Using Interviewer Observations To Improve Nonresponse Adjustments: NES 2004

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Abstract

Variables used in nonresponse adjustments are sometimes associated with the response outcome and sometimes with survey variables. Both associations are paramount to the reduction of nonresponse bias in survey estimates. We demonstrate that it is only when both are present that adjustments change the point estimate of the mean from the unadjusted mean. We also set out to test whether the relatively low associations commonly found in survey data are sufficient to achieve this goal. There are many such auxiliary variables that can be used for nonresponse adjustment. We demonstrate augmenting nonresponse adjustments in the 2004 National Election Study using interviewer observations on the sampled address and the contacted individual.

1. Introduction

A common approach to adjustment for unit nonresponse in surveys is weighting. Variables used in the construction of the weights may be associated with the likelihood of participation, with the survey variables, or may not happen to be associated with either. For example, allowing a response propensity model to select variables used in the creation of weights selects only covariates of the likelihood of responding, but not those that are clearly related to what is being measured in the survey.

If an adjustment variable used is predictive of the response outcome but is not associated with the survey variables, the effect on survey estimates may be detrimental on the Mean Square Error of an adjusted mean, increasing variance without sufficiently reducing nonresponse bias.

Little and Vartivarian (2005) simulate how correlations between the response outcome (from here on R, where R=1 for respondents), a survey variable (Y), and an auxiliary variable (Z) will affect an estimated survey mean and its variance. While a variable that is associated with a survey variable, but not with the response outcome can reduce the variance of a statistic, the only condition under which the bias of a statistic such as a mean can be reduced, is when the auxiliary variable is strongly associated with both the response outcome ($corr(Z,R)\neq0$) and the survey variable ($corr(Z,Y)\neq0$).

Any variable that is available for respondents and nonrespondents can be used in nonresponse adjustment. Such information in face to face surveys can be collected by the interviewers. Some information can be collected on the entire sample, such as the type of housing structure. It may be possible to collect stronger correlates of both response outcome and survey variables only on those who are contacted, such as any comments made by the household informant or selected respondent.

Ideally, information on respondents and nonrespondents collected by the interviewers would be strongly associated with both response outcome and survey variables in order to reduce nonresponse bias in survey estimates. In this case, then conditional on this variable, there would be no association between response outcome and a particular survey variable of interest. However, whether the correlations used in Little and Vartivarian's (2005) simulations are found empirically is an open question. Anecdotal accounts from sampling statisticians relate that estimated means are relatively robust to differences in weighting procedures. If this is true, then it is likely due to relatively low correlations between the variables used for weighting, the response probabilities, and the survey variables, being insufficient to move point estimates.

We have three main objectives:

1) To examine the magnitude of associations between survey variables, response probabilities, and data typically used for auxiliary variables in weighting adjustments.
2) To demonstrate how these associations contribute to the effectiveness in adjusting survey estimates.
3) To present interviewer observations which are more highly correlated with survey variables and response probabilities than the current adjustment variables, and show the movement in the final estimate when these variables are included in the adjustment scheme.

2. Data and Methods

We use data from the 2004 National Election Study (NES 2004) in this paper. The 2004 NES was a face to face survey of the adult US population. The survey was conducted prior to the Bush-Kerry Presidential election; responding units were reinterviewed after the

election. Our analyses focus on the pre-election interview; adjustments for attrition are out of scope for this study. A unique feature of the NES is the collection of interviewer observations on respondents and nonrespondents at the time of recruitment into the sample. These interviewer observations document what the informant and/or respondent said "on the doorstep" to the interviewer. In the pre-election interview, 1213 were respondents and 621 were nonrespondents.

The 2004 NES has three weight components: a within-household selection weight, a nonresponse weight, and a post-stratification weight. Improving the nonresponse weight is the focus of this paper. The traditional NES nonresponse adjustment is a weighting class adjustment. Eight cells are formed by a cross-tabulation of the four Census regions and a Metropolitan Statistical Area (MSA) indicator, and respondents within each cell are weighted by the inverse of the response rate in that cell.

There are many ways to conduct a nonresponse adjustment. Although other models (e.g., propensity models) are used in some surveys (such as the National Survey of Family Growth) for purposes of nonresponse adjustment, we deliberately employ the same method that is used in the NES 2004. We seek to discover whether there is a benefit of incorporating additional information to the existing NES nonresponse adjustment, not inventing the "best" or "optimal" method for these data. To do this, we add a dichotomous variable to the nonresponse adjustment, crossing the existing eight Census region by MSA cells by the additional variable, with a resultant sixteen cells in our new weighting class scheme. Following the original adjustment plan, we create a weight that is simply the inverse of the response rate.

Two main types of interviewer observations exist in the NES data that could be used for nonresponse adjustment. First, there are observations on all (or at least possible for all) households that do not require contact with a person in a selected household. Second, observations that document the interaction between the interviewer and a household member are collected. For purposes of this paper, we selected one observation that is available for all households in the sample - the type of housing structure - and dichotomized it into an indicator variable of whether the housing structure was a detached single family housing unit. Sixty-three percent of the sample was coded as living in such a housing unit. We also selected two observations that are collected at the time of contact with someone at the household – whether the household informant made a negative comment (30.5%) and whether no interest in politics was expressed (5.2%).

From the Little and Vartivarian simulations, we expect that for an effective adjustment variable for nonresponse bias has to be associated with both the response outcome and with the survey variables. Housing structure and no interest in politics had very small correlations with the response outcome, 0.06 and -0.08, respectively. Whether a negative comment was made had a more moderate correlation of -0.51, indicating that those who make negative comments are unlikely to participate in the survey. The question is now whether interviewer observations with small or moderate correlations with P could shift survey estimates when used in the adjustment for nonresponse.

Even if these associations between the interviewer observations and the response outcome are large, they still need to be correlated with the survey variables. We selected 21 demographic and political attitude variables that vary in their associations with the interviewer observations, from 0.001 to 0.291, presented in Table 1.

The evaluation proceeds in three steps. First, we compute the unweighted means and proportions of these variables. Second, we present the means and proportions weighted only by within-household selection weights. Finally, we present three nonresponse-adjusted estimates: (1) an estimate weighted for selection probabilities and the traditional nonresponse adjustment; (2) an estimate weighted for selection probabilities and a new nonresponse adjustment including only a new interviewer observation, excluding the traditional variables, and (3) an estimate weighted for the selection probabilities and the combined 16-cell adjustment formed by the existing adjustment cells and new interviewer observation. The process is repeated separately for each of the three interviewer observations due to the sparse weighting cells when all three are included.

3. Results

We first turn to the Z-variable that was collected for the entire sample— the indicator for a detached single family housing unit. The correlations between the Z-variable and the Y-variables were low to moderate, varying from 0.005 to 0.291, second column in Table 1. Most of the estimates were unchanged from the probability of selection-weighted estimate under either nonresponse adjustment scheme, with the exception of the mean number of years the respondent lived in the current home. Most estimates, such as whether the respondent voted in 2000 and whether the respondents put off medical treatment that the respondent could not afford, change in the second or third decimal when adjusting by the combined NES nonresponse and Z-variable weight. These differences in estimates in

means and proportions are miniscule; however, these results should be expected as the correlation between Z and R is only 0.06.

Now, we then turn to the interviewer observations requiring contact with someone at the sampled unit. The indicator for whether no interest in politics was expressed had a low correlation with R (-0.08). Here, the correlations between Z and the Y-variables were even lower, the highest being 0.171 for whether the respondent was interested in following campaigns, presented in Table 2. For this Y-variable, the weighted estimate of the mean incorporating the Z variable alone is slightly different from that using the traditional NES nonresponse adjustment weight (2.488 with Z and 2.471 with the NES adjustment). However, the low prevalence of this variable restricts its effectiveness when combined with the traditional NES adjustment, with the combined estimate approximately equal to the traditional NES nonresponse adjusted estimate. Similar minor changes in estimates were also observed for the mean number of years in current home and the mean number of days in the past week the respondent watched national news on television. As already alluded to, the lack of associations between this Z variable and producing any differences in the adjusted estimates is likely related to the low prevalence of Z—only 5.2% of the cases were coded as having expressed no interest in politics.

The final Z-variable - whether a negative comment was made - is also conditional on contact, but unlike the ones above, it has a substantial correlation with R (-0.51) and unlike the other contact observation, has a prevalence rate of 30.5%. However, this Z has only small correlations between Z and the Y variables, the highest being 0.100. However, due to the strength of the relationship between this Z variable and probability of response, adjustments based on the negative comment Z variable produced shifts in the estimates for more variables than the other two Zs. This difference remained when the new Z variable was combined with the from the traditional NES nonresponse adjustments. The correlation between the existing NES weight and the new weight adding negative comment was only 0.542, compared to 0.990 and 0.998 for the adjustments with housing structure and interest in politics, respectively. The differences in the new weighted estimates were in the expected directions, based on using negative comments: Lower interest in politics, lower affect towards G.W. Bush, lower thermometer rating for John Edwards, and lower mean number of days in the past week having watched national news on television.

To summarize these findings, we computed the absolute difference between estimates of the mean using the NES nonresponse adjustment, and the weighted estimates when the Z variable is added to the adjustment. For proportions, we use the difference between the two proportions[1]:

$$\left|\bar{y}_{w_{xz}} - \bar{y}_{w_x}\right| \times 100$$

For means, we divided each estimate by the range of values for that variable, placing the estimates on the same scale as the proportions[2]:

$$\left|\frac{\bar{y}_{w_{xz}}}{y_{max} - y_{min}} - \frac{\bar{y}_{w_x}}{y_{max} - y_{min}}\right| \times 100$$

These differences in means and proportions are plotted against their Z-Y correlations in Figure 1. The estimates are repeated for each of the three Z-variables, each of which has a different Z-R correlation and prevalence rate.

As expected, when either association is not present (Z,R and Z,Y), adding Z to the adjustment does not affect the weighted estimates. Both "Single Family Detached Housing Unit" and "No Interest In Politics" lack an association with the response outcome (Z,R) and regardless of the association with the survey variable (Z,Y, along the x-axis), the estimates of the mean and proportion remain essentially unchanged.

However, "Negative Comment" was associated with the response outcome (Z,R) and for variables that were correlated with it (Z,Y), the estimates changed. While these changes are not large, the important result is that even relatively small correlations can produce a change in the estimate, as long as both conditions are met.

4. Discussion

Interviewer observations could improve nonresponse adjustment for point estimates when they are related to both response outcome and the survey variable, even when these correlations are not as strong as demonstrated in the simulation studies by Little and

[1] Alternatively, we could have used the percent difference relative to one of the proportions, but that depends on whether the proportion with or without the characteristic is selected. The results were very similar under the two approaches.

[2] Another method would be to divide by the variance of each estimate; here the purpose is to illustrate the change in estimates similar to the proportions. Furthermore, estimates of the variance require replication of the weights, which is beyond the scope of this paper.

Vartivarian (2005). As expected, lack of either association diminishes the effectiveness of nonresponse adjustments for survey estimates of the mean.

This study did not look at variance properties of these items; we expect that presence of a Z,Y association would reduce the variance of an estimate, just as a Z,R without a Z,Y association would increase the variance. This needs to be examined in future research.

These findings underscore the importance of deliberately selecting interviewer observations for nonresponse adjustment, and measuring those well. Negative comments were associated with both the response outcome and some survey variables; however, these associations were low to moderate and therefore the resulting differences in survey estimates were relatively small.

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References

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Table 1. Correlations between Single Family Detached Housing Unit (Z) and Survey Variables (Y), and Estimates of the Mean under Different Weighting.

Estimate	Correlation Between Z and Variable Among Respondents	n	Weighting Used in Estimate				
			None	Selection Weight	Selection and Nonresponse without Z	Selection and Z (without NES Nonresponse)	Selection and Nonresponse with Z
Interested in following campaigns? (1=Very much interested, 3=Somewhat interested; 5=Not at all interested)	-0.031	1140	2.486	2.481	2.480	2.484	2.485
Did Respondent vote 2000? (1=yes)	0.148	1128	0.679	0.678	0.676	0.675	0.673
Does R think will vote this November? (1=yes)	0.043	1126	0.891	0.891	0.890	0.890	0.890
Respondent self-placement on liberal-conservative scale (1=Liberal, 3=Neutral, 5=Conservative)	0.085	1088	3.368	3.392	3.379	3.385	3.373
Did R put off medical treatment R could not afford (1=yes)	-0.197	1139	0.330	0.331	0.331	0.335	0.334
Respondent age	0.218	1140	47.070	46.400	46.377	46.249	46.249
Both parents born in the U.S. (1=yes)	0.096	1139	0.834	0.842	0.838	0.841	0.836
Feeling thermometer: Republican Party (0-100)	0.081	1107	52.911	53.762	53.690	53.675	53.612
Unemployment better or worse in last year (1=better,3=stayed same, 5=worse)	-0.073	1015	3.457	3.447	3.438	3.453	3.442
Anything R likes about Republican party? (1=yes)	0.069	1117	0.480	0.489	0.491	0.488	0.489
Affect for GW Bush: hopeful (1=yes)	0.083	1133	0.554	0.567	0.566	0.565	0.565
Feeling thermometer: John Edwards (0-100)	-0.056	991	55.653	54.958	54.958	55.012	55.012
Years lived in current home	0.291	1139	11.417	11.348	11.341	11.197	11.241
Importance of government health insurance issue to R (1=Extremely important; 5=Not at all important)	0.005	1139	1.890	1.894	1.893	1.894	1.893
Active at church besides attendance (1=yes)	0.159	1137	0.270	0.275	0.272	0.272	0.269
Favor/oppose ban on late-term/partial-birth abortions (1=Favor; 0=Oppose)	0.024	1057	0.627	0.631	0.628	0.630	0.627
Religion important part of R life (1=yes)	0.049	1131	0.771	0.771	0.768	0.770	0.767
Defense spending scale: Dem party placement	-0.034	1045	3.633	3.599	3.600	3.602	3.602
Care who wins Presidential Election (1=Care a good deal; 0=Don't care very much)	0.038	1135	0.854	0.859	0.859	0.858	0.858
Care who wins House election (1=Very much, 4=Not at all)	-0.068	1131	2.039	2.039	2.039	2.042	2.043
Days in past week watched national news on TV	0.037	1138	3.535	3.532	3.535	3.527	3.526

Note: corr(Z,R)=0.06, p<.05; prevalence=63%

Table 2. Correlations between Stated No Interest In Politics (Z) and Survey Variables (Y), and Estimates of the Mean under Different Weighting.

Estimate	Correlation Between Z and Variable Among Respondents	n	Weighting Used in Estimate				
			None	Selection Weight	Selection and Nonresponse without Z	Selection and Z (without NES Nonresponse)	Selection and Nonresponse with Z
Interested in following campaigns? (1=Very much interested, 3=Somewhat interested; 5=Not at all interested)	0.171	1202	2.484	2.474	2.471	2.488	2.470
Did Respondent vote 2000? (1=yes)	-0.092	1190	0.680	0.679	0.678	0.677	0.677
Does R think will vote this November? (1=yes)	-0.110	1188	0.887	0.888	0.887	0.885	0.887
Respondent self-placement on liberal-conservative scale (1=Liberal, 3=Neutral, 5=Conservative)	-0.009	1146	3.380	3.403	3.390	3.402	3.389
Did R put off medical treatment R could not afford (1=yes)	0.011	1201	0.330	0.330	0.330	0.331	0.330
Respondent age	-0.025	1202	47.291	46.605	46.588	46.596	46.577
Both parents born in the U.S. (1=yes)	-0.022	1201	0.832	0.839	0.835	0.839	0.835
Feeling thermometer: Republican Party (0-100)	0.011	1166	53.227	54.029	53.977	54.045	54.001
Unemployment better or worse in last year (1=better,3=stayed same, 5=worse)	0.031	1059	3.440	3.421	3.409	3.424	3.408
Anything R likes about Republican party? (1=yes)	-0.091	1178	0.481	0.491	0.493	0.489	0.494
Affect for GW Bush: hopeful (1=yes)	-0.026	1194	0.554	0.566	0.565	0.566	0.566
Feeling thermometer: John Edwards (0-100)	-0.068	1041	55.477	54.749	54.726	54.667	54.692
Years lived in current home	0.019	1201	11.666	11.608	11.599	11.639	11.591
Importance of government health insurance issue to R (1=Extremely important; 5=Not at all important)	-0.001	1200	1.899	1.902	1.900	1.902	1.899
Active at church besides attendance (1=yes)	0.001	1198	0.269	0.273	0.270	0.273	0.270
Favor/oppose ban on late-term/partial-birth abortions (1=Favor; 0=Oppose)	-0.001	1116	0.625	0.630	0.628	0.630	0.627
Religion important part of R life (1=yes)	-0.001	1193	0.774	0.774	0.771	0.774	0.770
Defense spending scale: Dem party placement	0.001	1103	3.611	3.577	3.576	3.576	3.576
Care who wins Presidential Election (1=Care a good deal; 0=Don't care very much)	-0.097	1197	0.855	0.860	0.861	0.858	0.861
Care who wins House election (1=Very much, 4=Not at all)	0.117	1192	2.036	2.033	2.032	2.039	2.030
Days in past week watched national news on TV	-0.131	1200	3.583	3.583	3.587	3.560	3.587

Note: corr(Z,R)=-0.08, p=.0007; prevalence of Z=5.2%

Table 3. Correlations between Negative Comment (Z) and Survey Variables (Y), and Estimates of the Mean under Different Weighting.

Estimate	Correlation Between Z and Variable Among Respondents	n	Weighting Used in Estimate				
			None	Selection Weight	Selection and Nonresponse without Z	Selection and Z (without NES Nonresponse)	Selection and Nonresponse with Z
Interested in following campaigns? (1=Very much interested, 3=Somewhat interested; 5=Not at all interested)	0.064	1202	2.484	2.474	2.471	2.513	2.496
Did Respondent vote 2000? (1=yes)	-0.037	1190	0.680	0.679	0.678	0.668	0.671
Does R think will vote this November? (1=yes)	-0.067	1188	0.887	0.888	0.887	0.877	0.877
Respondent self-placement on liberal-conservative scale (1=Liberal, 3=Neutral, 5=Conservative)	0.005	1146	3.380	3.403	3.390	3.408	3.390
Did R put off medical treatment R could not afford (1=yes)	-0.081	1201	0.330	0.330	0.330	0.310	0.314
Respondent age	0.088	1202	47.291	46.605	46.588	47.219	47.238
Both parents born in the U.S. (1=yes)	-0.001	1201	0.832	0.839	0.835	0.845	0.843
Feeling thermometer: Republican Party (0-100)	0.002	1166	53.227	54.029	53.977	53.930	53.838
Unemployment better or worse in last year (1=better,3=stayed same, 5=worse)	0.002	1059	3.440	3.421	3.409	3.422	3.414
Anything R likes about Republican party? (1=yes)	-0.002	1178	0.481	0.491	0.493	0.491	0.493
Affect for GW Bush: hopeful (1=yes)	-0.080	1194	0.554	0.566	0.565	0.551	0.549
Feeling thermometer: John Edwards (0-100)	-0.087	1041	55.477	54.749	54.726	53.641	53.631
Years lived in current home	0.100	1201	11.666	11.608	11.599	12.170	12.270
Importance of government health insurance issue to R (1=Extremely important; 5=Not at all important)	0.010	1200	1.899	1.902	1.900	1.910	1.905
Active at church besides attendance (1=yes)	0.024	1198	0.269	0.273	0.270	0.279	0.274
Favor/oppose ban on late-term/partial-birth abortions (1=Favor; 0=Oppose)	-0.007	1116	0.625	0.630	0.628	0.629	0.624
Religion important part of R life (1=yes)	-0.031	1193	0.774	0.774	0.771	0.768	0.763
Defense spending scale: Dem party placement	0.028	1103	3.611	3.577	3.576	3.590	3.582
Care who wins Presidential Election (1=Care a good deal; 0=Don't care very much)	-0.075	1197	0.855	0.860	0.861	0.849	0.850
Care who wins House election (1=Very much, 4=Not at all)	0.025	1192	2.036	2.033	2.032	2.052	2.032
Days in past week watched national news on TV	-0.004	1200	3.583	3.583	3.587	3.551	3.574

Note: corr(Z,R)=-0.51, p<.0001; prevalence of Z=30.5%

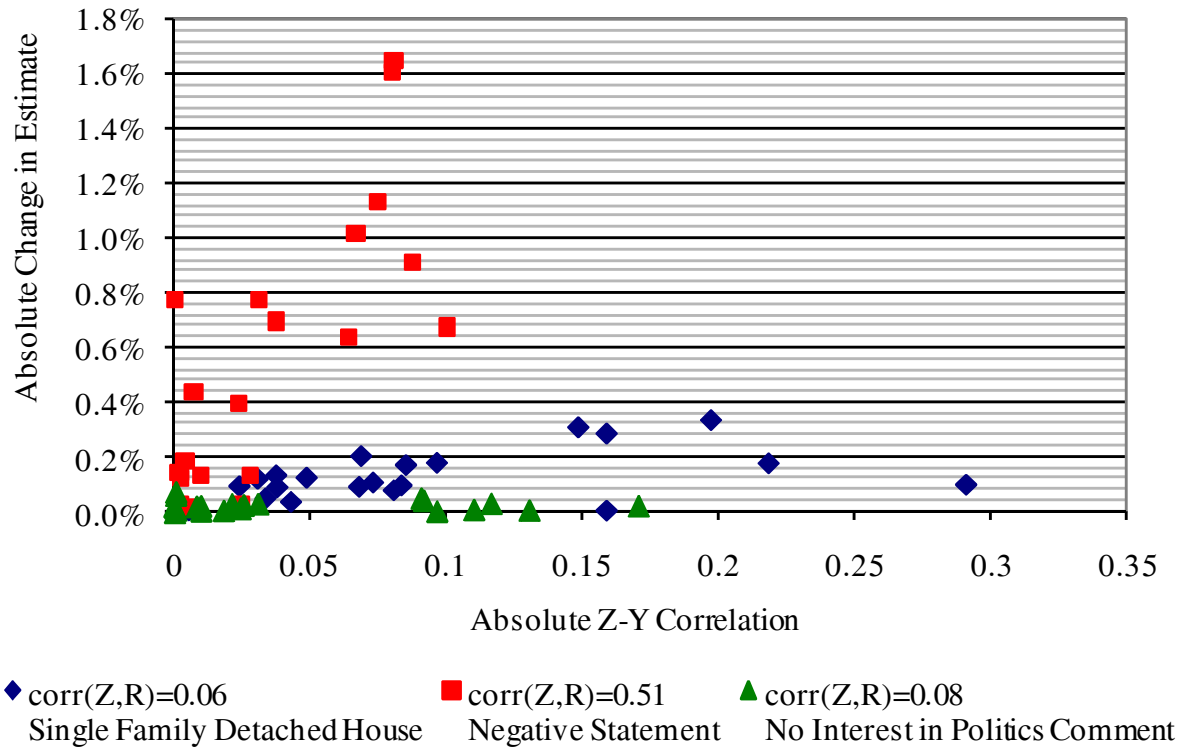

Figure 1. Absolute Change in Estimates of Means and Proportions for 21 Variables From Adding Z-variables to NES Nonresponse Adjustment: Single Family Detached Housing Unit, No Interest in Politics, and Negative Statement.

Appendix

Interviewer observations used:
Type of structure
- Mobile home
- Detached single family
- Multi-family
- Apartment house
- Condo complex
- Other (SPECIFY)

Whether or not he/she used these exact words, did the informant/respondent make any of the following comments?
- Surveys are a WASTE OF TIME
- I DON'T TRUST SURVEYS
- Surveys are a WASTE OF TAXPAYERS MONEY
- NEVER DO SURVEYS
- I'm NOT INTERESTED
- Other negative statement

Whether or not he/she used these exact words, did the informant/respondent make any of the following comments?
- I'm not interested in POLITICS