where: $D_2 = d_2 + d_3,$

$D_3 = d_3,$

$\gamma_3 = \alpha_2 - \gamma_2$ and

$\gamma_4 = \beta_2 - \alpha_2.$

A stochastic version of this equation, with dummy reunion year variables added where appropriate, forms the quadratic spline function, equation (7), discussed in the text.

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Footnotes

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[1]See, for example, Clotfelter (1980), Clotfelter and Steuerle (1981), Feldstein (1975), Feldstein and Clotfelter (1976), Feldstein and Taylor (1976), and Reece (1979).

[2]Clotfelter and Steuerle (1981), p. 404.

[3]We would like to thank Wellesley College for making these data available to us. While the size, income profile and single sex status of the student body at Wellesley may imply that our actual estimates should not be generalized to all institutions, the methodology employed is certainly transferable.

[4]A total of 1850 observations was actually available as 10 class-year combinations were deleted due to missing data.

[5]Whether these reunion effects, working on the demand side, simply reflect greater preferences for contributions as landmark years are reached or whether they suggest returns to an increase in charity supplied due to institutional fundraising efforts, etc., is something this analysis cannot determine.

[6]In this formulation, $\theta = (g_1 - g_0)/g_0$, where g_1 and g_0 will equal the mean value of $g_{c,a}$ when $R^*_{c,a}$ equals one and zero respectively. See Halvorsen and Palmquist (1980) for a complete discussion of interpreting dummy variables in semi-logarithmic equations.

[7]See articles cited in note 1.

[8]From (5) the estimated coefficient on $R^*_{c,a}$ will equal $\ln(1 + \theta)$, therefore, $\theta = e^{.205} - 1 = .228$.

[9]For this stage of the analysis goodness-of-fit was a major criterion for selecting specification. A discussion of spline functions appears in Suits, Mason and Chan (1977).

[10]The regression from which equation (8) is derived is (standard errors are in parentheses):

$$\begin{aligned} n_{c,a} = \; & \underset{(1.054)}{41.292} + \underset{(0.288)}{1.650}\,(a-1) - \underset{(0.0163)}{0.0706}\,(a-1)^2 \\ & + \underset{(0.0172)}{0.0617}\,(a-11)^2\,(D_{2,c}) \\ & - \underset{(0.021)}{0.213}\,(a-51)^2\,(D_{3,c}) + \underset{(0.520)}{3.593}\,R^*_{c,a} \end{aligned}$$

$$R^2 = 0.3124$$

[11]F-statistics of 9.357 (11,1835) and of 5.384 (11,1833) are obtained and reject the null hypotheses of equality of reunion coefficients for per capita gifts and number of contributors respectively.

[12]The regression results upon which these findings are based are not reported but are available from the authors.

[13]This adjustment entailed the following: in column 3, the estimated proportion of contributors from column 2 is multiplied by the ratio

$$\frac{\%\text{ white females surviving to age 22}}{\%\text{ white females surviving to reunion year}}$$

[14]For per-capita giving, the pre-reunion F-statistic is 1.400 (12,1812) and the post-reunion is 0.134 (11,1812). For number of contributors the statistics are 0.586 (12,1810) and 0.976 (11,1810) respectively.