

The Effectiveness of Training Programs in Raising Earnings

Robert E. Hall

Summary

The evidence surveyed in this paper seems persuasive in demonstrating that the rate of return to training programs measured as the increment in annual earnings attributable to the programs divided by their cost, including the value of the participants' time, is in the range of 0 to 10 percent. Barring favorable external effects not captured by the trainees, this establishes a fairly tight upper bound on the social rate of return to training programs. This finding gives little reason to expect that even a massive increase in federal training efforts could do much to alleviate the plight of workers with low earnings. The active proprietary sector has already expanded to the point where the return to training seems comparable to the return to other investments, and further expansion through subsidized federal programs would presumably depress the return even below this level. In fact, the large increase in publicly-supported junior colleges that offer specialized training programs may already have depressed the return in some markets.

The evidence cited here does not help to settle the issue of the possible favorable external effects of manpower programs in general and training programs in particular. As Freeman has emphasized, one of the main functions of proprietary training programs is the placement of their graduates in jobs, and much effort

goes into placement in government programs as well. There can be strong externalities associated with these aids to mobility, especially to the extent that workers are drawn from markets with high unemployment rates and placed in jobs in markets with low unemployment rates. Modern thought on the causes of unemployment emphasizes factors that make the private value of unemployment higher than the social value, and indeed much unemployment probably has no social value at all. In this case, the social value of the participation of a marginal worker in a high-unemployment market is less than his wage, and the social value of a program that moves him out of the market is greater than his increase in earnings.¹ Very little is known about the magnitude of this kind of external effect. Now that research has provided a fairly sharp answer to the question of the effect of training on earnings, it should turn its attention to the challenging problem of the more global effects of training.

Introduction

Training programs no longer dominate federal manpower policy as they did a decade ago, but they are still widely advocated as a way to increase the earnings of low-income workers and to reduce high unemployment rates. This paper takes a new look at the arguments in favor of training programs and the evidence on their effectiveness. New research on longitudinal data has substantially improved our knowledge of the effect of training on earnings. The new estimates agree fairly closely that training programs yield a return on investment that is neither much greater nor much less than the return to alternative investments. Training programs have an important role in preparing workers for their jobs, but are incapable of bringing about any major transformation of the labor market in the direction of greater equality of earnings.

The paper begins with a discussion of the purposes and contents of training programs offered by public and private agencies. It presents an appraisal of what would be reasonable to expect of training programs in a market economy where businesses are free to offer almost any program they think is profitable and workers are free to enroll in a wide variety of privately offered programs. It would be a surprise to find that investment in training yielded a return much in excess of the return on other investments in this kind of economy, since markets tend to equalize returns on all investments. Other considerations suggest that the measured return to investment in training might easily fall short of the return to other investments. An attempt is made in this part of the paper to predict the observed effect of a typical training program on annual earnings under a variety of assumptions about the effectiveness of the program.

The paper then turns to empirical evidence on the success of training programs. Three major recent studies based on longitudinal data are surveyed. Two draw on the National Longitudinal Survey of Work Experience (the Parnes data) and cover a wide variety of programs offered by proprietary colleges and institutes, the armed forces, private employers, apprenticeships, and government agencies. The other study uses data from the Social Security Administration on the earnings of a large group of men who entered a particular federal training program in 1964. The three studies together provide strong empirical support for the view that training programs yield a small positive return on investment in the range from 0 to 8 percent a year. Conceptual ambiguities in defining the yield, possible statistical biases, and differences among programs make it difficult to be more precise about the exact value of the various programs studied. The evidence does provide a fairly strict upper limit on the

return to training. It is no longer appropriate to say, as many did five years ago, that we know very little about the value of training. The new research has shown that it is very unlikely that the return to training much exceeds the return to other investments.

Recent work has been much more successful in pinpointing the private return to training received by workers themselves than in measuring the total social return to investment in training. The paper discusses some reasons for the social to exceed the private return, but so far these have eluded quantification.

The Market for Training

An active market exists in the United States for specific vocational training. Part of the privately supplied training is offered in classroom courses in business colleges, technical institutes, and company training schools, and part in formal on-the-job training programs (informal training on the job is probably rather more important than all other forms of training, but is outside the scope of this paper because it is not directly measurable). The government supplies training in the armed forces and in manpower programs. The volume of training from each of these sources is shown in Table 1, which is drawn from Richard Freeman's important study of proprietary colleges and institutes.² Freeman's data are taken from the National Longitudinal Surveys for younger and older men. In both age groups, proprietary schools account for about a third of the total amount of training received beyond regular school. The heterogeneous category of other classroom and on-the-job programs (including apprenticeships) accounts for another third. The remaining third is supplied by company programs and the armed forces. The typical older man receives 8.5 months of training in total over his working life, virtually another

year of school. Younger men have already received 6.7 months by the time of the interview, when they were 18 to 24 years old (Freeman restricts his sample to those who have finished school). Vocational training is plainly a significant factor in the accumulation of human capital, and it appears to be growing in importance.

Freeman characterizes the scope of the proprietary sector in the following way, taking data from a survey conducted by the Upjohn Institute:

. . . there were over 7,000 for-profit schools in 1966 divided among three broad categories: 3,000 trade and technical schools, offering curricula in areas like data processing, auto maintenance, and electronics, with about 835,000 students; 1,300 business colleges enrolling over 440,000 students; and 2,700 schools of cosmetology and barbering, with about 320,000 students. While most proprietary schools are small enterprises, a number are operated by major corporations, such as I.T.T., R.C.A., Career Academy, and Bell and Howell. In some job areas, notably barbering, cosmetology, nursing, and office machine operating, the majority of workers obtain job skills from proprietary schools and technical institutes; in others (auto mechanics and electrical work, accounting and auditing), the schools train a large proportion of workers.³

Freeman emphasizes the major role of placement in the service of proprietary schools. The schools are highly conscious of their reputations for placing graduates, and will even offer scholarships to highly qualified students to improve their placement records. It has often been noted that the success or failure of federal training programs depends critically on their success in placement. Freeman goes on to describe a variety of other means that are used by proprietary schools to

Table 1
Sources of Vocational Training Received by
White Males, 1966

Source	Age group			Age group		
	Percent having training	Months, trainees	Months, total	Percent having training	Months, trainees	Months, total
Business college or technical institute	17.0	17.6	3.0	15.0	14.7	2.2
Company training school lasting 6 weeks or more	10.0	9.1	1.1	5.0	16.0	0.8
Training program in armed forces	17.0	14.1	1.2	18.0	8.9	1.6
Other classroom vocational program or formal on-the-job program including apprenticeship	19.0	16.8	3.2	10.0	21.0	2.1
Total	—	—	8.5	—	—	6.7

Source: Computed by Richard Freeman from the National Longitudinal Surveys.

attract students, including scheduling classes at times convenient for part-time work and adjusting tuitions by individual classes. One is left with the strong impression of a vigorous, successful industry which leaves few stones unturned in the effort to locate areas where

training is sufficiently valuable to potential workers that they will pay enough for training to make its provision profitable.

Less is known about the category of formal on-the-job training and classroom training not offered by proprietary schools or businesses (it is probably unfortunate that the two were combined in the NLS survey). Formal apprenticeships exist mainly in the building trades. Enrollment is strictly limited so that, until recently at least, the value of the training far exceeded its cost. Union restrictions in some parts of the construction industry prevented the proprietary training sector from taking advantage of the situation. Some of the men reporting training in this category may have been the graduates of federal training programs under the MDTA, but those programs had just begun at the time of the survey.

Training programs offered by employers to their workers and by the military to servicemen share the similar feature that the benefits of the training may accrue to the employer rather than to the worker. If the skill taught in the program is specific to the employer or to the military, and if the program is financed by the employer, then the graduates of even the most successful program will not necessarily have higher earnings as a result of the training. On the other hand, many employers find it convenient to offer training with a value in a broader market to their employees, and these programs should raise the earnings of participants. Though the military does recruit servicemen partly on the basis of the vocational training that it offers, and the same is doubtless true of a few employers, it does not appear that company or military training programs are anywhere near as responsive to market conditions as are the proprietary programs.

The data suggest the following general picture of the market for training. Two-thirds of the total volume

of training is offered by suppliers who are not strongly responsive to the value of the training. These include apprenticeships, government training programs under MDTA and other legislation, military, and company classroom and on-the-job programs. The remaining third is offered by the proprietary sector and is highly responsive to the value of training. Proprietary programs expand rapidly when the value of a particular kind of training rises (for example, medical technicians recently) and shrink when it falls (for example, barbering). The expansion and contraction of the skilled labor force offsets the fluctuations in the value of training. If this mechanism functions instantly and fully, in fact, no fluctuations in the value of training will actually be observed.

Standard economic principles give fairly definite predictions about the functioning of the market for training when it has this sort of structure. First, in the market for skills where the supply of training is rationed and the proprietary sector is unable or prohibited from providing training, the observed return to training can be very high, certainly well above the rate of return to alternative investments. This was almost certainly true of apprenticeship training in the building trades in the 1960s. Second, there are some skills where the employer captures the return to the investment to training, and others where the government has subsidized the acquisition of the skills (notably under programs like the MDTA). In these cases, the return measured as the increment in earnings divided by the cost of the training should fall short of the return to alternative investments. Finally, in the market for skills which the proprietary sector is permitted to offer, the return to training will never exceed the return to alternative investments.

The practical testing of these predictions is limited

to some extent by uncertainties about the appropriate value to assign to the return to alternative investments. The extreme measure is the interest rate at which trainees can borrow, as some do in fact borrow to attend proprietary schools. For young workers who can borrow from their parents, or older workers with savings, the interest rate earned on savings is more appropriate, and considerably lower. In any case, the interest rate should be stated in real terms, as the returns to training discussed later in the paper are in real terms. Over the past decade, real interest rates for borrowers have fluctuated in the range from 5 to 10 percent per year and real returns to savings have fluctuated in the range from 0 to 5 percent per year.

Before turning to the empirical evidence on the effect of the various kinds of training programs on earnings, I will attempt to translate the considerations just discussed into numerical estimates. The results are shown in Table 2 and are intended merely to serve as benchmarks in judging the econometric estimates to be presented shortly. Table 2 embodies the following assumptions: First, workers enrolling in proprietary schools earn exactly the market rate of return on their investments. Second, one hour spent in a company, government, or military program adds the same to a worker's skills as one hour spent in a proprietary program. It also accepts certain of Freeman's estimates about proprietary programs: Participants spend 1,296 hours in the average proprietary program per year. In addition, they pay tuition whose value can be stated as the equivalent of 400 hours of work. Together, these mean that a participant invests the equivalent of 0.82 years of work for each year in the program. Finally, I have made the fairly arbitrary assumption that all the other programs are full-time, that is, 2,080 hours per year. Then the columns of Table 2 can be explained in a

Table 2
Benchmarks for Effects of Training Programs
on Earnings

Program and rate of return	Effect of one year in program on earnings (percent)	Years in program of typical participant	Effect on earnings for typical participant (percent)
Business colleges and technical institutes			
4%	3.3	1.5	5.0
8%	6.6		9.9
Company training schools			
4%	5.3	1.3	7.0
8%	10.5		13.7
Military programs			
4%	5.3	0.7	3.9
8%	10.5		7.8
Other classroom or OJT programs			
4%	5.3	1.8	9.3
8%	10.5		18.6

For explanation, see text.

straightforward way. For proprietary schools, the first column is the assumed rate of return multiplied by the amount of investment per year in the program (0.82). The second column is from Table 1, restated in years. The third column is just the product of the first two columns. Thus, for proprietary schools, assuming a 4 percent market rate of return, the average worker who has attended a school for a year should earn 3.3 percent more than the otherwise identical worker who has not attended such a school, and the typical member of the work force who has attended a proprietary

school should earn 5.0 percent more than his counterpart.

For other programs, the entries in column 1 were obtained by multiplying the figures for proprietary schools by the ratio of the number of hours spent in the other programs (2,080) to the number spent in the proprietary schools (1,296). Thus, under the assumption that hours spent in any of the programs are equally valuable, a year spent in any of the other programs should have a considerably larger percentage effect on earnings. At a 4 percent market rate of return, a year spent in any of the other programs should raise earnings by 5.3 percent, instead of 3.3 percent for the proprietary programs. Finally, the figures in column 3 are again the products of columns 1 and 2. At a 4 percent market rate of return, the typical participant in a military vocational training program should earn only 3.9 percent more than a worker without such training. At the other extreme, with an 8 percent market rate of return, the typical participant in an OJT program should earn 18.6 percent more than his counterpart. The relative values in column 3 for either the 4 percent or 8 percent returns give a benchmark against which to judge the empirical findings of a study which simply compares the graduates of programs to non-participants.

To the extent that empirical findings differ from Table 2, the assumptions it embodies are brought into question. The crucial assumptions are, first, that hours in different programs are equivalent, and, second, that participants in the non-proprietary programs spend substantially more hours per year in the programs than do participants in proprietary programs. Unfortunately, data on the intensity and effectiveness of programs in the other sectors are not available in any systematic way.

Recent Evidence on the Effectiveness of Training Programs

Richard Freeman has estimated the effect of training on earnings within a model which is a straightforward application of human capital theory. Briefly, the model hypothesizes that earnings are the return to human capital, and human capital is accumulated in formal schooling, in informal training on the job (measured by total years of employment and years on the present job), and in vocational training programs. Freeman measures earnings in a number of ways, but what is relevant for the purposes here is total annual wage and salary earnings. This variable is sensitive both to the effect of training in raising hourly earnings and in raising hours of work. Even if a program has its effect entirely by reducing unemployment, it will receive credit in Freeman's study.

The relevant portion of Freeman's results appears in Table 3. The numbers in the table are the percentage increases in earnings associated with one year of training. The numbers in parentheses are standard errors and provide a measure of the statistical reliability of his findings. For proprietary schools, the estimated effect is 7.1 percent increase in earnings per year of attendance. This should be compared to the numbers in the first column of Table 2, which show that a return of this magnitude is a market equilibrium only if the rate of return to alternative investments is above 8 percent (8.7 percent, to be exact). This is perhaps a little high to be reasonable, but the standard error of 2.0 percentage points means that statistical variation alone could easily account for its high value. The hypothesis that proprietary education is worthless, that its return is zero, is very strongly rejected (the t-statistic is 3.6). In general, the hypothesis of equilibrium in the market for training provided by proprietary institutions seems supported by these findings. The institutions provide

Table 3
Freeman's Estimates of the Effect of Training
on Earnings, 1965

Program	Effect of one year in program on wage and salary earnings, percent (standard error)
Business college or technical institute	7.1 (2.0)
Company training program lasting 6 weeks or more	5.5 (3.4)
Training program in armed forces	1.4 (3.9)
Other classroom vocational program or formal on-the-job-program, includ- ing apprenticeship	3.6 (1.7)

Source: Richard B. Freeman, "Occupational Training in Proprietary Schools and Technical Institutes," *Review of Economics and Statistics* 56 (August 1974): 310-18, Table 2, line 1.

worthwhile training, and workers are buying about the right amount of it.

Freeman's evidence about the value of company and military training programs is rather weak, as shown by the large standard errors of the estimates, but there is a hint that the increment to earnings from a year in them is smaller than for proprietary institutions. On the other hand, his evidence on the other classroom and OJT programs is quite precise—they add only 3.6 percent to earnings per year in the program, and the standard error of this estimate is only 1.7 percentage points. Table 2 suggests that these programs should add *more* to earnings than the proprietary programs, on the assumption that the programs involve more hours of training per year than do the proprietary ones. The fact that the estimated effect is smaller can

presumably be attributed to the net effect of four influences: First, restricted entry to occupations and apprenticeships should raise the return to this category relative to the proprietary category. Second, the existence of large government subsidies for some programs may reduce their measured effectiveness, because workers will be induced to enroll in the subsidized programs who cannot actually make effective use of the training (this effect is surely very weak in this sample, which was little affected by government training programs, but the effect could be important in later years for younger workers). Third, the programs may involve much less than full-time training. On-the-job programs, after all, require a good deal of actual work. Fourth, the workers may not receive the value of their training if it was supported by their employers and is specific to the firm. Much more research will be required to sort out these various influences. The major contribution of Freeman's research is to show that the relation between earnings and proprietary training is consistent with the view that the proprietary sector, even though it provides only a third of the total volume of non-school vocational training, acts to equilibrate the whole market.

Freeman's study did not make use of the longitudinal nature of the NLS (the necessary data had not been made available at the time of his research). His conclusions are susceptible to the criticism directed at all cross-section studies of the value of education—his finding of higher earnings among those who have received training may simply reflect the tendency for the programs to select the more able members of the labor force.⁴ Longitudinal data provide a way to overcome this defect. Instead of deducing the value of training from the comparison of individuals with training to those without it, as Freeman does, longitudinal data make it possible to compare the earnings of an individual after training to his earnings before training.

This approach was adopted by Arvil Adams in a recent study.⁵ Adams proceeded in the following way. First, he fitted a model of earnings to data for 1970, in which various categories of training were recognized for the period 1966-1969. Then he fitted a similar model to data for 1965, again recognizing the categories of subsequent training. The purpose of the second regression was to estimate the effect of the selectivity of the programs—even without helping the individual workers at all, the programs will make the participants' earnings higher in 1970 than those of non-participants if they tend to select the more able and highly-paid workers in the first place. The true, net effect of the programs is measured by the increase in the estimated contribution to earnings between 1965 and 1970.

The results of this procedure are shown in Table 4. The first column shows the estimated difference between the earnings of individuals who participated in various programs and those who did not, as measured in 1970. The NLS did not ask about military programs during this period; presumably almost no members of the sample participated in them. On the other hand, correspondence courses were added as a category. In two of the categories, proprietary institutions and correspondence courses, the sample is so small that reliable estimates cannot be obtained—the standard errors are 19 and 12 percentage points, respectively.⁶ Company training schools generate a difference of 13 percent in earnings, and the standard error of this estimate is a more satisfactory 5 per cent. The "other" category (which is not further defined in the NLS questionnaire) has a small negative estimated gross effect (-1), and its standard error is the same 5 percentage points. The second column of Table 4 gives estimates of the selectivity effect by comparing the earnings in 1965 of those who received training during 1966-69 to the earnings of those who did not receive training during this

Table 4
Adams's Estimates of the Effects of
Additional Training on Earnings

Program	Percent difference in earn- ings, 1970 (standard error)	Percent difference in earn- ings, 1965 (standard error)	Percent improve- ment in earnings, 1965-70	Number of indivi- duals in sample
Business colleges and technical institutes	20 (19)	26 (17)	-6	15
Company training schools	13 (5)	12 (4)	1	121
Correspondence courses	-13 (12)	-8 (11)	-5	33
Other	-1 (5)	-1 (5)	0	144

Source: Arvil V. Adams, "Earnings and Employment of Middle-Aged Men: A Special Study of their Investment in Human Capital," chapter 2 in *The Pre-Retirement Years: Five Years in the Work Lives of Middle-Aged Men*, ed. by Herbert S. Parnes et al., vol. 4 (Ohio State University: Center for Human Research, December 1974), Tables 2.8, 2.9, and 2A-5.

period. For company training schools, the great bulk of the gross effect is attributed to selectivity—12 out of 13 percentage points. For "other," exactly all of the small negative effect is attributed to selectivity.

Adams concludes, "The evidence suggests that the impact of formal occupational training during middle-age upon the subsequent labor market experiences of white men is marginal at best." This overstates his findings somewhat, however. A more cautious interpretation of his evidence would say that far too few of the members of the NLS sample enroll in business colleges or technical institutes or take correspondence courses to expect to provide any usable evidence on their effect.

For company training schools and "other" programs, the sample may possibly be large enough to sustain a sharp conclusion, but unfortunately Adams's technique does not provide a standard error of the estimated net effect to judge its reliability.

Evidence from Longitudinal Social Security Records

The Social Security Administration maintains longitudinal records of the earnings of every worker in the United States. Thanks to the initiative of Orley Ashenfelter, the records have been assembled for a large group of participants in MDTA classroom training programs in 1964. The data begin well before the date of the program, and continue through 1969. Ashenfelter himself has been a leader in the analysis of these data.⁷ Table 5 presents the sample means of earnings for the trainees and for a comparison group, also drawn from social security records. The third column of the table gives a very simple attempt to standardize the difference between the two groups by the ratio of the earnings of trainees to the earnings of the comparison group in the years 1959 through 1961 (the ratio is .564). This standardization has the effect of making the difference in earnings essentially zero in the first three years.

Table 5 seems to demonstrate that MDTA training has a large favorable effect on the earnings of trainees. After participating in training in 1964, which temporarily depresses earnings, the trainees' earnings grow much more rapidly than do the earnings of the comparison group, and the two are nearly equal in the last year. The standardized difference is positive in every year after training and reaches \$1,880 in 1969, 40 percent of the actual level of earnings, \$4,717. The implicit private rate of return is astronomical, and the social rate of return is nearly 100 percent, according to these figures.

Table 5

Ashenfelter's Longitudinal Data on Earnings of
White Male MDTA Classroom Trainees

Year	Earnings of 1964 trainees	Earnings of comparison group	Standardized difference
1959	1,443	2,588	-16
60	1,533	2,699	12
61	1,572	2,782	4
62	1,843	2,963	173
63	1,810	3,108	58
64	1,551	3,275	-295
65	2,923	3,458	974
66	3,750	4,351	1,297
67	3,964	4,430	1,467
68	4,401	4,955	1,608
69	4,717	5,033	1,880

Source: Orley Ashenfelter, "Estimating the Effect of Training Programs on Earnings with Longitudinal Data," presented at the Conference on Evaluating Manpower Training Programs, Princeton University, May 6-7, 1976, Table 1, following p. 12. Standardized difference is (Earnings of trainees) $- .564$ (Earnings of comparison group).

Table 5 grossly overstates the true effect of training, and serves as a good example of the pitfalls of longitudinal analysis even when the sample is adequately large. The basic difficulty is that the trainees tend to be younger than the members of the comparison group, and the earnings of young workers rise faster than the earnings of older workers, even in the absence of any formal training. In order to estimate the pure effect of training, it is necessary to adjust for the differential influences of aging and possible other factors distinguishing the trainees from the comparison group. Ashenfelter approaches this adjustment in several related ways. One is to estimate a relationship between current earnings, earnings in a base period (1957-61),

and age. Only the difference between the trainees and the comparison group remaining after adjustment on the basis of this relationship is identified as the effect of training. The results of this adjustment appear in the first column of Table 6. In 1963, the year before training, the trainees earned \$347 less than predicted by the model, given their earlier earnings and ages. Ashenfelter attributes this difference to the tendency for those who are recruited by a training program to have been unemployed or underemployed just before the program. Workers with good steady jobs are unlikely to be interested in a training program, and the managers of the program are not likely to try to attract such workers. As Ashenfelter points out, this depression of earnings of the trainees just before the program vitiates any study of training programs based on longitudinal data unless the data begin at least two years before the program begins. Many studies can be seriously faulted for overlooking this important point.

Not surprisingly, the earnings of trainees fall well below the model's predictions for non-trainees in the year of training, 1964, since the trainees have difficulty working during the program. The foregone earnings, \$907, are part of the social cost of the program, but overstate the private cost because MDTA trainees receive stipends from the program. The other component of the social cost is the actual expenditure required to operate the program. Finally, the adjusted differences for 1965-69 measure the favorable effect of the training on subsequent earnings. The effect is fairly strong for the first three years, but then apparently falls rather sharply. The cumulative effect over the five years covered by the data is only \$483, so the undiscounted payoff is only a little over half of the foregone earnings. Unless the effects become positive again in 1970 and later, the social rate of return for the program is clearly negative, according to the estimates in the first column.

Table 6

Ashenfelter's Estimates of the Effect of Training on Earnings

Year	Estimates from pure auto-regressive model	Estimates from fixed-effects autoregressive model
1963	-347 (16)	-280 (17)
64	-907 (18)	-826 (19)
65	139 (20)	227 (21)
66	150 (26)	230 (27)
67	138 (28)	227 (29)
68	-7 (34)	79 (34)
69	63 (36)	156 (36)

Source: Same as Table 5, tables following pp. 16 and 18.

The second column of Table 6 uses a somewhat different technique to adjust for the differences between the trainees and the comparison group. Here individual workers are viewed as having fixed differences from each other as well as having an autoregressive relation between current and past earnings. Estimates based on this model are somewhat more favorable to the training program. Foregone earnings in 1964 are estimated at \$826 instead of \$907, and the subsequent effects on earnings are about \$80 per year higher. The cumulative effects from 1965 through 1969 are \$919, and it appears that they may continue in 1970 and later. The private return to the program is certainly positive according to these estimates, and the social rate of return may be positive as well, though it is unlikely to be very high.

Notes

1. This point is discussed in detail by George Johnson in "The Labor Market Displacement Effects of the Net Impact of Manpower Training Programs" presented at the Conference on Evaluating Manpower Training Programs, Princeton University, May 5 and 6, 1976.

2. "Occupational Training in Proprietary Schools and Technical Institutes," *Review of Economics and Statistics* 56 (August 1974) : 310-18.

3. "Occupational Training," p. 310.

4. This problem is discussed at length by Zvi Griliches and William Mason, "Education, Income, and Ability," *Journal of Political Economy* 80 (May-June 1972) :S74-S103.

5. "Earnings and Employment of Middle-Aged Men: A Special Study of their Investment in Human Capital." chapter 2 in *Five Years in the Work Lives of Middle-Aged Men*, vol. 4. ed. by Herbert S. Parnes et al. (Ohio State University: Center for Human Resources, December 1974).

6. Even these standard errors are smaller than those reported by Adams, as he made separate estimates for two sub-samples. The estimates and standard errors in Table 4 were calculated by the present author by pooling Adams's results for the two sub-samples.

7. "The Effect of Manpower Training on Earnings: Preliminary Results," *Proceedings of the 27th Annual Meeting of the Industrial Relations Research Association* (1975), pp. 252-60; and "Estimating the Effect of Training Programs on Earnings with Longitudinal Data," presented at the Conference on Evaluating Manpower Training Programs, May 6-7, 1976, Princeton University.