TABLE C-1. THE RATIO OF AVERAGE ANNUAL EARNINGS ACCORDING TO SOCIAL SECURITY DATA AND AVERAGE ANNUAL EARNINGS ACCORDING TO SURVEY DATA[a]

	Women			Men		
	Year Before Training	Year After Training	Percent Change	Year Before Training	Year After Training	Percent Change
All CETA Training	1.05	1.00	-5	0.97	0.93	-4
Classroom training	1.07	1.05	-2	1.07	0.99	-7
On-the-Job training	1.00	0.89	-11	0.98	0.95	-3
Work experience	1.03	0.98	-5	0.85	0.82	-4

a. Earnings from both data sources were expressed in 1980 dollars.

But this bias was probably even smaller, due to a potential shift in the coverage of earnings by the surveys. Pre-program earnings data were obtained from surveys administered while participants were in the program. Thus participants may have understated their pre-program earnings to protect their eligibility for the program. This was less likely to be the case for the post-program earnings data obtained from surveys administered after participants had left the program. Thus the ratio of Social Security to survey earnings may have overstated Social Security coverage during the pre-program year but not during the post-program year. If this were the case, the previous estimate of the decline in participants' Social Security coverage between these two years would be too large.

Because of the small size of this potential bias and lack of more precise information, estimates of the effect of training were not adjusted explicitly for it.

THE SOCIAL SECURITY REPORTING MAXIMUM

Only earnings up to a specified limit are covered by Social Security taxes, so earnings are reported only up to this limit.[5] If a substantial number of participants or comparison group members reached this limit for a number of years and this problem occurred more frequently during the pre-program period than it did during the post-program period (or vice-versa) and this disproportionate occurrence was more pronounced or entirely different for CETA participants than it was for comparison group members, then estimates of the effect of CETA training might be biased.

But few CETA participants or comparison group members ever reached the Social Security earnings maximum during the 1970-1978 pre-to-post-program analysis period (see Table C-2). This was especially true for female participants and for all comparison group members.

TABLE C-2. PERCENTAGE OF THE SAMPLE THAT REACHED THE SOCIAL SECURITY EARNINGS MAXIMUM BETWEEN 1970 AND 1978[a]

Percentage Who Reached the Maximum	Women			Men		
	One Time	Two Times	Three or More Times	One Time	Two Times	Three or More Times
All CETA Training	1	0	0	6	3	5
Classroom training	1	1	0	7	3	5
On-the-job training	2	0	0	7	4	9
Work experience	1	0	0	4	3	2
Comparison Group	0	0	0	3	1	0

a. Percentages do not sum across different types of training because the base for each group was different.

5. This upper bound was $7,800, $7,800, $9,000, $10,800, $13,200, $14,100, $15,300, $16,500, and $17,700 during the years 1970-1978, respectively (the analysis period for this study).

The 14 percent of the male participants who ever reached the earnings maximum during the nine-year analysis period did so primarily during the pre-program period (see Table C-3).[6] This probably produced a slight underestimate of post-program earnings in the absence of training, which probably overestimated the effect of training for men slightly. But due to the small proportion of male participants involved and the relatively infrequent occurrence of this phenomenon, its effect was probably negligible.

TABLE C-3. PERCENTAGE OF MALE CETA PARTICIPANTS WHO REACHED THE SOCIAL SECURITY EARNINGS MAXIMUM DURING THE PRE-PROGRAM AND POST-PROGRAM PERIODS

Number of Times During the Pre-Program Period	Number of Times During the Post-Program Period		
	0	1	2
0	86	1	0
1	5	0	0
2	3	0	0
3+	4	1	0

6. From 5 to 9 percent of the male participants reached the earnings maximum in any given year during this period.

APPENDIX D. ESTIMATING THE BIAS CAUSED BY CETA PARTICIPANTS IN THE COMPARISON GROUP

Because the comparison group was drawn from a national sample of U.S. residents (the Current Population Survey), it probably contained unidentified CETA participants. But the likely percentage of such unidentified participants was negligible and thus the effect of their presence (frequently referred to as contamination bias) was negligible.

NATURE OF THE PROBLEM

The model used to estimate the effect of training can be expressed as:[1]

$$Y_{it} = f(\bar{Y}_{it-s}, \bar{X}_i) + \Sigma_q \gamma_q \cdot T_{qit} + \gamma_c \cdot c_{it} + U_{it} \qquad (D1)$$

where:

Y_{it} = person i's earnings in year t;

$f(\bar{Y}_{it-s}, \bar{X}_i)$ = person i's expected earnings in year t without training, according to a vector of past earnings $\bar{Y}_{it-s}$ and a vector of personal characteristics, $\bar{X}_i$;

T_{qit} = one if person i had participated in the qth type of CETA training (classroom training, on-the-job training, or work experience) before year t, and zero otherwise;

c_{it} = one if person i was a comparison group member and year t was a year corresponding to a post-program year for participants, and zero otherwise;

1. To simplify the discussion, this appendix expresses the basic model somewhat differently from the way it is expressed elsewhere in this paper. It also ignores the minor adjustment for the pre-program dip and the adjustment for inflation, neither of which would affect the conclusions of this appendix.

γ_q and γ_c = mean deviations from expected earnings for the qth type of training and the comparison group, respectively; and

U_{it} = a random disturbance.

$\hat{I}_q$, the estimated impact of training type q, can thus be expressed as:

$$\hat{I}_q = \hat{\gamma}_q - \hat{\gamma}_c \tag{D2}$$

where $\hat{\gamma}_q$ and $\hat{\gamma}_c$ are estimates of γ_q and γ_c. If there were no CETA participants in the comparison group then:

$$E(\hat{I}_q) = \gamma_q - \gamma_c \tag{D3}$$

and, in the absence of any other problems, one would obtain unbiased estimates of the impact of each type of training.

But if the comparison group contained CETA participants in proportion π_q, where:

$$\pi_c + \sum_q \pi_q = 1 \tag{D4}$$

then estimates $\hat{\gamma}_c$ obtained from Equation D1 would be biased. Consequently, estimates $\hat{I}_q$ would also be biased. To see this note that:

$$E(\hat{\gamma}_c) = \pi_c \cdot \gamma_c + \sum_q \pi_q \cdot \gamma_q \tag{D5}$$

and

$$E(\hat{\gamma}_q) = \gamma_q \tag{D6}$$

Thus:

$$\begin{aligned} E(\hat{I}_q) &= E(\hat{\gamma}_q) - E(\hat{\gamma}_c) \\ &= \gamma_q - \pi_c \cdot \gamma_c - \sum_q \pi_q \cdot \gamma_q \end{aligned} \tag{D7}$$

and

$$\begin{aligned} \text{BIAS}(\hat{I}_q) &= E(\hat{I}_q) - I_q \\ &= (1 - \pi_c)\gamma_c - \sum_q \pi_q \cdot \gamma_q \end{aligned} \tag{D8}$$

That is, the bias depends on the contamination proportions, π_q. If they were all zero (i.e., if there were no CETA participants in the comparison group) there would be no bias. But as these proportions increase, other things being equal, the bias increases.[2]

MAGNITUDE OF THE PROBLEM

To estimate the contamination bias, one must estimate the contamination proportions. Estimates of the largest likely proportions were obtained as follows for minority and non-minority men and women.

First, the size of the populations represented by the participant and comparison group samples were computed by summing their sampling weights accordingly (see Table D-1). Contamination proportions were then approximated by the ratio of the size of the participant population to the size of the comparison group population (see Table D-2).

For example, the sum of the weights for minority females indicated a participant population of 57,900 persons and a comparison group population of 5,530,900 persons. Thus 57,900/5,530,900 or 0.010 of the comparison group probably entered CETA training between January 1975 and June 1976. The corresponding results for non-minority females, minority males, and non-minority males were contamination proportions of 0.002, 0.013, and 0.005, respectively.

To complete the analysis, the presence of other CETA participants (public service employees and participants in multiple activities) plus earlier CETA participants (who entered in 1974) and later CETA participants (who entered by 1978) were accounted for as follows. The ratio of all CETA participants (including those in public service employment and multiple activities) over 24 years old who entered the program between January 1975 and June 1976 and stayed for more than seven days, to CETA participants included in Tables D-1 and D-2 was about 2.0.[3] In addition, according to data from Bassi (1982, p. 85), the ratio of all CETA

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2. For positive γ_q.

3. This ratio was estimated from the Continuous Longitudinal Manpower Survey.

TABLE D-1. PARTICIPANT AND COMPARISON GROUP POPULATION SIZE BY SEX, MINORITY STATUS, AND TYPE OF TRAINING[a]/

	Women		Men	
	Minority[b]/	Non-Minority[b]/	Minority[b]/	Non-Minority[b]/
All CETA Participants	57,900	64,700	55,800	77,000
In classroom training	37,600	30,500	27,900	24,400
In on-the-job training	7,000	10,000	10,900	22,400
In work experience	13,300	24,200	17,000	30,200
Comparison Group Members	5,530,900	27,508,700	4,293,400	16,865,600

SOURCE: Estimates were derived from the Continuous Longitudinal Manpower Survey and the March 1976 Current Population Survey.

a. For persons over 24 years old and in CETA training for more than seven days.

b. Non-minority persons included all white, non-Hispanic persons. Minority persons included everyone else.

TABLE D-2. CONTAMINATION PROPORTIONS RESULTING FROM 1975-1976 ADULT CETA PARTICIPANTS BY SEX, MINORITY STATUS, AND TYPE OF TRAINING[a]

	Women		Men	
	Minority[b]/	Non-Minority[b]/	Minority[b]/	Non-Minority[b]/
All CETA Participants	0.010	0.002	0.013	0.005
In classroom training	0.007	0.001	0.006	0.001
In on-the-job training	0.001	0.000	0.003	0.001
In work experience	0.002	0.001	0.004	0.002

a. For persons over 24 years old and in CETA training for more than seven days.

b. Non-minority persons included all white, non-Hispanic persons. Minority persons included everyone else.

entrants from the beginning of the program in 1974 through the end of the analysis period in calendar year 1978, to all entrants between January 1975 and June 1976 was about 3.1.[4]

To account for the presence of these additional participants in the comparison group, each of the contamination proportions in Table D-2 was multiplied by 2.0 times 3.1 or by 6.2. But this did not affect the results appreciably (see Table D-3). On balance it appeared that contamination bias was probably negligible.

TABLE D-3. CONTAMINATION PROPORTIONS INCLUDING ALL 1974-1978 ADULT CETA PARTICIPANTS BY SEX AND MINORITY STATUS[a]

	Women		Men	
	Minority	Non-Minority	Minority	Non-Minority
Adult CETA Participants	0.062	0.012	0.081	0.031

a. For persons over 24 years old and in CETA training, public service employment, or multiple activities more than seven days.

b. Non-minority persons included all white, non-Hispanic persons. Minority persons included everyone else.

4. See Laurie Jo Bassi, "Estimating the Effect of Training Programs with Nonrandom Selection," draft of Ph.D. dissertation, Economics Department, Princeton University (1982).

APPENDIX E. FINDINGS BY OTHER STUDIES ABOUT THE RELATIVE EFFECTIVENESS OF CLASSROOM TRAINING, ON-THE-JOB TRAINING AND WORK EXPERIENCE

Westat, Inc. (1981), Taggart (1981), the U.S. General Accounting Office (1982) and Bassi (1982) used the Continuous Longitudinal Manpower Survey to examine the effect of CETA training on participants' post-program earnings.[1] The first three studies used the same estimates of this effect--those obtained originally by Westat, Inc. These studies are hereafter referred to as Westat, et al. Bassi obtained independent estimates using a different statistical estimation procedure.

The results of these studies were similar in many respects to the results presented in this paper. But a key finding by Westat, et al--that on-the-job training worked best by a substantial margin--is directly contrary to the result of the present analysis of no statistically significant or substantively large difference among the effects on earnings of classroom training, on-the-job training or work experience.

As indicated below, however, the finding by Westat, et al that on-the-job training was most effective was based on a statistical model that undercompensated for the fact that participants in on-the-job training consistently earned more than participants in classroom training or work experience before they entered a CETA program.

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1. See Westat, Inc., Continuous Longitudinal Manpower Survey: Net Impact Report No. 1 (U.S. Department of Labor, March 1981). See Robert Taggart, A Fisherman's Guide: An Assessment of Training and Remediation Strategies (W.E. Upjohn Institute for Employment Research, 1981). See U.S. General Accounting Office, CETA Programs For Disadvantaged Adults--What Do We Know About Their Enrollees, Services and Effectiveness? (June, 1982). And see Laurie Jo Bassi, "Estimating the Effect of Training Programs With Nonrandom Selection," draft of Ph.D. Dissertation, Economics Department, Princeton University (1982).

The principal findings of these past studies are described below. Then a detailed discussion of the problem with the statistical model used by Westat, et al is presented.

SUMMARY OF FINDINGS

Bassi found large program-induced earnings gains for female participants with no clear pattern of differences by type of training. In addition, she found that female participants with the least past earnings experienced the largest earnings gains and that earnings gains for minority women were somewhat smaller than those for non-minority women.

Bassi concluded that the matched comparison groups for male participants developed by Westat, Inc., for the Continuous Longitudinal Manpower Survey (upon which she based her analysis) were not suitable for estimating the effect of training. Thus, except for one subgroup, she did not present results for men.

Westat, et al found: large earnings gains for female participants; that the largest gains accrued to women with the least past earnings; that earnings gains increased with the length of training; and that earnings gains were due mostly to increased employment. In addition, they found small earnings gains for men that were not statistically significant, on average. These results were basically consistent with the results of the present analysis. But contrary to the results of the present analysis, Westat et al found that on-the-job training was substantially more effective than classroom training or work experience in increasing the post-program earnings of participants.

PROBLEMS WITH THE STATISTICAL MODEL UPON WHICH THE RESULTS OF WESTAT et al WERE BASED

The following is a discussion of why the model upon which the results of Westat et al were based undercompensated for the fact that participants in on-the-job training consistently earned more than participants in classroom training and work experience before they entered a CETA program.

The Statistical Model

The model used by Westat, et al to estimate the effect of training can be expressed as:

$$Y_{it} = a + \sum_s b_s \cdot Y_{it-s} + \sum_j \delta_j \cdot X_{ji} + \sum_q \gamma_q \cdot T_{qit} + U_{it} \qquad (E1)$$

where:

Y_{it} and Y_{it-s} = person i's earnings in post-program year t and pre-program year t-s;

X_{ji} = the jth personal characteristic for person i;

T_{qit} = one if person i had been in training activity q (classroom training, on-the-job training, or work experience) and zero otherwise;

γ_q = the average effect on future earnings of training type q;

a, b_s and δ_j = other parameters to be estimated; and

U_{it} = a random disturbance.

Numerous versions of this model (first developed by Orley Ashenfelter (1978) and commonly referred to as an autoregressive earnings model) were used, yielding a broad range of results.[2]

Problems with the Model

For reasons explained below, autoregressive earnings models do not fully compensate for differences in the average pre-program earnings of different groups. Thus part of these initial differences are reflected in estimates of the relative effect of training.

Table E-1 indicates that participants in on-the-job training consistently earned more before entering CETA than their counterparts in classroom training and work experience did. By undercorrecting for these differences, autoregressive models will overestimate the effect of on-the-job training relative to that of classroom training and work experience.

The following is a brief explanation of why this problem occurs. To simplify the discussion without limiting its

2. See Orley Ashenfelter "Estimating the Effect of Training Programs on Earnings," The Review of Economics and Statistics, vol. LX, no. 1 (February 1978), pp. 47-57.

TABLE E-1. AVERAGE PRE-PROGRAM EARNINGS BY SEX, TYPE OF TRAINING, AND PRE-PROGRAM YEAR (In nominal dollars)[a]

Sex and Type of Training	Pre-Program Year				
	1970	1971	1972	1973	1974
Female CETA Participants					
In classroom training	730	810	1,010	1,240	1,370
In on-the-job training	890	1,020	1,280	1,500	1,660
In work experience	570	610	750	930	1,070
Male CETA Participants					
In classroom training	1,400	1,540	2,040	2,640	2,800
In on-the-job training	1,760	1,990	2,670	3,280	3,590
In work experience	1,130	1,220	1,540	1,840	1,780

SOURCE: Estimates were derived from the Continuous Longitudinal Manpower Survey supplemented by individual Social Security earnings records.

a. For persons of all ages in CETA training for more than seven days.

generality, the personal characteristics X_{ji} were deleted from Equation E1 yielding:[3]

$$Y_{it} = a + \sum_s b_s \cdot Y_{it-s} + \sum_q \gamma_q \cdot T_{qit} + U_{it} \qquad \text{(E2)}$$

3. Problems of covariance adjustments such as those produced by the personal characteristics are widely recognized. For example, see S. Director, "Underadjustment Bias in the Evaluation of Manpower Training," Evaluation Quarterly, vol. 3, (May 1979).

Past studies indicate that earnings increase at a decreasing rate throughout one's working life.[4] For shorter periods (ten years or less) earnings profiles are approximately linear. Estimates of the effect of training based on autoregressive earnings models such as Equation E2 are biased when the profiles (either linear or nonlinear) of participants (by type of training) and comparison group members are different (which was the case for the Westat, et al analysis). For example, linear earnings profiles imply that:

$$Y_{it} = \alpha_i + \beta_i \cdot t + \sum_q \gamma_q \cdot T_{qit} + U_{it} \qquad \text{(E3)}$$

where α_i and β_i are the intercept and slope of person i's pre-program earnings profile. Now consider the results of estimating the effect of training using an autoregressive earnings model from data generated by Equation E3.

Start with a first-order autoregressive model--one based on a single pre-training year--with s years between the post-program year and the pre-program year. Differencing Equation E3 accordingly yields:

$$Y_{it} - Y_{it-s} = \sum_q \gamma_q \cdot T_{qit} + U_{it}' \qquad \text{(E4)}$$

or

$$Y_{it} = Y_{it-s} + \sum_q \gamma_q \cdot T_{qit} + U_{it}' \qquad \text{(E5)}$$

where

$$U_{it}' = S \cdot \beta_i + U_{it} - U_{it-s} \qquad \text{(E6)}$$

Using Equation E5 to determine the effect of training involves estimating coefficients for both Y_{it-s} and T_{qit}. If the coefficient for Y_{it-s} were estimated without bias (by constraining it to one as in Equation E4) the estimated coefficient for T_{qit} would be biased because of the correlation between T_{qit} and β_i in the error term. For example, if participants' earnings were increasing more slowly than those of comparison group members (T_{qit} and β_i were correlated negatively) the coefficient for T_{qit} (the effect of training activity q) would be underestimated. Furthermore, the magnitude of this bias would increase as s, the

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4. See J. Mincer, Schooling, Experience and Earnings (National Bureau of Economic Research, 1971).

number of years between the pre-program year and post-program year, increased.

Additional problems arise from bias in the estimated coefficient for Y_{it-s} because of the correlation between Y_{it-s} and β_i, controlling for T_{qit}. And, lastly, if U_{it} and U_{it-s} were serially correlated, another source of bias would exist.

Unbiased training effect estimates would result only if: (1) the earnings profiles of comparison group members and participants in all three types of training were identical (in which case, it would be unnecessary to control for past earnings to eliminate bias) or (2) the biases mentioned above cancelled each other (a remote possibility).

The preceding result generalizes to higher-order autoregressive models by further differencing Equation E3 and generalizes to nonlinear earnings profiles by substituting an appropriate functional form into Equation E3. For example, one might substitute ln(t) for t to represent earnings that increased over time at a decreasing rate.

APPENDIX F. COMPONENTS OF THE AVERAGE EARNINGS GAIN EXPERIENCED BY FEMALE PARTICIPANTS

Chapter III indicated that most of the average earnings gain experienced by female CETA participants was due to an increase in the amount of time they worked rather than increased wage rates. This appendix describes how this and other related results were obtained and discusses their interpretation and limitations.

BASIC APPROACH

By definition, annual earnings can be decomposed as follows:

$$Y = L \cdot (E/L) \cdot (H/E) \cdot W \qquad (F1)$$

where:

- Y = annual earnings;
- L = the number of weeks that an individual was available for employment during the year;
- (E/L) = the number of weeks that an individual was employed during the year as a proportion of the number of weeks that he or she was available for employment;
- (H/E) = the average number of hours worked per week employed; and
- W = the average hourly wage rate.

The proportional change in earnings, $\Delta Y/Y$,equals the sum of the proportional change in each of its four components plus the sum of all interactions among the proportional changes in these components. In general the interactions are small so that:

$$(\Delta Y/Y) \approx (\Delta L/L) + [\Delta(E/L)/(E/L)] + [\Delta(H/E)/(H/E)] + \Delta W/W \qquad (F2)$$

Therefore the proportion of the change in earnings due to a change in one of its components approximately equals the proportional change in that component as a proportion of the sum of the proportional changes in all components. For example, the proportion of the change in earnings due to a change in labor force participation approximately equals

$$(\Delta L/L)/[(\Delta L/L) + [\Delta(E/L)/(E/L)] + [\Delta(H/E)/(H/E)] + (\Delta W/W)].$$

This procedure implicitly allocates each component's contribution to the interaction terms in proportion to its contribution to the sum of the terms in Equation F2.

DATA AND ANALYSIS

Earnings component data were not available for the full multiyear period upon which estimates of post-program earnings gains were based. Complete data for participants were available from the Continuous Longitudinal Manpower Survey only for the year before and the first year after training,[1] whereas corresponding data for comparison group members were available from the Current Population Survey for only one year (1975).

Thus it was necessary to infer the composition of post-program earnings gains from the observed composition of the gross change in participants' earnings from the year before to the first year after training (see Table F-1). Applying the computational procedure described above to this information produced estimates of the composition of post-program earnings gains (see Table F-2).

INTERPRETATIONS OF THE FINDINGS

Although subject to limitations, the results in Table F-2 support several broad generalizations about the effect of CETA training for women.

First, even conservative estimates indicate that the effect of training was substantial. For example, three-fifths of the average post-program earnings gain observed for female

1. Data for the second year after training were available for only part of the sample.

TABLE F-1. THE COMPONENTS OF EARNINGS FOR FEMALE CETA PARTICIPANTS BEFORE AND AFTER TRAINING

	Average Weeks in the Labor Force	Average Weeks Employed as a Proportion of Weeks in the Labor Force	Average Hours Worked per Week Employed	Average Hourly Wage Rate (in 1980 Dollars)
All Female Participants				
Year before training	35	0.47	33	3.81
Year after training	41	0.62	38	4.49
Female Classroom Training Participants				
Year before training	34	0.45	34	3.77
Year after training	40	0.57	38	4.65
Female On-The Job Training Participants				
Year before training	35	0.51	36	3.99
Year after training	45	0.73	39	4.46
Female Work Experience Participants				
Year before training	36	0.50	31	3.76
Year after training	41	0.64	36	4.19

TABLE F-2. PERCENTAGE OF THE AVERAGE EARNINGS GAIN EXPERIENCED BY ADULT FEMALE PARTICIPANTS DUE TO EACH OF THE FOUR BASIC COMPONENTS OF EARNINGS

	Percentage Due to Average Annual Change In:				
For Women In:	Weeks in the Labor Force	Weeks Employed as a Percentage of Weeks In the Labor Force	Hours Worked per Week Employed	Real Hourly Wage Rate	Total
All CETA Training	21	39	18	22	100
Classroom training	22	34	15	29	100
On-the-job training	31	47	9	13	100
Work experience	20	41	23	16	100

SOURCE: Estimates based on the information in Table F-1.

participants remained after eliminating the portions due to increased labor force participation and increased hours worked per week employed. This left roughly $800 due solely to increased abilities to find and hold a job and to increased wage rates.

A second major generalization supported by the results in Table F-2 is that the effects of the three different types of training were roughly the same in terms of their magnitude and to a large extent also in terms of their composition. Chapter III indicated that average post-program earnings gains were $1,400, $1,100, and $1,300 for women in classroom training, on-the-job training, and work experience, respectively. Table F-2 indicates that 63, 60, and 57 percent of these gains respectively were due to the effect of increased wage rates and increased abilities to find and hold a job.

Lastly, a third important generalization supported by the data is that most (71 percent for classroom training, 87 percent for on-the-job training, and 84 percent for work experience) of the average earnings gain experienced by female CETA participants was due to an increase in the amount of time they worked.

LIMITATIONS OF THE FINDINGS

Several potential problems limit more precise interpretation of the preceding results. First is the fact that gross earnings changes (upon which the earnings component analysis was based) do not overlap perfectly with post-program earnings gains (to which the results of this analysis were inferred). Nevertheless the average post-program deviation from trend in the first year after training (Segment C in Figure F-1), which largely determined the average post-program earnings gain for that year,[2] comprised about three-fifths of the average gross earnings change for female participants (Segments A plus B plus C). Thus there was a substantial overlap between the two measures of change in earnings.

A second potential problem stems from the fact that data for the components of earnings were obtained from retrospective surveys. Participants were asked on a quarter-by-quarter basis about the extent to which they sought employment, the percentage of time they were employed, their wage rates, and their total earnings. Undoubtedly, this produced numerous reporting errors. But individual reporting errors largely cancelled each other in the determination of the group averages upon which the present analysis was based. For example, Appendix C indicated that average earnings obtained from survey data generally were within 5 percent of corresponding average earnings obtained from Social Security records. Thus it is unclear to what extent, if at all, survey errors were a problem for this analysis.

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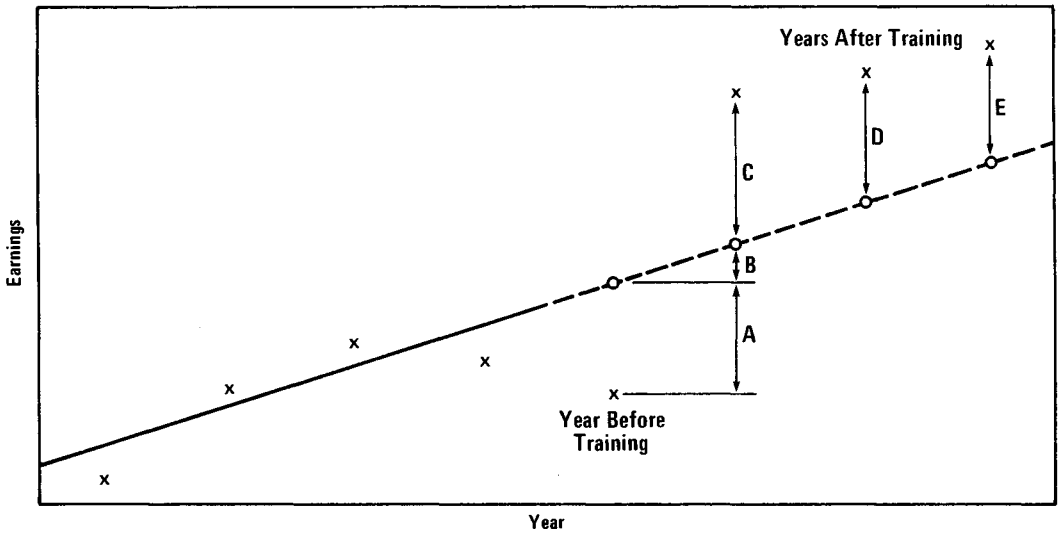
2. Post-programs earnings gains actually represent the average of segments C, D, and E in Figure F-1 minus their comparison group counterparts (which are not shown but were quite small) with a slight adjustment for the pre-program dip.

Figure F-1.
Post-Program Earnings Gains versus Gross Earnings Changes



KEY:
A = Recovery from pre-program dip
B = Earnings increase according to long-term trend
C = Deviation from trend in the first year after training
D = Deviation from trend in the second year after training
E = Deviation from trend in the third year after training

APPENDIX G. EXAMINING THE RELATIONSHIP BETWEEN POST-PROGRAM EARNINGS GAINS AND THE LENGTH OF TRAINING

Longer training was associated with larger post-program earnings gains for female CETA participants at a rate of $3.70 per day, on average. On the other hand, there was generally no significant effect for male participants, regardless of the length of training.

ANALYSIS

Appendix A developed the following model for estimating the average effect of training:

$$\hat{\hat{DEV}}_{it}^{*} = \gamma^{*} \cdot T_{it} + \sum_{j} \delta_{j}^{*} \cdot X_{ji} + \sum_{m} \epsilon_{m}^{*} \cdot YR_{m} + U_{it}^{*} \qquad (G1)$$

where:

$\hat{\hat{DEV}}_{it}^{*}$ = the post-program year deviation from trend adjusted for serial correlation, in 1980 dollars;

T_{it} = one for participants and zero for comparison group members;

YR_{m} = one when year t=m and zero otherwise;

ϵ_{m}^{*} = the average deviation from trend in year m due to changing economic conditions, in 1980 dollars;

X_{ji} = the jth personal characteristic for person i;

γ^{*} = the average effect of training, in 1980 dollars; and

U_{it}^{*} = a random disturbance, in 1980 dollars.

Adding an interaction between the training variable T_{it} and the length of training L_i (in days) produced a variable whose coefficient measured the additional gain in average annual post-program earnings per additional day of training. Replacing T_{it}

with a set of dummy variables T_{qit} --one for each of the three major types of training--and interacting each of these new variables with L_i , produced a set of interaction terms whose coefficients measured the additional gain in average post-program earnings per additional day of each type of training.

Estimates of these coefficients indicated that an additional day of training was associated with a $3.70 increase in the average annual post-program earnings of female participants (see Table G-1). Similar results were obtained for each of the three major types of training. On the other hand, none of the three types of training appeared to increase the future earnings of male participants, regardless of the length of the training.

To test for increasing or decreasing returns to additional days of training, quadratic interaction terms were added to the model, but the coefficients for these terms were not statistically significant, suggesting roughly constant returns to additional days of training within the range of program lengths examined (about 10 to 250 days).

TABLE G-1. THE MARGINAL CHANGE IN ANNUAL POST-PROGRAM EARNINGS ASSOCIATED WITH AN ADDITIONAL DAY OF TRAINING BY SEX AND TYPE OF TRAINING (In 1980 dollars)[a]

Type of Training	Women	Men
All CETA Participants	3.70[c]	-1.00
In classroom training	3.60[c]	2.80
In on-the-job training	6.50[c]	-7.80[c]
In work experience	2.90[b]	-1.90

SOURCE: Estimates were derived from the Continuous Longitudinal Manpower Survey and the March 1976 Current Population Survey supplemented by individual Social Security earnings records.

a. For persons over 24 and in CETA training for more than seven days.

b. Significant at the 0.05 level.

c. Significant of the 0.01 level.

APPENDIX H. COMBINING RESULTS FOR DIFFERENT GROUPS OF PARTICIPANTS, DIFFERENT POST-PROGRAM YEARS, AND DIFFERENT TYPES OF TRAINING

To summarize estimates of the effect of CETA training on participants' future earnings, it was necessary to combine these estimates for as many different groups as possible. Empirical tests indicated that there were no statistically significant differences: (1) between participants who entered the program early in the analysis period (from January through August 1975) and participants who entered later (from September 1975 through June 1976); (2) among the results for each of the first three post-program years; (3) among the results for each of the three major types of training; and (4) between the results for minority and nonminority participants. Thus it was appropriate to combine these results. On the other hand, differences between the findings for male and female participants were both statistically significant and large. Thus results for these groups were not combined.

TESTING PROCEDURE

Appendix A developed the following model for estimating the average effect of CETA training:

$$\hat{\hat{DEV}}_{it}^{*} = \gamma^{*} \cdot T_{it} + \sum_{j} \delta_{j}^{*} \cdot X_{ji} + \sum_{m} \epsilon_{m}^{*} \cdot YR_{m} + U_{it}^{*} \qquad (H1)$$

where:

$\hat{\hat{DEV}}_{it}^{*}$ = the post-program year deviation from trend adjusted for the pre-program dip, in 1980 dollars;

T_{it} = one for participants and zero for comparison group members;

YR_{m} = one when year t = m and zero otherwise;

ϵ_m^* = the average deviation from trend in year m due to changing economic conditions, in 1980 dollars;

γ^* = the average effect of training, in 1980 dollars;

X_{ji} = The j^{th} personal characteristic for person i; and

U_{it} = a random disturbance, in 1980 dollars.

To test for significant differences in estimates of γ^* (the effect of training) across each of the groups mentioned above, the program variable was interacted with variables representing each group, including all possible higher-order interactions. The full resulting model was then estimated. It was then reestimated sequentially after first eliminating distinctions between entry groups; after next eliminating distinctions by post-program year; after next eliminating distinctions by type of training; after next eliminating distinctions by minority status of the participant; and lastly after eliminating distinctions by sex of the participant. To minimize the substantial computational costs involved, only data for participants were used.

At each stage an F statistic was computed to determine whether or not eliminating a specific distinction decreased the explanatory power of the model by a statistically significant amount. No distinctions other than sex were statistically significant at the 0.05 level (see Table H-1). Thus combining results across all dimensions except sex appeared to be justifiable.

TABLE H-1. F TESTS FOR POOLING RESULTS BY CETA ENTRY GROUP, POST-PROGRAM YEAR, TYPE OF TRAINING, MINORITY STATUS, AND SEX[a]

Pooling Sequentially	F Statistic[b]	Significant at the 0.05 Level[b]
First by Entry Group	0.8	No
Then by Post-Program Year	0.5	No
Then by Type of Training	0.8	No
Then by Minority Status	1.5	No
Then by Sex	14.3[c]	Yes[c]

SOURCE: Estimates were derived from the Continuous Longitudinal Manpower Survey and the March 1976 Current Population Survey supplemented by individual Social Security earnings records.

a. For persons over 24 years old who were in CETA training more than seven days.

b. Each F test was conditional upon the elimination of prior distinctions in the sequence and the sequence was based on expectations about the likely importance of each distinction.

c. Significant at the 0.01 level.