Response Bias in Reports of Father's Education

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1. INTRODUCTION

Father's educational attainment is an important explanatory variable in studies by sociologists, educationists, and economists. It has been shown to be a significant predictor of youngsters' intergenerational occupation mobility [1] educational attainment [4,5] and success in school [7]. Yet the predictive power of this variable may be related to the inaccurate responses individuals (usually youth) give to questions on their fathers' educational attainment. Systematic response biases have been found in a number of other common variables secured from surveys [e.g., 2,6,9].

The evidence on response errors in estimates of father's education is very limited. Nonresponse rates appear to vary with age, with the lowest rates of refusal among teenagers and young adults.[1] In the only study we could find where the extent of the response error in reporting this variable was measured, Blau and Duncan concluded that there was ". . . no general tendency for the OCG respondents to exaggerate the attainment of their fathers, except that considerable numbers of OCG respondents appear to have classified their fathers as high school graduates when they should have been reported as completing only one to three years of high school" [1, p. 15]. This finding must be considered very tentative, however, since it was based on a rather circuitous and complicated estimation procedure.[2] Furthermore, Blau and Duncan presented only aggregate data and did not search for systematic biases which might be offsetting such as have been found in earnings data (2).

In this paper we make use of a unique sample of households in which the father and son were interviewed separately at different times within the same year and asked to report the number of years of schooling completed by the father. After a brief description of this data we turn to a summary of the bivariate relationships between each of three different measures comparing the two responses and selected characteristics of the son, his family, and his community. We then highlight some of the findings from two different multivariate techniques used to quantify the extent of these relationships and to assess the relative importance of the different explanatory factors. The final section provides an overall summary of these findings and some suggestions for further research.

2. THE DATA

The data for this study were obtained from two of the four National Longitudinal Surveys (LGS) of the civilian noninstitutional population in the United States. Each of the samples was selected by the Bureau of the Census under a contract with the Department of Labor with the initial interviews of the two relevant age-sex cohorts for this study--approximately 5,000 young men between the ages of 14 and 24 years and a comparable number of men between 45 and 59 years of age--completed in 1966. In each of the four surveys nonwhites were oversampled and comprised about 30 percent of the total sample.[3]

In an attempt to contain the costs of administering these surveys over a five-year period the Bureau of the Census allowed certain households to be represented in more than one cohort group. In the initial survey of the older men, one out of three households had at least one additional member represented in one of the four age-sex cohort samples, while three out of four households in the young boys' sample were multiple-respondent households. In total, there were 931 households, consisting of 936 men and 1167 boys, where at least one man and one boy in the same household were interviewed. Among the possible man-boy combinations, 1,013 were found to be father-son relations.[4] The sample was then reduced by 44 cases because the father failed to report his educational attainment. In another 56 cases the son did not report the years of schooling completed by his father and these observations also were eliminated. The remaining 913 cases contained father-son responses to similarly worded questions on the number of years of schooling completed by the father. Each of the respondents was also asked to report on selected demographic, economic, and geographical characteristics. Thus, it was possible to study not only the extent of the response discrepancy to the educational attainment variable but also to identify some of its correlates.

3. BIVARIATE ANALYSIS

The extent of the discrepancy between the son's reporting of his father's educational attainment and the father's response is measured in three ways: by the arithmetic difference in the two reported responses; by the absolute value of the response difference; and by an indicator variable which takes the value of "1" if the son and father report identically and a value of "0" if the responses differ. We began our analysis by examining the gross relationship between each of these dependent variables and a variety of possible explanatory variables (these findings are presented in columns 3, 5, and 7 of Table 1.)

Even though we do not provide in this paper a formal theory of the incidence and magnitude of the response variation from which a set of contributory variables can be identified we nevertheless expect to find that the discrepancy between what the son reports and his father's response is related to the various characteristics listed in the previous section. Among the demographic factors considered are the age of the son, his father's age, the differences between the two ages, the size of the household, and the son's color. Also included in this category are educational status of the son, the number of years of schooling he has completed, and his estimate of the educational attainment of his father. The geographic place of residence of the household and whether it is located in a central city of an SMSA are considered. The list of economic factors includes the labor force status of the son, the occupational category of the job his father held

for the longest period in the 12 months prior to the son's interview, and the son's estimate of his family's income.

The strong color difference in responses among the respondents is perhaps the single most significant finding from this preliminary analysis. Whereas in the total sample 61 percent of the 913 father-son responses are identical, among the 686 whites it is 68 percent, while among the 211 blacks it falls to 37 percent. The greater likelihood of a response discrepancy among the blacks also suggests that the distribution of the latter responses will be more variable and thus on the average contain the larger error.[7] This is what we find in Table 1; the mean absolute discrepancy for this color group is about one year, which is double the magnitude found among the whites.

The likelihood of a discrepancy in response is substantially reduced at what are traditionally called terminal attainment points. The likelihood of a father-son match is about three of four cases for sons who report 8, 12, or 16 or more years of schooling completed by their fathers. The corresponding probability of a match for other reported attainments of the father is considerably smaller and varies between four or five of every ten comparisions. The lowest likelihood of a match is found among sons who report their fathers' educational attainment as less than eight years of schooling (Table 1).

We also found the difference in responses to be associated with several other characteristics. Whereas the mean arithmetic difference is less than one-tenth of one year when the age difference between the father and his son is 21 to 25 years it increases to almost four-tenths of a year when the age difference is between 41 and 45 years. Households with family sizes of at least 10 members (including father and son) are considerably more likely to have fathers and sons report differently and to have larger mean discrepancies in responses than smaller households. Sons who report their fathers employed in white-collar occupations are much more likely to agree with their fathers' responses on educational attainment, while those who say their fathers are in service occupations are most likely to report differently. Finally, boys who were enrolled in school were more likely than those not enrolled to match their fathers' responses.

The bivariate analyses, however informative and suggestive, fail to control for the interrelationships among the set of explanatory variables. For example, since color, household size, and educational attainment are intercorrelated, it is difficult to distinguish which of these variables, if any, is significant. To redress this limitation, we also analyze the data using multivariate techniques.

4. MULTIVARIATE ANALYSIS

Two multivariate techniques were used--Multiple Classification Analysis (MCA) and the AID program developed by Morgan and Sonquist [8]. The MCA program assumes an additive relationship among the variables with the parameters estimated by ordinary least squares procedures.[9] The AID analysis is designed to uncover nonadditive or interaction effects among the factors and is a sequential application of a one-way two-factor analysis of variance test.[10]

4.1 Additive Specification--MCA Findings

The results of the MCA analysis do not drastically change the findings deduced from the bivariate relationships (See columns 4, 6, and 8 of Table 1). The singular importance of the color variable still prevails even after statistically controlling for the other specified factors. The mean absolute discrepancy among blacks is now a little less than one year but still double the mean discrepancy reported by the whites. The adjusted likelihood of a father-son match remains at about two in three for the whites but increases to almost one in two for the blacks.

The likelihood of a mismatch continues to be above the sample mean where the son reported his father's educational attainment as less than 8 years, 9 to 11 years, or 13 to 15 years and in the case of a response in the 0-7 year category it is 22 percentage points below the mean. Similarly, the higher-than-average likelihood of a match if the son reported his father's educational attainment level at a transition point is also evident; in almost three of every four cases the father reported the identical number of years of schooling completed. Finally, the mean absolute discrepancy in response, while expected to be larger at nontransition points, also continues to be largest among sons who reported their fathers' educational attainment as less than eight years. For these respondents the adjusted mean absolute discrepancy is about one year, which is about one and one-half times the sample average.

The less-than-average likelihood of a father-son match for households with 10 or more members and the above-average mean discrepancy in response is not substantially altered by the multivariate findings. Whereas in the entire sample about three of five father-son responses are identical, among the largest-sized households only two of five responses coincide. Similarly, whereas in the entire sample the mean absolute discrepancy is about three-fifths of a year among these households it is slightly more than one year.

The larger-than-average likelihood of a father-son match that was observed in the bivariate relation when the son reported his father as employed in a white-collar occupation is no longer evident with the introduction and control of other factors. In contrast, the low likelihood of a match when the father is reported in a service occupation, while increased as a result of the multivariate analysis, is still about 10 percentage points below the average for the entire sample.

There continues to be some evidence that boys who are enrolled in school at the time of interview are more likely than those not enrolled to report in the same way as their fathers do. The adjusted likelihood of a matching response for boys out of school is about nine percentage points below the likelihood for those in school. Once again the higher likelihood of a match is accompanied by a smaller mean absolute difference.

The coefficient of multiple determinantion adjusted for the number of explanatory variables is a summary measure frequently used to evaluate the goodness of fit of a statistical relation. Since each specification attempts to answer a different question,[11] it is not too surprising to find that the regressor variables explain only 4.5 percent of the total variance in the arithmetic difference formulation, approximately 10.3 percent of the variation when the dependent variable is the absolute difference in response, and 19.3 percent of the total variance in the linear probability model.

4.2 Nonadditive Specification--AID Findings

The results of the AID analysis further highlight the importance of color and the son's estimate of the educational attainment of his father and help to identify other variables which interact with these factors to explain the degree of variation in the father-son responses to the number of years of schooling completed by the father. In both the absolute difference and the likelihood of a matching response specifications the color of the son is the basis for the initial split of the sample. With the latter dependent variable the two color subgroups are then further dichotomized by the educational attainment of the father as reported by his son. As expected, the overall likelihood of a match among the blacks (0.374) is substantially reduced when the sons reported their fathers' attainments as less than eight years (0.313) and it is increased above the group average if they report attainments of eight or more years (0.544). No other specified variable has sufficient explanatory power to split these latter two subgroups further.

The pervasive importance of the son's estimate of his father's educational attainment is also evident in the subsample of nonblacks (whites and other-than-blacks). The sample is split repeatedly by this variable and the terminal groups highlight the greater likelihood of a matching response when the son reports one of the terminal attainment points. The likelihood of a match for this color group varies from about two in very five cases when the son reports his father's education as between nine and eleven years to about four of five cases if he reports an attainment of eight years.

The likelihood of a match among the nonblacks where the son reports his father has completed at least a high school education is also affected by the age of the father and the occupation group he is reported employed in by his son. The likelihood of a match is inversely related to the age of the father and is significantly reduced below the group average if the father is reported employed in the white-collar occupation.

There is additional evidence that place of residence also affects the likelihood of a match for the sample of nonblacks where the sons report the lowest educational attainments for their fathers. The likelihood of a father-son match is only one in five for nonblack households living in central cities of SMSA but greater than six in ten for those who live outside the central city or do not live in an SMSA.

As we indicated earlier the difference in color is also the basis for the initial split of the sample when the dependent variable is defined as the absolute difference in response. In this specification, however, the geographic locational characteristics of the blacks and nonblacks affect the magnitude of the absolute response difference. This magnitude is also influenced by the size of the family income of the blacks and the age of the father and the labor force status of the son among the nonblacks. For example, the mean absolute error is less than one-third of a year for nonblack households not located in the largest populated urban areas and where the son was not employed at the time of interview, while it is almost two years for blacks who live in a noncentral city of an SMSA.

5. CONCLUSIONS

The findings from the multivariate analysis highlight the greater than average likelihood of a response difference and a larger mean discrepancy in reporting among blacks than nonblacks and among boys who did not report their fathers' educational attainments as one of the terminal points. We also found that boys from very large households, who reported their fathers employed in service occupations, or who were not enrolled in school, were also more likely than others to respond differently from their fathers. There is also evidence of an interaction effect between color and locational characteristics of place of residence on the size of the mean absolute discrepancy.

These findings indicate the need for caution when using a son's report of his father's educational attainment. Moreover, our estimates may be understated since we have limited the comparisons to fathers and sons living in the same households. In addition, since this analysis is restricted to specific father-son age categories the findings may not generalize to other age group comparisons. Thus there is a need to replicate this study for other universes and also to determine a set of "correction factors" which may be used to adjust the responses of the sons to improve the predictive power of this variable.

FOOTNOTES

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[1]Bowles and Levin report that 50 percent of first graders, 40 percent of third graders, 41 percent of sixth graders, 21 percent of ninth graders and 11 percent of twelfth graders did not respond when asked to report their fathers' educational attainment [3, p. 7]. Blau and Duncan found that for adult males the percentage of nonreporters increased with age, rising from 5.4 percent for those 20 to 24 years of age to 18.2 percent for men aged 55 to 64 years [1, p. 472].

[2]Blau and Duncan arrayed their sample by year of birth, used vital statistics records to estimate the distribution of father's year of birth, and compared the educational attainment reported in the 1940, 1950, and 1960 Censuses for each age cohort with the distribution

as reported by the respondents. For a complete description of this process see Blau and Duncan [1, p. 463-66].

[3] A more complete description of these is found in Parnes, et al., [10, 11].

[4] In order to qualify as a potential match the man had to report that he had at least one son in the household and the boy had to list his father as a member of his household. The son's age, as reported in the man's household record, also had to agree with the age reported by the boy when he was interviewed. In addition, the father's age reported in his son's record had to coincide with the age reported by the man. If these criteria were satisfied then a father-son relation was established.

The surveys of the men and boys were not conducted simultaneously, however. The boys were interviewed in October and November of 1966 and the men in June of the same year. Thus the age of the father when reported by his son could exceed by one year the age that the father reported. Similarly, the father could understate his son's age by one year because of the different dating of the two interviews. Our matching procedure allowed for these possibilities.

In households where more than one boy (man) was interviewed each man-boy combination was treated separately. Thus to the extent that there were multiple father-son relations in the same household they were considered as individual observations in the analysis.

[5] The overall nonresponse rate--5.8 percent--was expected to be small because of the age distribution of the boys and the fact that they were living in the same households as their fathers. Higher than average rates were found among boys whose fathers reported between one and four years of schooling completed, among the nonwhites, among boys with six to eight years of schooling, and among boys whose fathers were 55 years and older.

[6] The independence in reporting was made possible by the four-month interval between the father-son interviews. There is the possibility that during this period the father completed an additional year of formal schooling. We believe, however, that this likelihood is very small, particularly for the age group of men and the short time interval under consideration, and we discount, therefore, this possibility.

[7] We have been deliberately careful in this discussion to avoid any inference that the father's response is necessarily accurate or even that it is likely to be more accurate than what his son reports. To the extent that the father reports his educational attainment inaccurately it would not be too surprising to find that he selects one of the terminal educational points as a response (if you include 104 respondents in the 16 years or more category, better than one-half of the fathers reported their educational attainments as 8, 12, or 16 years. Alternatively, we are suggesting the possibility that both respondents report inaccurately. Unfortunately, our data do not provide a means to test for the accuracy of the father's response.

[8] It is also of interest to observe that the conditional distribution of the educational attainment of the father as reported by his son is skewed to the right. The son's response is necessarily bounded from below by zero for very low attainments reported by his father. Nevertheless, even when the alternatives are more symmetrical (educational attainments of the father between 8 and 10 years) the son's response is more likely to exceed than understate that of his father. It is not too surprising to find, therefore, that the mean discrepancy in the sample is positive.

[9] It needs to be mentioned that the traditional "t" and "F" tests of maintained hypotheses involving linear combinations of the unknown parameters are somewhat suspect in this study in two of the three specifications. The frequency distribution of the absolute discrepancy measure is clearly asymmetrical, positively skewed, and bounded from below by zero. Since the least squares estimators in this case are weighted sums of nonsymmetrically distributed variables (the weights depend on the data matrix) one has to defer to the central limit theorem to argue that in repeated sampling these estimators will be normally distributed. The speed by which this convergence takes place, particularly when the universe is finite and the observations not independent, is not known, however.

In the case of the linear probability model (or discriminant function) the dependent variable is binomially distributed and the estimators are known to be inefficient unless a weighted least squares estimation procedure is used (however, the estimated probabilities may exceed one or fall below zero in which case further complications are introduced). If one also adds to these statistical complications the fact that our sample was selected by a multistage probability design, and therefore the traditional standard error formulas based on simple random sampling may be in error, and that the universe sampled is finite, there is some justification on our part to de-emphasize throughout this paper all tests of hypotheses.

[10] At each stage in the analysis the algorithm searches the data to identify a binary split of the codes of one of the variables which among the class of all binary partitions for all specified variables reduces the error sums of squares of the dependent variable by the largest amount. The search procedure continues until there are no eligible groups remaining which have sufficient sample cases or where the total sums of squares in each of the eligible groups do not exceed some earlier assigned constant. The program also terminates if the between sums of squares of the maximum partition of a variable fails to exceed another preassigned constant. In this study no group is eligible to be "split" unless it contains at least 10 sample cases and the total sums of squares in the group is at least one-tenth of 1 percent of the total sums of squares in the sample. No binary partition of a variable is allowed unless the between sums-of-squares associated with this partition exceeds six-tenths of 1 percent of the total sums of squares in the sample.

[11] It should be recalled in this context that we have standardized the set of regressor variables in each of the specifications and varied only the definition of the dependent variable. The specification involving the arithmetic difference in father-son response involves both a sign and magnitude consideration whereas the absolute difference abstracts from the direction of the discrepancy while still retaining the metric of the difference. In contrast, the linear probability formulation asks only whether or not the father and son respond identically. The later specification thereby abstracts from both the sign and magnitude of the discrepancy.

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Table 1 Gross and Net Mean Difference in the Education Attainment of the Father as Reported by Father and Son, by Selected Characteristics and Type of Discrepancy, 1966

Characteristics	Sample cases		Mean arithmetic difference		Mean absolute difference		Likelihood of identical responses	
	N (1)	% (2)	Gross relationship (3)	Net relationship (4)	Gross relationship (5)	Net relationship (6)	Gross relationship (7)	Net relationship (8)
Total	913	100.0	0.239	0.239	0.631	0.631	0.611	0.611
Age difference (years)								
21-25	22	2.4	0.091	-0.373	0.545	0.453	0.545	0.545
26-30	240	26.3	0.217	0.079	0.500	0.521	0.679	0.627
31-35	409	44.8	0.311	0.290	0.682	0.697	0.604	0.598
36-40	203	22.2	0.108	0.285	0.670	0.634	0.576	0.631
41-45	39	4.3	0.384	0.794	0.744	0.691	0.487	0.584
Color (son)								
White	686	75.1	0.172	0.175	0.504	0.542	0.682	0.654
Black	211	23.1	0.450	0.448	1.056	0.925	0.374	0.471
Other	16	1.8	0.313	0.222	0.438	0.554	0.688	0.644
Household size								
2	8	0.9	0.250	0.343	0.500	0.255	0.500	0.622
3	140	15.3	0.271	0.285	0.614	0.684	0.611	0.564
4-6	558	61.1	0.142	0.140	0.543	0.573	0.658	0.636
7-9	142	15.6	0.331	0.355	0.697	0.610	0.570	0.636
10-26	65	7.1	0.800	0.720	1.292	1.107	0.308	0.443
Father's educational attainment[b]								
0-7	205	22.5	0.132	-0.083	1.010	0.939	0.370	0.392
8	153	16.8	-0.020	-0.035	0.386	0.387	0.732	0.731
9-11	140	15.3	0.407	0.384	0.821	0.792	0.436	0.440
12	240	26.3	0.342	0.311	0.458	0.491	0.783	0.775
13-15	61	6.7	0.262	0.454	0.623	0.668	0.508	0.509
16+	114	12.5	0.342	0.528	0.412	0.482	0.789	0.764
Father's occupation group[b]								
White-collar	292	32.0	0.188	0.079	0.476	0.592	0.702	0.605
Blue-collar	418	45.8	0.225	0.236	0.689	0.689	0.572	0.609
Service	48	5.3	0.542	0.512	1.000	0.819	0.417	0.495
Farm worker	104	11.4	0.231	0.447	0.673	0.727	0.577	0.613
Armed forces	1	0.1	a	a	a	a	a	a
NA	50	5.5	0.380	0.516	0.620	0.489	0.660	0.771

Type of discrepancy

Table 1 (continued)

Characteristics	Sample cases		Type of discrepancy: Mean arithmetic difference		Mean absolute difference		Likelihood of identical responses	
	N (1)	% (2)	Gross relationship (3)	Net relationship (4)	Gross relationship (5)	Net relationship (6)	Gross relationship (7)	Net relationship (8)
Educational status (son)								
Enrolled	697	76.3	0.195	0.220	0.585	0.603	0.641	0.632
Not enrolled	216	23.7	0.380	0.301	0.778	0.721	0.514	0.545
Educational attainment (son)								
0-7	51	5.6	0.373	0.302	0.765	0.411	0.549	0.774
8	94	10.3	0.213	0.262	0.766	0.685	0.511	0.571
9-11	426	46.7	0.221	0.269	0.662	0.654	0.598	0.594
12	172	18.8	0.279	0.218	0.523	0.519	0.662	0.670
13-15	145	15.9	0.206	0.153	0.552	0.726	0.676	0.574
16+	25	2.7	0.280	0.154	0.520	0.702	0.600	0.540
Residence								
Urban: one million or more	249	27.3	0.313	0.290	0.707	0.732	0.594	0.590
Urban: 250,000-999,999	120	13.1	0.417	0.337	0.750	0.762	0.542	0.542
Urban: less than 250,000	76	8.3	0.395	0.369	0.789	0.775	0.618	0.673
Urban: outside urban	135	14.8	0.178	0.226	0.504	0.593	0.644	0.574
Rural	332	36.4	0.108	0.141	0.548	0.491	0.633	0.652
NA	1	0.1	a	a	a	a	a	a
SMSA								
SMSA central city	258	28.3	0.333	0.164	0.736	0.527	0.554	0.612
SMSA noncentral city	300	32.9	0.337	0.372	0.670	0.758	0.630	0.579
Not SMSA	355	38.9	0.087	0.181	0.521	0.599	0.637	0.638
Age (son) years								
14-15	257	28.1	0.206	0.092	0.634	0.604	0.588	0.571
16-17	281	30.8	0.206	0.199	0.676	0.703	0.612	0.596
18-19	207	22.7	0.227	0.268	0.546	0.606	0.647	0.619
20-21	84	9.2	0.381	0.478	0.619	0.555	0.679	0.747
22-23	65	7.1	0.308	0.500	0.708	0.640	0.492	0.592
24	19	2.1	0.421	0.538	0.632	0.507	0.632	0.763
Family income[b]								
Under $1,000	18	2.0	-0.444	-0.329	0.444	0.366	0.667	0.731
1,000-2,999	71	7.8	0.451	0.382	0.958	0.576	0.366	0.569
3,000-4,999	91	10.0	0.264	0.233	0.725	0.561	0.549	0.6337
5,000-7,499	175	19.2	0.074	0.149	0.657	0.647	0.634	0.660
7,500-14,999	370	40.5	0.254	0.240	0.514	0.576	0.665	0.623
15,000 or more	135	14.8	0.400	0.362	0.681	0.840	0.615	0.519
NA	53	5.8	0.170	0.229	0.698	0.713	0.566	0.580
Labor force status (son)								
Employed	489	53.6	0.303	0.284	0.716	0.680	0.558	0.577
Unemployed	51	5.6	0.235	0.222	0.667	0.613	0.647	0.686
Out of labor force	243	26.6	0.107	0.128	0.428	0.498	0.704	0.657
Never worked	130	14.2	0.246	0.282	0.677	0.701	0.623	0.627
Age of father (years)								
45-47	272	29.8	0.199	0.339	0.522	0.617	0.665	0.630
48-50	252	27.6	0.258	0.243	0.663	0.614	0.619	0.642
51-53	212	23.2	0.307	0.305	0.618	0.602	0.604	0.609
54-56	108	11.8	0.250	0.137	0.898	0.823	0.481	0.510
57-59	69	7.6	0.101	-0.213	0.565	0.539	0.594	0.590

a Means are not presented when number of sample cases is less than 5.

b Reported by son.