AN ANALYSIS OF NONRESPONSE TO JOB CORPS EVALUATION INTERVIEWS

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I. INTRODUCTION

In designing survey samples, a great deal of care must be taken to ensure that estimates of the parameters of interest have a specified degree of precision and, especially if a "program treatment" is being studied, that comparisons between controls and treated individuals are valid (i.e., that measurements of differences between treatment and controls are not biased by the presence of unmeasurable or unmeasured characteristics). For this reason the causes and impacts of sample erosion are of interest so as to improve sample designs for future studies, as well as to properly interpret the results of the study in which such erosion has occurred.

Individual characteristics that are hypothesized to affect sample erosion (also called "sample attrition" or "interview nonresponse") are numerous--age, level of education, race, health status, employment history, criminal history, use of drugs, mobility, type of living arrangement, and experience with previous interviews are just a few. For example, it could be argued that older, less-educated individuals are less familiar with the concept of surveys and thus would be less likely to respond to an interview. Similarly, if it is necessary to interview an individual at several points in time, the inability to locate him or her after the initial contact poses a serious sample-attrition problem. Thus, an unstable life-style or a high degree of mobility could be considered a possible cause of sample erosion. These factors may be reflected in an individual's employment or criminal history or in the type of living situation he or she chooses. If the survey is used to evaluate a social program, particularly one in which program participants perceive that they will benefit from being interviewed, then program participation may be associated with an increased likelihood of response to interviews.

As can be seen, there are a number of factors that can influence survey response. However, nonresponse itself (even differential treatment-comparison response rates) does not necessarily bias the estimates of an experimental effect, although it can lessen the precision of these estimates. If all the factors that cause nonresponse can be measured adequately, they can then be accounted for in models used to estimate experimental impacts. However, if unmeasured traits affect both the likelihood of response and some behavior that the experiment is hypothesized to influence, or if the behavior itself influences response, then nonresponse bias will generally be present in simple estimates, and findings that do not take this bias into account will be misleading.

This paper presents an analysis of nonresponse to interviews used in the Job Corps program evaluation. Studies of factors that influence nonresponse based on evaluation samples for other social experiments (such as the various Negative Income Tax experiments and the national demonstration of Supported Work)1/ suggest that an

individual's experimental-treatment status, age and possibly employment history, and residence in public housing have a significant impact on his or her likelihood of response. Those receiving the treatment, as compared with control-group members, older individuals, individuals with some work history, and individuals living in public housing (that is, possibly more responsible, less-transient persons), seem to be more likely to respond to interviews administered over a period of several years. In particular, the Job Corps sample can be considered to most closely resemble the Supported Work subsample of young school dropouts. Within this Supported Work subsample, females and individuals who lived with their parents were also more likely to be respondents. Although few studies have been conducted on the effect of nonresponse bias on the measurement of experimental impacts, and although they have uncovered generally very little evidence of bias, some bias was found for the Supported Work subsample of young school dropouts. Nonresponse bias caused the experimental effect on hours of work to be understated by 20 percent (see R. Brown, 1979).

II. A SUMMARY OF THE JOB CORPS PROGRAM AND EVALUATIVE SURVEY OPERATIONS

Job Corps, a program sponsored by the Department of Labor, is designed to alleviate unemployment problems among disadvantaged youths by providing them with job training, education in basic skills, and ancillary services such as health care. In addition, it provides a residential setting away from the participants' homes because it is believed that the home environment of these youths is not conducive to learning new skills and is, in most cases, detrimental to such development. Participants may remain in Job Corps for as long as 24 months, but the average participant remains only about 6 months. The effectiveness of this program was examined by administering a series of survey interviews to both Job Corps participants and a carefully selected comparison group. This paper will discuss the problems that are likely to stem from nonresponse to these interviews.

The sample of Job Corps participants used in the evaluation was a random selection of one-third of all individuals enrolled in Job Corps as of April 1977. Comparison-group members were chosen from school-dropout and Employment Service lists in 15 areas of the country, which were selected because they were similar to the areas in which Corpsmembers lived, except that they were areas in which Job Corps did not recruit extensively.

Baseline interviews were conducted from April to June 1977. There was a total of 6,629 interviews completed--5,133 for Corpsmembers and 1,496 for comparison-group members (a completion rate of 97 percent). Approximately nine months later, a follow-up interview was administered to all comparisons and to those Corpsmembers who had been out of Job Corps at least five months. The

completion rate for this interview was 86 percent. In March 1979, a second follow-up interview was fielded, and an attempt was made to contact all comparison-group members and Corpsmembers, with the exception of individuals who were in the military (5 percent), who were incarcerated (2 percent), or who were not yet out of Job Corps (1 percent). The completion rate for the second follow-up was 72 percent.

Most of the evaluation analysis was performed on the sample of individuals who had taken both the baseline interview and at least one of the follow-up interviews.2/ Therefore, a nonrespondent was defined as a person with a baseline interview and for whom at least one follow-up interview was attempted but no follow-up interview was completed.

III. THE METHODOLOGICAL APPROACH

The model used to investigate the existence of nonresponse bias in the measurement of Job Corps' impacts was originally developed by Heckman.3/ It allows the computation of a variable (called $\hat{\lambda}$ below) that may be included in ordinary least squares (OLS) models that are designed to test program impacts so as to correct for the fact that such OLS models are estimated on a censored sample--namely, the sample of individuals who respond to follow-up interviews. The corrected model can then be compared with its uncorrected counterpart, and any differences found can be attributed to nonresponse bias if the assumptions of the model hold.

The impact of Job Corps on various types of behavior was examined with models of the following form:

$$Y = X\beta_1 + Y_L\beta_2 + \epsilon,$$

where Y is some behavior of interest (such as weekly earnings or the proportion of time employed) measured at some point in time after participation in Job Corps; the vector X contains factors believed to affect the outcome (demographic and socioeconomic characteristics measured prior to enrolling in Job Corps, and variables that indicate program completion status from Job Corps); and Y_L is a measurement of the dependent variable taken prior to enrolling in Job Corps. These models were estimated using only the subsample of individuals who responded to Job Corps interviews. Therefore, it is reasonable to wonder whether selecting this sample on the basis of response to surveys is related to the outcomes of interest, and, hence, whether it could introduce bias to the measurements of program impacts.

Estimating a model of the probability of response of the form

$$PR(R=1) = \Phi(Z\beta_3/\sigma^{\frac{1}{2}})$$

provides the necessary information to compute $\hat{\lambda}$ for each observation in the censored (i.e., respondent) sample. Z contains many of the same variables as X, as well as some additional variables believed to affect response to follow-up interviews but not necessarily employment (for example, the individual's living arrangement, mobility prior to Job Corps enrollment, and the

length of his or her baseline interview).

IV. A MODEL OF THE PROBABILITY OF RESPONSE

In evaluations of other social programs, participation in the program was associated with higher response rates. This might also be expected with the Job Corps evaluation, although, due to the relatively small number of comparisons and relatively high number of program completers in the original sample, more intensive search methods were used for locating comparison-group members for follow-up interviews, and less intensive search methods were used for the longer-staying Corpsmembers.

Furthermore, it can be hypothesized that persons who have had more stable living conditions and who come from relatively more advantaged backgrounds--that is, those who: have had more education; have had some history of employment; have engaged in relatively less deviant behavior; are from less economically depressed areas--will be more likely to be found and be willing to respond to interviews than more disadvantaged, transient persons. On the other hand, individuals who are relatively better off prior to enrolling in Job Corps may be more likely to move to a new location to find work. Thus, they would be less likely to appear in our sample of respondents. Hence, a priori, it is difficult to predict who will or will not respond.

The average response rate among the male sample was 83.9 percent. Comparison-group members were, on average, approximately 15 percentage points more likely to respond than Corpsmembers. Completers and partial completers were the least likely to respond. This seems consistent with the fact that comparison-group members were the subject of more intensive search methods. Blacks seemed to be approximately 5 percentage points more likely to respond than members of other racial groups. American Indians, who made up approximately 4 percent of this sample, were least likely to respond. However, among the subsample of American Indians, Corpsmembers and comparison-group members were equally likely to respond.

None of the variables that describe age or socioeconomic characteristics seemed to have had any statistically significant effect on response. There was a trend for older, better-educated individuals from less economically depressed areas with prior employment, some receipt of welfare, a serious health problem, and some use of hard drugs to be more likely to respond. Individuals from areas with a high concentration of eligible youths participating in Job Corps were likely to be most familiar with the Job Corps program. Greater familiarity seemed to have been associated with increased likelihood of response (though not significantly).

Young men who lived with their parents prior to enrolling were, on average, approximately 5 percentage points more likely to respond than those who lived alone or in institutions; they were also somewhat more likely to respond than those living with other relatives or those who were heads of households. Males who said they had moved at least once in the last five years were less likely to be respondents. Those who had a telephone at the time of the baseline in-

terview, as well as those who were offered a payment for completing follow-up interviews, were more likely to respond. Living in public housing had a negative though not statistically significant effect on response.

The average response rate for the sample of females without children[4]/ was 85.5 percent. As with the male sample, the comparison response rate was, on average, nearly 15 percentage points higher than it was for Job Corps completers and partial completers. They were also somewhat, though not significantly, more likely to respond than Job Corps early dropouts. Blacks were more likely to respond than other racial groups.

Women who had been employed prior to enrolling were more likely to respond. Having used cocaine, heroin, or illegal methadone was associated with lower response rates. Individuals who had telephones at the time of their baseline interviews were more likely to respond than those who did not. Women whose baseline interviews were of a longer duration were more likely to respond to follow-up interviews.

Variables that characterize educational attainment, serious health problems, use of marijuana or alcohol, arrest history, and familiarity with Job Corps did not have statistically significant effects on response, but were associated with somewhat higher rates. Living arrangement, residence in public housing, and mobility prior to enrolling had no significant impact on response. However, the last two factors tended to be linked with lower response rates.

V.   NONRESPONSE BIAS AND THE MEASUREMENT OF JOB CORPS' IMPACT

Formal tests of nonresponse bias were performed on two of the employment outcomes examined in the body of the evaluation: the proportion of time employed, and average weekly earnings during the periods corresponding roughly to 7 and 16 months after terminating Job Corps training.[5]/ The specification of the outcome model adjusted for nonresponse bias is

$$Y = X\beta_1 + Y_L\beta_2 + \hat{\lambda}\beta_4 + \eta,$$

and any differences from the unadjusted model in estimates of the coefficients on the program status variables (included in X) can be attributed to nonresponse bias.

The coefficient on λ will be an estimate of the covariance of the disturbance terms in the response and outcome equations, divided by the standard deviation of the response disturbance term. Therefore, its sign will indicate the direction of the relationship between the likelihood of response and the outcome. For example, if the coefficient is positive, individuals with higher response rates are thus likely to have higher values of the outcome variables. (Recall that comparison-group members, relative to Corpsmembers, had higher response rates in both analysis samples).

Table I presents adjusted and unadjusted estimates of the effect of Job Corps on employment. For the subsample of males, unadjusted results indicate that Job Corps significantly increased the employment and earnings of program completers

and partial completers relative to comparison-group members, both 7 and 16 months after leaving Job Corps. Completers and partial completers earned, respectively, almost 45 dollars and 15 to 20 dollars more per week, and worked a greater proportion of their available time each quarter. Employment and earnings of early dropouts were not significantly different than those of comparison-group members.

From the estimates of the coefficient on $\hat{\lambda}$, there did not appear to be any statistically significant nonresponse bias in these estimates of program impacts, except for the estimate of the impact of Job Corps on the proportion of time employed 16 months after Job Corps. In this case, the effectiveness of Job Corps was understated by 13 percent for program completers and 22 percent for partial completers.[6]/ While there was no significant bias in the other employment and earnings estimates, nonresponse tended to cause these impacts to be somewhat understated as well. The negative signs on the coefficient for $\hat{\lambda}$ reflect this understatement. They imply that low response rates were associated with greater employment and earnings. Because Corpsmembers and, in particular, program completers were the least likely to respond, the working Corpsmembers were those who were most likely to be lost from the analysis sample. Thus, including these individuals in the analysis sample increases the estimates of these program impacts.

For the subsample of females without children, models of employment and earnings that have not been corrected for possible nonresponse bias suggest that program completers worked more of their available time and earned between 26 and 29 dollars more per week than comparisons, both 7 and 16 months after leaving Job Corps. Partial completers and early dropouts were indistinguishable from comparisons in this behavior, using the usual statistical criteria.

There was no statistically significant nonresponse bias in these estimates, although they tended to overstate program impacts for completers by approximately 10 percent at 16 months, and to overstate impacts on earnings by 4 and 11 percent 7 and 16 months, respectively--again with essentially no difference between early dropouts and comparisons. (However, employment effects at 7 months after leaving Job Corps seemed to be somewhat understated). The 16-month findings suggest that, unlike the male subsample, non-working Corpsmembers tended to be nonrespondents for the subsample of females without children.

VI.   CONCLUSION

In general, we found that response rates were significantly higher for comparison-group members than for Corpsmembers. Of the Corpsmembers, completers and partial completers were less likely to respond than early dropouts. This may have been due to the fact that early dropouts were more likely to be eligible for the first follow-up, thereby increasing their likelihood of responding to any follow-up interviews. Further, they were not as likely as completers and partial completers to have moved out of our interviewing areas to take employment after leaving Job Corps. Several other factors were found to be associated

TABLE I

ESTIMATES OF JOB CORPS EFFECTS ON SELECTED OUTCOMES, UNADJUSTED AND ADJUSTED
FOR NON-RESPONSE BIAS, BY ANALYSIS SAMPLE[1]/

A. APPROXIMATELY 7 MONTHS AFTER LEAVING JOB CORPS

	Unadjusted Coefficients			Adjusted Coefficients			
	Completers	Partial Completers	Early Dropouts	Completers	Partial Completers	Early Dropouts	$\hat{\lambda}$
Males							
Proportion time employed	.219**	.138*	.121	.216°°	.135°	.121	.023
Weekly earnings ($)	43.909**	19.268	17.276	44.408°°	19.709	17.290	-3.137
Females without children							
Proportion time employed	.155**	.002	-.093	.170°°	.019	-.088	-.091
Weekly earnings ($)	29.315**	10.144	-4.805	28.139°°	8.827	-5.254	6.160

B. APPROXIMATELY 16 MONTHS AFTER LEAVING JOB CORPS

	Completers	Partial Completers	Early Dropouts	Completers	Partial Completers	Early Dropouts	$\hat{\lambda}$
Males							
Proportion time employed	.244**	.134*	.124	.276°°	.163°°	.124	-.209°
Weekly earnings ($)	45.084**	15.891	12.260	49.306°°	19.648	12.353	-27.291
Females without children							
Proportion time employed	.212**	.141	.049	.191°°	.118	.043	.125
Weekly earnings ($)	26.129**	14.867	-.900	23.168	11.523	-1.986	16.164

[1]/Estimates of the impact of Job Corps on the proportion of time employed and average weekly earnings roughly 7 and 16 months after terminating Job Corps training are given as average differentials between comparison-group members and Corpsmembers in each program completion status category: program completers, partial completers, and early dropouts.

 * Statistically significant at the 10 percent level using a two-tailed test.
 ** Statistically significant at the 5 percent level using a two-tailed test.

 ° Approximate significance level: statistically significant at the 10 percent level using a two-tailed test.
 °° Approximate significance level: statistically significant at the 5 percent level using a two-tailed test.

These significance levels are only approximate because, while coefficients from this adjustment procedure are consistent, the usual standard errors computed during OLS estimation are only approximate and tend to overstate significance. That is, an estimate which appears not to be significant probably is not; however, we are uncertain about the actual significance on an estimate which appears significant.

with higher response rates in both analysis samples: being black; having some familiarity with the Job Corps program; not living in public housing; having more education; coming from relatively less economically depressed areas; and not having moved in the five years prior to enrolling in the study. The latter factors can be considered to indicate relatively more stable living conditions, which in turn can be associated with a propensity to respond to interviews.

In general, nonresponse bias was not a significant threat to the estimates of the impact of Job Corps. In fact, only one of the tests performed revealed a statistically significant estimate of the covariance between unmeasured influences on interview response and post-Job Corps behavior; moreover, that estimate could be stated only with 90 percent confidence. Furthermore, all changes in estimates of program impacts after adjusting for nonresponse were under 22 percent and, on average, closer to 10 percent. However, there was a tendency for program impacts on employment and earnings to be somewhat understated for males, but somewhat overstated for females without children. This suggests that Job Corps increased employability among males by increasing their mobility for finding employment, but increased employment locally for females without children. Therefore, we conclude that while nonresponse to follow-up interviews did exist and, in fact, was greater for Corpsmembers than for comparison-group members, estimates of the impact of Job Corps based only on the responding sample did not suffer from nonresponse bias.

NOTES

[1/] The following references were included:

Brown, R. "Assessing the Effects of Interview Non-Response on Estimates of the Impact of Supported Work." Princeton, New Jersey: Mathematica Policy Research, Inc., 1979.

Cain, G. and S. Garber. "Attrition." In The Rural Income Maintenance Experiment: Final Report. Madison, Wisconsin: Institute for Research on Poverty, 1976.

Hausman, J. and D. Wise. "Attrition Bias in Experimental and Panel Data: The Gary Income Maintenance Experiment." Econometrica, March 1979.

Peck, J. "The Problem of Attrition." The Final Report of New Jersey Graduated Work Incentives Experiment (Part C, Studies Relating to the Validity and Generalizability of the Results). Madison, Wisconsin: Institute for Research on Poverty; Princeton, New Jersey: Mathematica, 1974.

Pencavel, John and Richard West. "Attrition and the Labor Supply Effects of the Seattle and Denver Income Maintenance Experiments." September 1978.

Watts, H., J. Peck, and M. Taussig. "Site Selection, Representativeness of the Sample and Possible Attrition Bias." The New Jersey Income Maintenance Experiment. New York: Academic Press, 1977.

[2/] In the body of the evaluation analysis, error-components models were used to adjust for (1) the correlation of individual-specific errors over time and (2) the possibility of missing data because a respondent missed one of the follow-up interviews.

[3/] See Heckman, James. "Sample Selection Bias as Specification Error." Econometrica, January 1979.

[4/] The subsample of females with children has been excluded from this presentation: it was relatively homogenous and, because it made up less than 10 percent of the sample, estimates of the program impacts were rather imprecise. The body of the evaluation examined the three subsamples (males, females without children, and females with children) separately due to their underlying differences in behavior.

[5/] Although the models used in the nonresponse analysis (1) are somewhat simpler than those used in the body of the evaluation, (2) use OLS estimation rather than error components, and (3) examine behavior at a specific point in time rather than averages of post-Job Corps behavior, the estimates of program impacts obtained in the nonresponse analysis are reasonably similar to those found in the body of the evaluation. It should also be noted that all these outcome measures are limited dependent variables, so that ordinary least squares is not the most appropriate method of analysis. However, because least squares estimation was used in the body of the evaluation and because we are testing the results of this evaluation for nonresponse bias, least squares was also used here.

[6/] The overall effects of Job Corps would be understated by less, however, because there is essentially no difference between comparisons and the largest group of Corpsmembers--early dropouts.