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Attrition and Some Tests of the Implications of Attrition

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SNP Working Paper No.1

Attrition and Some Tests of the Implications of Attrition

by

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This summarizes (1) the extent of attrition between Kenya 1 and Kenya 2, (2) some recent studies on attrition in longitudinal surveys for developed countries, (3) some theoretical aspects of the implications of attrition, and (4) some tests for implications of attrition between Kenya 1 and Kenya 2.

Section 3A.1 Attrition between Kenya 1 and Kenya 2

Table 1 summarizes the data on attrition for the first two rounds of the Kenyan data.

Table 1. Number of Respondents in Different Waves of Survey

Respondents	Numbers in			Numbers in 1 but not in 2	Numbers in 2 but not in 1
	Kenya 1	Kenya 2	Kenya 1 and 2		
Women	925	743	663	262	80
Men	859	656	576	283	80
Couples[a]	672	490	398	274	92

[a] "Couples" refers to both respondent and her husband being interviewed.

The extent of attrition appears considerable between Kenya 1 and 2: 28% for women, 33% for men, 41% for couples. The data permits identification of some causes of attrition. For women, for example, 8% of the attrition was due to death, 16% due to marital disruption (which leads to migration of women out of the sample villages in this patrilocal society), 25% due to migration, 8% due to refusals to participate, 11% due to being unable to be interviewed (bereaved or too busy), and 32% due to not being found after three visits by interviewers.

Section 3A.2 Summary of Recent Studies on Attrition in Longitudinal Samples in Developed Countries

There have been a number recent studies of attrition in major longitudinal samples in developed economies including those that are summarized in a special Spring 1998 issue of *The Journal of Human Resources* on "Attrition in Longitudinal Surveys." The striking result that comes from these studies is that the biases in estimated socioeconomic relations due to attrition are small even with attrition rates as high as 50% and with significant differences between attritors and nonattritors for the means of a number of outcome and standard predetermined variables. For example, Fitzgerald, Gottschalk and Moffitt (1998) summarize their analysis:

> "By 1989 the Michigan Panel Study on Income Dynamics (PSID) has experienced approximately 50 percent sample loss from cumulative attrition from its initial 1968 membership.... (p. 251) We find that while the PSID has been highly selective on many important variables of interest, including those ordinarily regarded as outcome variables, attrition bias nevertheless remains quite small in magnitude. The major reason ... for this lack of effect [is] that the magnitudes of the attrition effect, once properly understood, are quite small (most attrition is random).... (P. 252) Although a sample loss as high as [experienced] must necessarily reduce precision of estimation, there is no necessary relationship between the size of the sample loss from attrition and the existence or magnitude of attrition bias. Even a large amount of attrition causes no bias if it is 'random' ...." (P. 256)

The other studies in this volume have similar conclusions: Lillard and Panis (1998, p. 456 on PSID)-- "While we found significant evidence of selective attrition, it appears that this ... introduces only very mild biases in substantive results." Van den Berg and Lindeboom (1998, p. 477 on data from the Netherlands) -- "...the estimates of the covariate effects in the labor market transition rates do not change a lot when allowing for ... relations between labor market durations and attrition. In any standard empirical analyses these covariate effects are the parameters of interest." Zabel (1998, p. 502 on SIPP and PSID) – "It appears that accounting for attrition has little impact on the parameter estimates." Ziliak and Kniesner (1998, p. 507 on PSID) –"...nonrandom attrition is of little concern when estimating [labor relations] because the effect of attrition is absorbed into the fixed effects...." Falaris and Peters (1998, p. 531 on NLS and PSID) – "In general ...we find that attrition either has no effect on the regression estimates or only affects the estimates of the intercept..."

Section 3A.3 Some Theoretical Aspects of the Impact of Attrition on Estimates

Fitzgerald, Gottschalk and Moffitt (1998) provide a statistical framework for the analysis of attrition bias that shows that the common distinction between selection on unobservables and observables is critical to the development of tests for attrition bias and adjustments to eliminate it. They also show that selection on observables is not the same as exogenous selection because selection can be based on endogenous observables such as lagged dependent variables that are observed prior to the point of attrition. They note that the attrition bias generated by this type of selection can be eliminated by the use of weighted least squares (WLS), using weights obtained from estimated equations for the probability of attrition, and hence without the highly parametric procedures used in much of the literature. Therefore they focus on tests for attrition bias based on whether lagged endogenous variables affect attrition rates (though they also conduct an implicit test for selection on unobservables by comparing PSID distributions with those from the CPS). This section summarizes their theoretical discussion.

Selection on Observables and Unobservables

What is of interest is a conditional population density f(y|x) where y is a scalar dependent variable and x is a scalar independent variable (for illustration, but in practice extension to making x a vector is straightforward). Define A to be an attrition indicator equal to 1 if an observation is missing its value of y because of attrition and equal to zero if an observation is not missing its value of y. Only the density g(y|x, A=0) can be observed or estimated. The problem is how to infer f from g. This requires restrictions of some kind. Fitzgerald, Gottschalk and Moffitt focus on a set of restrictions that can be imposed directly on the attrition function, which is defined as the probability function PR(A=0|y, x, z), where z is an auxiliary variable (that in practice, again, can be a vector) that is assumed to be observable for all units but not included in x.

The key distinction that Fitzgerald, Gottschalk and Moffitt make is between **selection on observables** and **selection on unobservables**. Selection on observables occurs if

(1) $Pr(A=0|y, x, z) = Pr(A=0|x, z)$

Selection on unobservables occurs if (1) fails to hold so that the attrition function cannot be reduced from Pr(A=0|y, x, z).

Fitzgerald, Gottschalk and Moffitt suggest that these definitions probably are clearer to social scientists within the basic textbook parametric model:

(2) $y = ß_0 + ß_1x + e$, y observed if A = 0

(3) $A^* = d_0 + d_1x + d_2z + ?$

(4) $A = 1$ if A^* $ 0
$\quad = 0$ if $A^* < 0$"

Within this model selection occurs on unobservables if z is independent of e|x but ? is not independent of e|x. Selection occurs on observables if z is not independent of e|x but ? is independent of e|x.

Selection on Unobservables: The expected mean for the nonattriting sample is:

(5) $E(y|x, z, A=0) = ß_0 + ß_1x + E(e|x, z, ? <- d_0 - d_1x - d_2z)$
$\quad = ß_0 + ß_1x + h(- d_0 - d_1x - d_2z)$
$\quad = ß_0 + ß_1x + h'(F(- d_0 - d_1x - d_2z))$

where h and h' are functions with unknown parameters. To go from the first to the second line requires that the joint distribution of e and ? is independent of x and z, so that the conditional expectation depends on x and z only through the attrition index. To go from the second to the third line the attrition index is replaced by its probability, which can be done because they have a one-to-one correspondence. Given estimates of the attrition index or of the predicted attrition probability, equation (5) is a function the parameters of which can be consistently estimated. Identification of ß requires: (i) nonlinearities in the h, h' and F functions; (ii) fixed effects for the coefficient estimates of time-varying elements in y if E(e|x, z, ? <- d_0 - d_1x - d_2z) can be represented by a fixed component and a stochastic component that is independent of x; or (iii) an exclusion restriction -- i.e., some z that is not in x. It is difficult to rationalize most such exclusion restrictions because, for example, personal characteristics that affect attrition would seem also to be in x. There may be some such identifying variables, however, in the form of variables that are external to individuals and not under their control, such as characteristics of the interviewer as are available in Kenya 2 and Malawi 1 (and thus can be used to investigate attrition between Kenya 2 and Kenya 3 and between Malawi 1 and Malawi 2). Fitzgerald, Gottschalk and Moffitt suggest that indirect tests for selection on unobservables can be made by comparisons with data sets without (or with much less) attrition (e.g., the CPS for the U.S.), but only very limited possibilities are present for such comparisons with the Kenyan and Malawian data (e.g., the KDHS permits some possibilities for comparisons but the timing in not well-synchronized).

Selection on Observables

If there is selection on observables, the critical variable is z, a variable that affects attrition propensities and that is also related to the density of y conditional on x (in this sense, z is "endogenous to y"). Such a variable can exist only for "structural" y functions in which z does not belong (i.e., in reduced form or demand relations there generally are not any variables z that are not in x). Such a variable z need not be an exogenous variable; a lagged value of y can play the role of z if it is not in the "structural" relation being estimated and if it is related to attrition.

The complete-population density f(y|x) can be computed from the conditional joint density of y and z, denoted by g:

(6) $f(y|x) = \int g(y, z|x, A=0)\, w(z, x)\, dz$

where

(7) $w(z, x) = [(Pr(A=0|z, x))/(Pr(A=0|x)]^{-1}$

are normalized weights. The numerator in relation (7) inside the brackets is the probability of retention in the sample (and, in the parametric model described above, is $F(- d_0 - d_1x - d_2z)$). Because both the weights and the conditional density g are identifiable and estimable functions, the complete population density f(y|x) is estimable, as are its moments such as its expected value ($ß_0 + ß_1x$ in the parametric model). Equation (6) demonstrates that the complete-population density can be derived by weighting the conditional density by the (normalized) inverse selection probabilities; in the parametric model, it can be shown that this implies that WLS can be applied to equation (2) using the weights in equation (7). Fitzgerald, Gottschalk and Moffitt claim that, while these results are relatively unfamiliar in the econometric literature, they are pervasive in the survey sampling literature, where they form the intellectual justification for the construction and use of attrition-based survey weights.

Fitzgerald, Gottschalk and Moffitt also emphasize that simply conditioning on z does not solve the attrition bias problem due to selection on observables. What generally is of interest is E(y|x), not E(y|x, z). Including z in the regressor set generates biased coefficients of x in a linear-regression model, for example, in the sense that it does not yield estimates of the effect of x on y unconditional on z. Because z is an endogenous variable in the sense noted above, it distorts the conditional distribution of y on x. Thus correcting for selection on observables must be distinguished from the correction for unobservables selection in equation (5) that involve conditioning on functions of x and z. Such methods are not appropriate for selection on observables.

Two sufficient conditions for the absence of attrition bias on observables are either (1) the weights equal one (i.e., z does not affect A) or (2) z is independent of y conditional on x. Specification tests can be based on either of these two conditions. Therefore one test simply is to determine whether candidate variables for z (for example, lagged values of y) significantly affect A. A second test is to conduct specification tests for whether OLS and WLS estimates of equation (2) are significantly different, which is an indirect test for whether the identifying variables used in the weights are endogenous.

Another test for selection on observables is based on Becketti, Gould, Lillard and Welch (BGLW, 1988). In the the BGLW test, the value of y at the initial wave of the survey (y_0) is regressed on x and on future A. The test for attrition is based on the significance of A in that equation. This test is closely related to the test already described of regressing A on x and y_0 (which is z in this case); in fact, the two equations are simply inverses of one another. Formally, let the attrition function be the latent index in the parametric model:

(8) $A^* = d_0 + d_1x + d_2z + ?$

Fitzgerald, Gottschalk and Moffitt state that, inverting this equation, taking expectations, and applying Bayes' Rule, it can be shown that

(9) $E(y_0|A, x) = \int y_0 f(y_0|x) w(A, y_0, x) dy_0$

where

(10) $w(A, y_0, x) = Pr(A|y_0, x)/Pr(A|x)$

which are essentially the same as the weights appearing in equation (7) but including the probabilities of A = 1 as well as A = 0. Equation (9) shows that if the weights all equal one, the conditional mean of y_0 is independent of A and hence A will be insignificant in a regression of y on x and A (the conditional mean of y_0 in the absence of attrition bias is $ß_0 + ß_1x$, so a regression of y_0 on x will yield estimates of this equation). The weights equal one only if y_0 is not a determinant of A conditional on x. Thus the BGLW method is an indirect test of the same restriction as the direct method of estimating the attrition function itself. However, if the weights do not equal one, Fitzgerald, Gottschalk and Moffitt note that it would be difficult to derive an explicit solution for equation (9) from the estimates of (8) obtained in attrition propensity models. To do so would require conducting directly the integration shown in equation (9). It is simpler to estimate a linear approximation to equation (9) by OLS, as did BGLW, to determine the magnitude of the effect of A on the intercept and coefficients of the equation for y_0 as a function of x. This is not an independent test of attrition bias separate from that embodied in estimates of equation (8), but only a shorthand means of deriving the implications of estimates of equation (8) for the magnitudes of differences in initial y conditional on x between attritors and nonattritors.

Section 3A.4 Some Attrition Tests between Kenya 1 and Kenya 2

We conduct three sets of tests, along the lines of some of the tests presented by Fitzgerald, Gottschalk and Moffitt (1998):

(1) We compare means for our major outcome and standard predetermined variables and standard variables for the those in both Kenya 1 and 2 versus those in only one of the two waves (Table 2). We find: (a) significantly (at 5% level) greater means for attritors than non attritors for: secondary schooling, speaks English, speaks Swahili, and (at 10% level) some schooling, residence in Ugina, heard family planning message on radio, husband received salary; (b) significantly smaller means for attritors than non attritors for: number of surviving children, want no more children, age, speaks Luo only, belongs to a clan welfare society, and (at 10% level) visited by community-based distribution agent, no schooling, belongs to a credit group; (c) no significant difference between means for attritors than non attritors for: ever used contraceptives, currently using contraceptives, size of family planning, health, and wealth social networks, knowing a secret contraceptive user, heard about family planning at a clinic, talked with others after heard family planning lecture at clinic, primary schooling, lived out of province, lived in Nairobi and Mombasa in particular, sells things at the market, location of residence other than Ugina, polygamous household, household has a radio, house has a metal roof, husband is home.

(2). We estimate attrition probits with alternative specifications that start with a very parsimonious specification in which only one of our outcome and network variables at a time are included and then add other standard x variables (Table 3). We find that individually or with other variables included among our primary outcome and network variables only number of surviving children is significantly related to attrition (negatively), but not such variables as ever use contraception, current use of contraception, want no more children (a significant negative association if included by itself becomes insignificant with other controls) and size of social network (nor these four variables taken as a group). Among control variables, there are significant associations with husband home (negative) and with residence in Oyugis (negative at 10% level), but not with age, schooling, selling in the market, owning a radio, living in a house with a metal roof, husband home, polygamous household, speaking English, speaking Luo only, or past residence in Nairobi or Mombasa.

(3) We conduct BGLW tests with Kenya 1 contraceptive use (ever or currently), want no more children, number of surviving children and family planning network size as the respective dependent variables for total the Kenya 1 sample and for the nonattriting sample between Kenya 1 and Kenya 2 with right-side variables including "standard" x variables (e.g., age, schooling, wealth indicators, language indicators, sublocation of residence). Tests for the joint significance of the differences in the slope coefficients and intercepts in all cases fail to reject equality of all the coefficients and of an additive

variable for attrition (with the single exception of number of surviving children in which case the constant differs between attritors and nonattritors, but not the coefficient estimates).

Thus our conclusions are similar to those of Fitzgerald, Gottschalk and Moffitt (1998) for the PSID: (a) a number of critical variables do differ between attritors and nonattritors, (b) a few Kenya 1 variables are significant predictors of attrition though most are not, and (c) the coefficients on 'standard' variables in equations with our major outcome and family planning social network variables are unaffected by attrition (and, in contrast to their study, the constants also do not differ with the single possible exception of number of surviving children in which case the constant differs at the 10 percent level). Therefore, attrition apparently is not a general problem for obtaining consistent estimates of the coefficients of interest.

Table 2. T-tests for Differences in Means in Kenya 1 Data for Women Attritors versus Nonattritors [a]			
Variables	**Means for Nonattritors (Standard Deviation)**	**Means for Attritors (Standard Deviation)**	**Difference in Means (T test)**
Fertility-Related Outcome Variables			
Currently using contraceptives	0.126 (0.012)	0.103 (0.021)	0.024 (0.91)
Ever used contraceptives	0.238 (0.016)	0.196 (0.027)	0.042 (1.25)
Want no more children	0.351 (0.018)	0.220 (0.037)	0.132 (3.59*)
Number of surviving children	3.88 (0.089)	2.78 (0.138)	1.10 (5.90*)
Family Planning Program Variables			
Visited by community-based distribution agent	0.163 (0.014)	0.113 (0.022)	0.050 (1.75***)
Heard family planning message on radio	0.870 (0.916)	0.916 (0.019)	-0.046 (1.79***)
Heard about family planning at clinic	0.851 (0.013)	0.828 (0.027)	0.023 (0.80)
Discussed with others family planning lecture heard at clinic	0.629 (0.070)	0.661 (0.037)	-0.032 (0.76)
Number of Network Partners in Network for:			
Family planning	2.9 (0.11)	3.1 (0.20)	-.18 (0.78)
Reproductive health	2.8 (0.12)	2.4 (0.21)	0.38 (1.45)
Wealth flows	3.2 (0.16)	2.8 (0.23)	0.38 (1.19)
Woman knows secret contraceptive user	0.408 (0.02)	0.377 (0.03)	0.030 (0.77)
Predetermined Variables			
Age (years)	29.7 (0.332)	26.3 (0.488)	3.4 (5.04*)
Education			
No schooling	0.214 (0.015)	0.141 (0.024)	0.072 (2.30***)
Primary schooling	0.669 (0.018)	0.668 (0.033)	0.001 (0.03)
Secondary schooling	0.117 (0.012)	0.190 (0.027)	-0.074 (2.75*)
Language			
Luo only	0.422 (0.018)	0.327 (0.033)	0.095 (2.46**)
English	0.178 (0.014)	0.263 (0.031)	-0.086 (2.73*)
Swahili	0.396 (0.018)	0.517 (0.035)	-0.121 (3.11*)
Lived:			

outside of province	0.370 (0.018)	0.371 (0.034)	-0.001 (0.02)
in Nairobi or Mombasa	0.214 (0.015)	0.205 (0.028)	0.009 (0.29)
Belongs to credit group	0.351 (0.018)	0.288 (0.032)	0.064 (1.70***)
Belong to clan welfare society	0.747 (0.016)	0.644 (0.034)	0.103 (2.93*)
Woman sells on market	0.464 (0.019)	0.444 (0.035)	0.020 (0.51)
Household characteristics			
Polygamous household	0.350 (0.018)	0.371 (0.034)	-0.021 (0.56)
Husband received salary	0.334 (0.019)	0.402 (0.037)	-0.068 (1.66***)
Husband home **[???]**	0.765 (0.016)	0.752 (0.029)	0.013 (0.41)
Household has radio	0.492 (0.019)	0.546 (0.035)	-0.055 (1.38)
House has metal roof	0.201 (0.015)	0.187 (0.027)	0.014 (0.45)
Sublocation of residence			
Gwassi	0.213 (0.015)	0.210 (0.029)	0.003 (0.08)
Kawadghone	0.240 (0.015)	0.205 (0.028)	0.035 (1.06)
Oyugis	0.286 (0.017)	0.263 (0.031)	0.023 (0.63)
Ugina	0.261 (0.016)	0.322 (0.033)	-0.061 (1.72***)

[a] Absolute value of two-sample t test with unequal variances given in parentheses in last column. * indicates significance at 0.01 level, ** at 0.05 level, and *** at 0.10 level.

[???] Note: I could not find "husband home" variable. The results in this row are for "husband interviewed". Note that in the multivariate probit in Table 3, it retains its significance in this formulation.

Table 3. Multivariate Probits for Predicting Attrition for Women between Kenya 1 and Kenya 2 [a]						
Right-Side Variables	**Outcome and Network Variables One at a Time**					**All at Once[b] plus Stand. Var.**
Fertility-Related Outcome Variables						
Currently using contraceptives	-0.134 (0.92) [-0.038]					0.004 (0.02) [0.001]
Ever used contraceptives		-0.142 (1.26) [-0.041]				-0.036 (0.28) [-0.010]
Want no more children			-0.374 (3.60*) [-0.104]			-0.010 (0.07) [-0.003]
Number of surviving children				-0.139 (5.82*) [-0.039]		-0.136 (3.73*) [-0.037]
Number of Family Planning Network Partners					0.012 (0.78) [-0.004]	-0.010 (0.56) [0.003]
Predetermined Variables						
Age (years)						-0.001 (0.48) [-0.001]
Education (relative to no schooling)						
Primary schooling						0.120 (0.77) [0.033]
Secondary schooling						0.079 (0.32) [0.022]
Language						
Luo only						-0.104 (0.83) [-0.028]
English						0.057 (0.31) [0.016]
Lived in Nairobi or Mombasa						-0.159 (1.71) [-0.041]

Woman sells in market						-0.013 (0.11) [-0.004]
Household characteristics						
Polygamous household						0.149 (1.30) [0.041]
Husband home						-0.334 (2.78*) [-0.096]
Household has radio						0.051 (1.37) [0.040]
House has metal roof						0.123 (0.87) [0.034]
Sublocation of residence (relative to Ugina)						
Gwassi						-0.134 (0.86) [-0.035]
Kawadghone						-0.214 (1.36) [-0.055]
Oyugis						-0.265 (1.67***) [-0.068]
Constant	-0.753 (15.41*)	-0.738 (14.21*)	-0.658 (12.15*)	-0.336 (3.71*)	-0.808 (12.32*)	-0.097 (0.29)
Chi squared test (probability > Chi squared)	0.86 (0.354)	1.61 (0.204)	13.37 (0.000)	36.52 (0.000)	0.60 (0.438)	54.49 (0.000)

[a] Absolute value of z test in parentheses beneath point estimates: * indicates significance at 0.01 level, ** at 0.05 level, and *** at 0.10 level. dF/dx in brackets beneath z tests (dF/dx is for discrete change of dummy variable from 0 to 1 if x is a dummy variable).
[b] Chi squared joint tests for first five coefficients equal to zero is 37.30 (probability 0.0000) and for the first five except for number of surviving children is 14.10 (probability 0.0070).

Table 4. Multivariate Probits/Regressions for Testing Impact of Attrition for Women between Kenya 1 and Kenya 2 on Key Fertility-Related Outcome Variables [a]					
Right-Side Variables	**Probits**			**Regressions**	
	Currently using contra-ceptives	**Ever used contra-ceptives**	**Want no more children**	**Number of surviving children**	**Family planning social network size**
Predetermined Variables					
Age (years)	0.014 (2.03**) [0.002]	0.023 (3.68*) [0.007]	0.079 (11.80*) [0.026]	0.161 (20.82*)	0.025 (1.97**)
Education (relative to no schooling)					
Primary schooling	0.122 (0.72) [0.022]	0.094 (0.66) [0.027]	-0.004 (0.03) [-0.001]	-0.440 (2.66*)	0.957 (3.41*)
Secondary schooling	0.125 (0.47) [0.025]	0.279 (1.23) [0.087]	-0.107 (0.46) [-0.036]	-0.447 (1.60)	1.786 (3.83*)
Language					
Luo only	-0.268 (1.86***) [-0.048]	-0.236 (1.95***) [-0.067]	-0.228 (1.88***) [-0.074]	-0.142 (1.00)	-0.395 (1.68***)
English	0.264 (1.41) [0.054]	0.265 (1.59) [0.081]	-0.002 (0.01) [-0.001]	-0.334 (1.59)	0.125 (0.36)
Lived in Nairobi or Mombasa	0.311 (2.33**) [0.064]	0.356 (3.05*) [0.111]	0.240 (2.01**) [0.082]	0.144 (0.97)	-0.066 (0.26)
Woman sells in market	0.254 (2.02**) [0.048]	0.147 (1.34) [0.043]	-0.119 (1.07) [-0.039]	0.032 (0.24)	0.180 (0.83)
Household characteristics					
Polygamous household	-0.161 (1.28) [-0.029]	-0.104 (0.97) [-0.030]	0.187 (1.79***) [0.062]	-0.201 (1.57)	-0.089 (0.42)
Husband home	0.211 (1.51) [0.036]	-0.108 (0.94) [-0.032]	-0.113 (0.99) [-0.039]	-0.147 (1.05)	0.101 (0.44)
Household has radio	-0.019 (0.16) [-0.004]	-0.005 (0.05) [-0.001]	0.046 (0.44) [0.015]	-0.106 (0.85)	0.270 (1.31)
House has metal roof	0.003 (0.019) [0.001]	0.253 (2.00**) [0.077]	0.173 (1.39) [0.059]	0.810 (5.15*)	0.142 (0.53)

Sublocation of residence (relative to Ugina)					
Gwassi	-0.441 (2.37**) [-0.070]	-0.645 (4.10*) [-0.158]	0.169 (1.13) [0.057]	0.357 (2.03**)	-0.668 (2.29**)
Kawadghone	-0.170 (0.99) [-0.030]	-0.260 (1.79***) [-0.071]	0.130 (0.85) [0.044]	0.240 (1.34)	0.496 (1.68***)
Oyugis	0.013 (0.08) [0.002]	-0.179 (1.26) [-0.050]	0.437 (2.93*) [0.152]	0.218 (1.23)	1.537 (5.22*)
Constant	-1.85 (5.50*)	-1.34 (4.71*)	-3.03 (10.01*)	-0.90 (2.57**)	1.87 (3.23*)
Chi squared test for overall relation (probability > Chi squared)	44.22 (0.0001)	86.05 (0.0000)	234.12 (0.0000)		
R squared, F test (probability > F)				0.469 50.36 (0.0000)	0.082 5.48 (0.0000)
Tests for Attrition					
Effect of attrition on constant	0.126 (1.90***) [0.001]	-0.162 (1.31) [-0.137]	-0.189 (1.50) [-0.062]	-0.549 (3.77*)	0.057 (0.24)
Chi squared test for joint effect of attrition on constant and all coefficient estimates (probability > Chi squared) [F tests for regressions]	10.85 (0.763)	12.60 (0.633)	10.68 (0.775)	2.08 (0.009*)	0.82 (0.657)
Chi squared test for joint effect of attrition on all coefficient estimates but not on constant (probability > Chi squared) [F tests for regressions]	10.74 (0.706)	11.58 (0.640)	9.20 (0.818)	1.05 (0.397)	0.87 (0.588)

[a] Absolute value of z test (for probits) and t tests (for regressions) in parentheses beneath point estimates: * indicates significance at 0.01 level, ** at 0.05 level, and *** at 0.10 level. dF/dx in brackets beneath z tests (dF/dx is for discrete change of dummy variable from 0 to 1 if x is a dummy variable).

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