DOCUMENT RESUME

ED 336 616 CE 059 032

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TITLE Youth Training in the United States, Britain, and Australia.
INSTITUTION National Center on Education and Employment, New York, NY.; Rand Corp., Santa Monica, Calif.
SPONS AGENCY Office of Educational Research and Improvement (ED), Washington, DC.
REPORT NO ISBN-0-8330-1163-4; RAND/R-4022-ED
PUB DATE 91
CONTRACT G008690008
NOTE 58p.
AVAILABLE FROM Rand Corporation, 1700 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Adolescents; Adult Vocational Education; Comparative Analysis; *Educational Attainment; Educational Benefits; Education Work Relationship; Employment Patterns; Foreign Countries; *Job Training; Males; *Technological Advancement; Union Members; Unions; *Wages; Work Experience; *Youth; Youth Employment
IDENTIFIERS *Australia; *Great Britain; United States

ABSTRACT

Training measures in the U.S. National Longitudinal Survey of Young Men, the National Child Development Study for Britain, and the Australian Longitudinal Survey of Youth were used to study determinants and labor market outcomes of postschool training received by young men. Twelve percent of U.S. youth reported getting formal training in the first year, compared with between 30 and 40 percent of nonapprentice males in Britain and Australia. As they acquired work experience, a high proportion of U.S. youth reported receiving training, whereas job training in Britain and Australia proceeded at a slower pace. U.S. employers provided workers with company-based training; British and Australian employers relied on outside training sources. Level of schooling attainment was an important predictor of postschool training and labor market success. For all three countries, better-educated youth were considerably more likely to get training. Rapid technical changes increased the likelihood of getting company training, especially for youth with the most education. In all three countries, union membership was associated with an increased probability of training, and company-based training had by far the largest quantitative influence on raising youth wages. Other training benefits were employability and job stability. Wage effects of formal training in the United States were roughly twice those in Britain and Australia. (32 references) (YLB)

Youth Training in the United States, Britain, and Australia

Hong Tan, Bruce Chapman,
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The research described in this report was supported by the National Center on Education and Employment at Teachers College, Columbia University, through Grant No. G008690008 from the Office of Educational Research and Improvement, U.S. Department of Education.

ISBN: 0-8330-1163-4

Published 1991 by RAND
1700 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138

R-4022-ED

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PREFACE

This study was funded by the National Center on Education and Employment at Teachers College, Columbia University, through Grant No. G008690008 from the Office of Educational Research and Improvement, U.S. Department of Education. The study uses reported training measures and labor market data from three youth surveys: the National Longitudinal Survey of Young Men (U.S.), the National Child Development Study (Britain), and the Australian Longitudinal Survey of Youth (Australia). This cross-national comparison of youth training and its labor market consequences should be of interest to policymakers concerned with issues of education, labor markets, and work force quality.

SUMMARY

The imperatives of rapid technological change, rising international competition, and changing demographics have raised concerns about the adequacy of education and job training in many industrial countries, including the United States, Britain, and Australia. Much of the policy debate in these three countries has been limited by the paucity of reliable information. This report uses youth surveys with training information—the U.S. National Longitudinal Survey of Young Men (NLS), the National Child Development Study (NCDS4) for Britain, and the Australian Longitudinal Survey of Youth (ALS)—to conduct cross-national analyses of self-reported, formal job training, and labor market outcomes of that training among male youth in the three countries.

Despite some limitations, all three surveys contained information on educational attainment, wages, work and unemployment histories, training received from employers as well as off the job, and training incidence in the early years of their work career. These data revealed that there is not just one kind of training, but various kinds for different purposes. Highly aggregated descriptions of job training miss important behavioral differences among the training sources, their determinants, and their consequences for earnings and employment stability.

American youth appear to get little formal training upon entry into the labor market. Just 12 percent of them report getting any formal training in the first year, compared with between 30 and 40 percent of nonapprentice males in Britain and Australia; these figures rise to between 50 and 60 percent for male apprentices who get formal instruction as part of their apprenticeship program. However, the U.S. training situation is less bleak if youth are followed over time. As they acquire work experience, a high (and rising) proportion of males report receiving training, a figure that catches up and overtakes that of nonapprentice youth in Britain by about the sixth year in the labor market.

Much of the training of youth in Britain and Australia is concentrated in the first few years, possibly because of youth apprenticeship programs and public training and job placement schemes, with subsequent job training proceeding at a slower pace. In the United States, entry-level figures may be low because they exclude job-relevant

training from public and private vocational-educational (voc-ed) institutions that, in many other countries, are provided to school-leavers through youth apprenticeship programs and other schemes. Cross-national comparisons of entry-level training are thus potentially misleading because of these institutional differences; comparisons of training over the work career are more appropriate, and in this regard, American youth appear to accumulate job skills at a much faster pace than their counterparts in Britain or Australia.

To better understand these cross-national patterns of training, we estimated probit models relating training by source to a comprehensive set of covariates. These included level of educational attainment, labor market experience, time in the current job, the industry rate of technological change, union membership or coverage by collective bargaining, and other control variables.

This analysis confirmed the importance of formal educational attainment as a predictor of postschool training. In all three countries, better-educated youth were significantly more likely to get training, especially company training, which has the greatest influence on raising wages and reducing the likelihood of unemployment. Given this education-training link, current high dropout rates among American youth, blacks and hispanics in particular, together with the growing scarcity of jobs not requiring a high school or college education, are likely to exacerbate the gap between the educated and less educated, and between whites and racial minorities.

The results suggested that training requirements are shaped by the rate of technological progress in the industry of employment. In the United States and Britain, the likelihood of getting company training increased in industries experiencing rapid technological change, especially for the most educated workers. In contrast, training from schools and off the job sources declined as the pace of technical change quickened. This pattern of training is consistent with the hypothesis that rapid technical change increases demand for highly skilled and educated workers able to respond to the vagaries of new technologies. In contrast, the technology-training nexus was barely detectable in Australia, possibly because binding minimum wage legislation and restrictive work practices of unions have inhibited the ability of employers to respond flexibly to technical change. Training, and the ability of employers to adopt and adapt new technologies, may not be forthcoming without more flexible personnel policies and new forms of work organization. Finally, in all three countries, the least educated youth received significantly less training from all

sources in industries experiencing rapid technical change. This result confirms concerns that many policymakers have expressed about the possible detrimental effect of technological progress on the least educated in the workforce. It reinforces the need for remedial programs targeted at low education groups already in the labor market and for policies to reduce dropout rates, improve achievement, and raise school continuation rates for those still in the educational pipeline.

Years of general work experience and job tenure had different training effects in the three countries. First, British and Australian youth received most job training early in their careers. Subsequently, other than some on the job training, employers in these countries tended to rely more on schools and off the job training sources to augment long-tenured worker skills. In contrast, American young men continued to accumulate training from all sources with years of work experience, quite independently of years of tenure with the employer. Furthermore, American employers appeared to provide increasingly more company-based training to their workers with longer tenure. Such a continuing process of firm-based learning and job training is critical if companies are to successfully adapt and use new technologies. In this regard, American employers perform better than those in the other two countries.

The effects of union membership (or employment in a unionized firm) on youth training were fairly similar in all three countries. Among nonapprentices, union members were more likely to get both on the job training and school-based training, but typically at the expense of company training. In Britain (but not Australia), unionized apprentices were more likely to get training off the job rather than from the company. These results appear to be at odds with the commonly held view that unions inhibit job training.

We also investigated the effects of training on subsequent wages and the likelihood of experiencing unemployment. We estimated wage models both with and without summary measures of reported training, and probit models of the likelihood of experiencing future unemployment. Like the earlier findings on training determinants, these wage and unemployment results pointed to important differences in training effects on earnings and unemployment, varying by source of training.

In all three countries, company training had by far the largest quantitative effect on increasing weekly wages, followed by off the job training. In the United States and Britain, training taken in schools had no measurable effect on weekly wages, though the level of schooling

attainment itself was associated with positive returns. The effects of training appeared to diminish over time, reflecting both skill depreciation and loss of some firm-specific skills (the latter, however, was modest).

The returns to training also varied widely across countries, with training wage effects in the United States being roughly twice those in Britain and Australia. The relative size of these training returns provides insights into why incentives for workers to get (and employers to provide) training are so much lower in Britain and Australia than in the United States. More comparative research is needed to better identify the systemic institutional and organizational factors responsible for low training returns in these countries.

We found that the estimated returns to schooling were larger if the individual worked in a high-technology industry. These schooling-technology links were particularly strong for college graduates and postgraduates in the United States; similar, though somewhat weaker, results were found for college graduates in Britain and Australia. In all three countries, youth with little formal education appear to be poorly prepared for the demands of a rapidly changing workplace, are paid less, and are less likely to be hired. Second, wage profiles with labor market experience tended to be steeper in the United States than in the other countries. In large part, this is because job tenure had a large positive effect on NLS youth wages of about 4 percent but had no measurable effect in the NCDS4 or ALS.

Finally, we found evidence that formal training reduced the likelihood of experiencing a spell of unemployment. In the United States, company training had the largest quantitative effect on inhibiting unemployment; in Australia and Britain, company-based and off the job training had roughly the same effects on unemployment. Mirroring the wage-training results, the unemployment-reducing effects of training were ameliorated with the passage of time. The industry rate of technological change was usually associated with a lower likelihood of experiencing a spell of unemployment. From this result, we conclude that there is no empirical support for policy concerns about technology-induced youth unemployment, at least not in the youth samples studied.

ACKNOWLEDGMENTS

This comparative study of youth training in the United States, Britain, and Australia would not have been possible without the active participation and collaborative research effort of the RAND project team. Members included Hong Tan (Principal Investigator), Christine Peterson, and Lee Lillard from RAND, and two country collaborators—Bruce Chapman from the Australian National University, and Alison Booth of Birkbeck College, University of London. Margi Wood at the Australian National University also supplied expert programming assistance with the Australian data.

The authors presented early drafts of work in progress on each country's data at a Workshop on International Comparisons of Youth Training, held at RAND in July 1990. We are grateful to workshop participants, in particular Finis Welch, Jacob Mincer, Gus Haggstrom, and Nevzer Stacey, the project monitor from the Office of Educational Research and Improvement. Their insightful comments helped shape our research and the integration of the separate country studies. Other constructive comments by RAND reviewers John Strauss and Lorraine McDonnell, and by Georges Vernez, director of RAND's Education and Human Resources Program, contributed to the final version.

CONTENTS

TABLES

1. INTRODUCTION

Technological change, rising international competition, and changing demographics have stimulated policy interest in education and training issues in many countries, including the United States, Britain, and Australia. Policymakers in these countries have raised concerns about inadequate levels of skills investments in schools and in the workplace and have proposed wide-ranging strategies to reform the educational system, improve work-based learning, and encourage greater employer provision of training.[1] Much of this policy debate, especially about job training, has been limited by a paucity of reliable information, not only about how much training goes on in the country, but also about how this training compares with that of other countries.[2]

This report compares the postschool training experiences of young men in the United States, Britain, and Australia. We use the National Longitudinal Survey of Young Men (NLS) for the United States, and male samples from Britain's National Child Development Study (NCDS4) and the Australian Longitudinal Survey of Youth (ALS).[3] The three surveys elicited broadly similar kinds of information on educational attainment, participation in formal training programs, wages, job attributes, and unemployment, as well as panel data on the variables of interest. We use these data to document and compare the incidence of youth training in each country, not only at labor market entry, but over the early work career. We consider formal training from employers and from such off the job sources as business and technical institutes, industry training centers, and schools. Each training source is different, and important insights are

[1]In the United States, see Commission on Workforce Quality and Labor Market Efficiency, 1989; U.S. Department of Labor, 1989; Office of Technology Assessment, 1990. In Britain, see the summary report by Finegold and Soskice, 1988. In Australia, see Australian Department for Employment, Education and Training, 1988.

[2]Researchers have recently begun to exploit self-reported measures of formal training in several national surveys to document and explain the incidence of training. Examples include Lillard and Tan, 1986; Lynch, 1988; and Mincer, 1988, in the United States. In Britain, see Greenhalgh and Stewart, 1987; Connally, Micklewright, and Nickell, 1989; Booth, 1989; and Baker, 1990. See Miller, 1987, in Australia. To date, none have been explicitly comparative.

[3]Though available, data for American females in the NLS Girls Survey were not analyzed. Thus, for comparability, we focus on males in all three surveys, even though females are included in the NCDS4 and ALS surveys. Models estimated for female samples in these two surveys are available from the authors.

lost when training from all sources is aggregated. We explore several hypotheses about the most important determinants of training from each source and study their effect on labor market outcomes such as wages and the likelihood of unemployment.

In these analyses, we will be interested in addressing several broad questions. First, are education and work-related training complementary or substitute forms of skill investments? This issue is of policy interest because of the insights it gives into the question of whether youth make up for low schooling attainment with more job training or are penalized in terms of their access to future job training opportunities. Second, what role does technology play in shaping educational and skill needs in the workplace? The kinds of training strategies employers adopt in response to technological change will have important implications for productivity growth, innovation, and competitiveness. Third, do unions inhibit job training? High union wages and restrictive work rules are thought to reduce incentives for employers to provide training, especially in Britain and Australia where union coverage rates are high. Finally, how do patterns of training in the three countries compare? What policy lessons can be gained from commonalities and differences in the youth training experiences of these countries?

Section II describes the NLS, NCDS4, and ALS surveys and presents summary information on the incidence of youth training in the three countries. Section III discusses the research hypotheses and main findings about the correlates of postschool training. Section IV focuses on the effects of training on weekly wages and the likelihood of unemployment. Section V summarizes the results of the cross-national comparisons and their implications for education and training policy in the United States, Britain, and Australia.

2. DATA AND OVERVIEW

In this section, we first describe the main features and variables in the NLS, the NCDS4, and the ALS. Each survey contains a wealth of information on the number, timing, and sources of multiple training events, and on the demographic and labor market variables needed for analysis. For each survey, we develop a broadly consistent definition of schooling completion after which all reported training events (including school-based coursework) are treated as episodes of postschool training. The data are then used to describe and compare the incidence and timing of postschool training in the three countries, separately by training source.

THE YOUTH SURVEYS

The three surveys are among the best sources of data available for a study of youth training in the three countries. The NLS is a longitudinal survey of about 5000 young men, aged 14–24 years in 1966, who were followed over 14 years (until 1980) at one- or two-year intervals. The ALS is a panel survey of young Australians begun in 1985 and currently available for four waves to 1988. Modeled on the NLS, this survey focuses on youth between the ages of 15 and 26 years in 1985. The NCDS4 is a retrospective survey conducted in 1981 of one cohort of British youth who were 24 years old at the time of the fourth wave. To make this survey comparable to the NLS and ALS, we used the NCDS4 monthly calendar and date information to restructure the NCDS4 as a longitudinal dataset with one record for each 12-month period. For NCDS4 respondents joining the labor market at the minimum school-leaving age of 16, we observe a panel of up to eight years; for those completing a first degree, we observe a correspondingly shorter panel of about three years. In the latter two surveys, we restrict our analyses to the young men samples, 6250 males in the NCDS4 and over 3000 males in the ALS.

Respondents in all three surveys reported their participation in two broad kinds of formal training programs—company training, and training from various outside sources. Table 1 describes the main sources of training in each survey. Company training is unambiguously defined in all surveys as taking place in the firm. The "outside" category varies in how finely the training source is identified. In

Table 1

Training Information in the NLS, NCDS4, and ALS

Survey	Training Type	Sources of Training
NLS Young Men (United States)	Company	Company training school
	Business/technical	Business and technical institutes
	School courses	Colleges and universities
	Other training	Government training programs, adult education, correspondence courses
NCDS4 (Britain)	Company	Company training centers
	Off the job training	Colleges, industry centers, government skill centers
	School courses for qualification	Teacher or technical colleges, schools, adult education, commercial colleges
ALS (Australia)	Company	Company training centers
	Off the job training	Technical colleges, Technical and Further Education (TAFE), business colleges
	Further schooling	Schools, TAFE, business colleges, adult education

the NLS, outside sources include (1) business-technical institutes, (2) school-based coursework, and (3) "other" sources such as government training programs and correspondence courses. In the NCDS4, this outside category is of two types: (1) job-related training taken off the job in industry training centers and government skill centers and (2) school-based coursework taken for a higher qualification. In the ALS, the sources of outside training are not clearly defined and may well overlap with coursework taken for further education. We will focus only on job-related training.[1] We emphasize that these data refer only to formal training. This is an important limitation, since we do not observe potentially sizable investments in informal on the job training.[2]

The NLS elicited information on whether the respondent received formal training since the last interview and, if the response was

[1]ALS apprentices were not asked separate questions about training, though much of their formal instruction is likely to be from off the job sources.

[2]It is unclear how useful measures of informal on the job training would be even if they were available. Our earlier work using the *Current Population Survey* indicated that respondents poorly recalled or reported informal training (Lillard and Tan, 1986). The ALS also asked whether respondents received training from supervisors or fellow workers. Since virtually all responded in the affirmative, such informal training measures are of little use in discriminating between individuals.

affirmative, on the source of the "longest" training event in that interval. Only one training event within an interval is reported, but there is information on multiple intervals for each person in the NLS panel.[3] In the NCDS4, respondents were asked how many formal training courses they had attended since secondary school that lasted longer than 14 days or a total of 100 hours. However, training source and dates were elicited only for the first three training courses. Apprentices were also asked about the source of formal training received as part of their apprenticeship program. Finally, respondents provided information on up to four school courses they had taken for higher qualification since secondary school, not including events specifically covered by training and apprenticeship questions. Thus, including apprenticeship training, NCDS4 respondents could report up to four job-related training events and four schooling courses.[4] In the ALS, respondents were asked about training received since the last interview.[5] They could respond affirmatively to the receipt of both company and off the job training, and their training responses are recorded over a maximum of four years.

We structure the training data for all three surveys using a common definition of schooling completion—the date an individual completes full-time formal schooling and joins the workforce. We were motivated to define schooling completion on both theoretical and empirical grounds. In the tradition of Mincer's (1974) human capital research, individuals are usually modeled as specializing (full-time) in education before entering the labor market. Subsequently, they divide their time between earning and skill acquisition, with the fraction of time spent training declining over the work career, because there is a shorter period to recoup training investments and the opportunity cost of time rises as they become more skilled. Empiri-

[3]In the more recent NLS Youth Cohort Surveys, up to three training events may be reported in each interval. However, multiple episodes of training in a given interval are not common in this survey, suggesting that underreporting of job training in this NLS Young Men sample may not be a problem.

[4]Less than 3 percent ever exceeded these limits and thus have censored training data. For individuals reporting more than three training events *and* more than four schooling events, the earlier of the dates of the last training or the last schooling event was used to determine when censoring began. Therefore, 175 males and 46 females had censored periods, and a total of 241 and 56 censored periods for these two groups were dropped from the data.

[5]The ALS did not elicit information on time in training, so that even events of fairly brief duration (or minor consequence) are included. Since both NLS and NCDS4 surveys condition on either the longest training event or events meeting some duration or hours criterion, the ALS would tend to overstate the incidence of formal training in Australia.

cally, this definition of schooling completion allows us to distinguish between investments in schooling and postschool training. We treat school courses taken before schooling completion as part of the individual's initial stock of educational capital, but we treat school courses taken after labor market entry as a postschool "training" event. Furthermore, we can define years of labor market experience as beginning after schooling completion and control for any work experience acquired before labor market entry.

In defining schooling completion, we sought to develop rules that captured the many school-to-work transitions exhibited in the data and were simple to make operational. The majority of respondents in each of the three countries appear to follow distinct phases of educational and postschool skill investments. Upon completion of full-time schooling, they enter the labor market and never return (at least within the panel) to get further education leading to a higher degree.[6] However, for some nonnegligible fraction of the youth population, the transition between school and the workforce is less clear cut; some work and attend school part-time, others first work full-time before returning to school, often after a break of several years.[7] The rules we used may be summarized as follows.[8] An individual is defined to complete full-time schooling in a given year if subsequently (at least until the end of the panel) no full-time schooling is reported that results in a rise in his level of educational attainment. For those reporting an increase in schooling attainment (or receipt of a higher qualification), perhaps after an intervening period of work, the date of schooling completion is moved forward to that year.

With this school-to-work transition date in hand, we define the highest level of schooling with which respondents enter the labor market. For the NLS, we define five levels of schooling attainment: nongraduates, high school graduates, some college, college graduates,

[6]For example, in the NCDS4, two-thirds of the 1954 birth cohort left secondary school at age 16 and never returned to get further schooling leading to a higher qualification.

[7]There has been a slow secular rise in the United States of time to completion of postsecondary schooling, with many more American youth working while attending school. We are unable to address this issue within the framework of the model used here.

[8]In defining schooling completion, we used panel information on each person's level of schooling attainment at the start of the survey period, full-time employment or schooling status during the interval, and job histories over the entire panel. We build in some flexibility to accommodate schooling interruptions of less than two years (often in the first job) that are followed by full-time schooling. In these cases, the individual is deemed to complete formal schooling at the end of the last schooling event.

and postgraduates.[9] For the NCDS4, we define four levels of schooling, corresponding to compulsory minimum schooling for a school-leaver at age 16 years, "O" Level, "A" Level, and first degree qualifications. For the ALS, we define five schooling levels: less than 10 years, 10 to 11 years, 12 years, diploma or certificate, and a first degree.

OVERVIEW OF TRAINING IN THE NLS, NCDS4, AND ALS

Table 2 shows the cumulative probabilities of getting any training, and training by source, beginning with the period immediately following schooling completion. The first panel (Panel A) refers to the NLS sample of young men. The second and third panels refer to NCDS4 males by apprenticeship status. The final two panels show the corresponding male nonapprentice and those who ever were apprentices samples from the ALS. Reading across rows, we note that the proportion of NLS young men getting some form of training is 12 percent in the first year; with time in the labor market, the proportion who ever get formal training rises (at a decreasing rate) to about 54 percent by the eighth year. Company programs, business and technical institutes, and traditional schools appear to be equally important providers of postschool training for youth, excluding "other."

How do American youth fare in comparison with British youth? Three main differences stand out. First, a higher proportion of British youth appear to get training on entering the labor market. For example, 63 percent of apprentices report training, primarily from off the job sources (see Panel C). This is not surprising since formal study is a requisite for completing an apprenticeship program. However, even among nonapprentices (Panel B), the proportion training on labor market entry is twice as high—27 percent—as that in the NLS. Second, and in marked contrast to the NLS, the cumulative probability of training rises slowly with time in the labor market, so that by the eighth year the training gap between youth in the two countries is reduced considerably. The proportion with training rises from 63 percent to 77 percent for the apprentice group; for nonapprentices, the U.S.-U.K. training differential is actually reversed. By the eighth year, only 47 percent of nonapprentices have received training (up from 27 percent in the first year) compared with 54

[9]These categories are associated with less than 12, 12, 13 to 15, 16, and over 16 years of formal schooling.

Table 2

Cumulative Probabilities of Training by Source[a]

	Sample/Sources of Training	Years in the Labor Market							
		1	2	3	4	5	6	7	8
A.	NLS young men								
	Any	.12	.19	.31	.38	.42	.52	.52	.54
	Company	.02	.05	.08	.10	.12	.15	.15	.17
	Business-technical	.03	.04	.07	.09	.09	.13	.13	.15
	Schools	.02	.04	.07	.10	.11	.16	.16	.17
	Other sources	.04	.08	.12	.15	.18	.20	.22	.22
B.	NCDS4 males: Nonapprentice								
	Any	.27	.35	.40	.43	.46	.47	.47	.47
	Company	.07	.10	.12	.12	.14	.15	.15	.15
	Off the job	.13	.17	.19	.21	.22	.24	.24	.24
	Schools	.08	.11	.13	.15	.17	.18	.18	.18
C.	NCDS4 males: Ever apprentice								
	Any	.63	.68	.72	.74	.75	.76	.77	.77
	Company	.02	.03	.04	.05	.07	.08	.09	.09
	Off the job	.60	.65	.67	.69	.70	.71	.71	.71
	Schools	.02	.03	.04	.05	.06	.08	.09	.10
D.	ALS males: Nonapprentice								
	Any	.39	.55	.65	.69	—	—	—	—
	Company	.27	.41	.50	.58	—	—	—	—
	Off the job	.22	.36	.46	.54	—	—	—	—
E.	ALS males: Ever apprentice								
	Any	.53	.59	.65	.68	—	—	—	—
	Company	.26	.33	.41	.47	—	—	—	—
	Off-the-job	.45	.50	.54	.61	—	—	—	—

[a]The length of panels varies across survey—up to 15 years in the NLS, eight years in the NCDS4, and four years in the ALS.

percent in the NLS. In Britain, there is apparently less ongoing job training of the sort found in the United States. Finally, in contrast to the NLS, off the job training is the most common source by far among NCDS4 males. By the eighth year, 24 percent of nonapprentices and 71 percent of apprentices have received off the job training. The figures for company training trail, at about 15 percent for nonapprentices and 9 percent for the apprentice group.

Patterns of postschool training among Australian males more closely resemble those of the NCDS4 than of the NLS (see Panels D and E). A very high proportion of Australians appear to get formal job training in the first year in the labor market—over 50 percent for apprentices and about 40 percent for nonapprentices. Subsequently, the

proportions of youth in the ALS with any training appear to rise slowly with time in the labor market. Another similarity is the greater likelihood of off the job training for apprentices in both the ALS and NCDS4. The main differences lie in the higher levels of postschool training and the smaller disparities in training by apprenticeship status in Australia. As we noted earlier, higher levels of reported formal training in Australia may simply reflect the inclusion in the ALS of fairly brief training events that would not have passed the hours or duration criteria used (or implied) in the NCDS4 and NLS.

These cross-national differences in patterns of youth training are striking. The entry-level differences are perhaps not surprising given institutional differences in the educational system, apprenticeship programs, and public training schemes in the three countries. For example, the majority of British students leave full-time schooling at the age of 16, often joining apprenticeship programs to acquire job skills. Like Britain, Australia also has well-developed youth apprenticeship programs that provide employment for over one-third of all school-leavers. In contrast, many American youth acquire vocational skills in public and private vocational-education (voc-ed) schools before labor market entry, but we treat this as formal schooling. Apprenticeship programs in the United States are also not common (under 1 percent of the labor force), and training seats that are available tend to be concentrated in construction and the trades, and among older, typically unionized workers (Glower, 1986). The United States also has no large public training and job placement program targeted at unemployed youth comparable to Britain's Training Opportunities Program (TOPS), which may account for some part of reported training in the NCDS4.

Differences in the steepness of experience-training profiles in the three countries are less readily explained. Some part of the difference may be systemic.[10] As reasons for "training failure" commentators on Britain's system point to poor technical preparation of managers, short-term perspectives of many companies favoring profits over training investments, restrictive practices of craft-based unions that

[10]The timing of surveys may also be responsible for differences in experience-training profiles. For example, the NCDS4 covered a period of depressed economic conditions in the late 1970s and early 1980s, while many NLS respondents entered the labor market during a period of expansion between the late 1960s and early 1970s. Arguably, employer incentives to augment worker skills and retrain vary across the business cycle, being lower in recessionary times and higher when macroeconomic conditions are good.

inhibit job training, and company organizational structures ill-suited to the adoption of new technologies (Finegold and Soskice, 1988). Similar concerns have been voiced in Australia, focusing on the role of trade unions, a complex centralized award wage system that sets occupation-specific minimum wages covering 80 percent of all wage and salary earners (Mitchell, 1985), and an industrial sector nurtured by protection from competition by tariffs and industry regulation (Australian Department of Education and Training, 1988). With the exception of union coverage—the United States has much lower coverage (less than 20 percent) than unionization rates of between 40 and 55 percent in Britain or Australia—we are unable to quantify many of these factors or evaluate their relative importance in the three countries. In the following sections, we investigate the determinants and outcomes of training for insights into the factors that might be responsible for these training profiles.

3. THE DETERMINANTS OF YOUTH TRAINING

With the broad overview of training as background, we now turn to an econometric analysis of the economic determinants of training in the three countries. The analysis is based on pooled period data from each survey, beginning with the first year in the labor market after schooling completion.[1] Each period represents an interval of 12 months in the labor market, except for several NLS cross sections spanning two years; these are identified by two-year indicator variables. Using these pooled period data, we estimate probit models for the likelihood of getting training from all sources, termed "Any," and separately for each training source. The probit models for each country include a common set of explanatory variables—the level of educational attainment, work experience and job tenure, technological change in the industry of the current job, and union membership or collective bargaining status—as well as a variety of control variables for region of residence, marital status, preentry work experience, level of macroeconomic activity, and missing values.

VARIABLES AND HYPOTHESES

We capture the training effects of schooling using indicator variables for discrete levels of educational attainment. For the NLS, we define four schooling levels—high school graduates, some college, college graduates, and postgraduates—and compare them with nongraduates. For the NCDS4 samples, three indicator variables for schooling attainment are used—"O" levels, "A" levels, and first degree qualifications—the omitted group being those who leave school at age 16 with the minimum compulsory level of education. For the ALS, we include indicator variables for attainment of several levels of secondary schooling and postsecondary school qualifications. The omitted group are Australian males with less than ten years of secondary schooling. Here our interest is in determining whether schooling and training are, on net, complementary or substitute forms of skill investments.

[1]This initial approach assumes independence across years even though the same individuals may appear in more than one cross-section. Future work might use fixed-effects models to address this issue.

We investigate the role of technology in influencing the training decisions of employers and workers. The perspectives on technical change and its relationship to training requirements come from research by Tan (1980). The argument is that many job skills are technology-specific and are acquired through working with particular production technologies and specialized equipment. As technology advances, technology-specific skill requirements also grow apace. And to the extent that few of these skills are readily available outside the firm, we would expect the demand for in-house company training to increase with the industry rate of technical change. Conversely, the demand for more general kinds of skills provided by outside training institutions, such as vocational schools or business and technical institutes, might be expected to fall, other things equal. Only when technologies become well understood and widely adopted by other firms do these specific skills become transferable to other employers.

We might also expect differences across educational groups in their training responses to technical change. It has been argued that workers with more education are more adept at critically evaluating new information, and therefore respond more readily to technological change (Welch, 1970). Bartel and Lichtenberg (1987) provide some evidence for this hypothesis. In U.S. manufacturing, firms employ a more educated workforce when the industry's capital stock is newer (and embodies more recent technologies), especially if research and development spending is also higher. This "allocative efficiency" of schooling hypothesis suggests that innovative firms in industries experiencing rapid technical change are more likely to use highly educated workers and to provide them with more training relevant to new technologies. When we control for the level of schooling attainment, this hypothesis predicts a higher likelihood of company training among more educated workers in high-technology industries.

We will test these two sets of hypotheses jointly. For each country, estimates of industry rates of total factor productivity (TFP) growth are used to characterize the technological progressivity of jobs in which individuals are employed. For the United States, we rely on TFP estimates developed by Jorgenson, Gollop, and Fraumeni (1987) for the period between 1966 and 1979. These measures, derived from constant returns to scale translog production functions, are available for 45 two- and three-digit industry groupings. For Britain, we use O'Mahony and Oulton's (1990) estimates of TFP growth over the 1954–1982 period. Their TFP estimates are, unfortunately, available only for 130 manufacturing and mining industries; we include a missing TFP indicator variable for NCDS4 respondents employed outside

manufacturing. For Australia, we use unpublished estimates of multifactor productivity growth over the 1967–1989 period for 20 industries covering about 60 percent of the ALS sample.[2] These TFP measures are interacted with level of schooling attainment to test the two sets of technology hypotheses.

We distinguish between several kinds of work experience. First, we include a quadratic measure of years of labor market experience. For the NCDS4 sample, we control for preentry experience using indicator variables for schooling interruption ("break"), time (years) worked before labor market entry, and whether any qualifications were earned during this break. For the NLS, where information on earlier years is less complete, preentry work experience is captured by a dummy variable for whether there was a break in schooling. For the ALS, the experience variable is adjusted to reflect time spent acquiring additional schooling. Second, we capture the effects of job tenure in the NLS and NCDS4 samples with (connected) spline variables for time in the current job; in the ALS, a quadratic specification of job tenure is used. The human capital model predicts that most training will be concentrated early in the work career (Ben-Porath, 1967), though training patterns over time (declining or rising) might differ by the source of training.

We include a union variable for whether the individual ever belonged to a union or was covered by a collective bargaining agreement. This definition of "ever" union member was necessitated by the large number of missing values for the union variable in the NLS and by the availability of union information only in the first and current or last jobs in the NCDS4. In the ALS, union membership is specific to each survey year. We hypothesize that unions are associated with a lower probability of job training. It is widely believed that unions inhibit employer incentives to provide training because (1) high levels of union-negotiated wages prevent firms from paying lower training wages to finance workers' share of training costs, (2) restrictive work and job demarcation rules of trade unions reduce the potential benefits to employers of providing training, and (3) unions impede employer efforts to introduce new technologies that threaten union jobs but also require extensive skill upgrading and retraining of workers.

[2]Of the three sets of TFP estimates, those of Jorgenson, Gollop, and Fraumeni (1987) most closely approximate the desired technological change measure. Their TFP estimates are based on carefully constructed quality-adjusted indexes of capital, labor, and intermediate products. O'Mahony and Oulton (1990) control for the quality of capital but make no adjustments for labor quality, while the Australian TFP estimates make no adjustments for input quality.

Finally, we include a set of variables to control for a variety of other training determinants. We control for the level of macroeconomic activity in a given period by including the national unemployment rate. This was not feasible in the ALS, given the four-year panel; instead we include year indicator variables for 1986, 1987, and 1988. Where available, we also included indicator variables for employment in the public sector (which is thought to provide more formal training), marital status, previous work experience gained before completion of formal schooling, and geographic location. Some variables are available only in the NCDS4. For the NCDS4 models, we include three firm-size indicator variables—25 to 99 workers (termed "medium size"), 100 to 499 workers ("large firms"), and 500 or more workers ("very large firms"), with the omitted size category being firms with less than 25 employees. Finally, we control for missing values by using missing value indicator variables.

Probit models of the probability of getting any training, and training from each source, are estimated by maximum likelihood methods. Since the estimated parameters of these nonlinear models are not readily interpreted, we report their partial derivatives evaluated at the sample mean for each training source. In the following tables, we summarize separately the most important training covariates: level of schooling attainment, technological change in the industry, general labor market experience, time in the current job, union membership or coverage, and other training determinants.

LEVEL OF SCHOOLING ATTAINMENT

In general, the probability of getting most kinds of formal training rises with the level of schooling attainment (see Table 3). Compared with nongraduates (the omitted group), increased schooling attainment in the NLS is usually associated with a higher probability of getting any training. Similarly, compared with 16-year-old school leavers, NCDS4 males with "A" level qualifications are (depending upon apprenticeship status) between 27 and 29 percent more likely to get any training; the corresponding figures for first degree holders range between 41 and 59 percent. For Australia, we find a somewhat weaker education-training relationship. Compared with the least educated group, ALS males who complete higher education, trade qualifications, or a first degree are usually more likely to get training. However, the ranking by level of education observed in the NLS and

Table 3

Schooling Attainment and Training[a]

Sample/Schooling Attainment	Partial Derivatives of Probit Model[b]				
	Any Training	Company Training	Outside Training	School Courses	Other
A. NLS young men					
HS graduates	.077[c]	.028[c]	032[c]	.002	.018[d]
Some college	.112[c]	.036[c]	.033[c]	.028[c]	.020[c]
College graduates	.092[c]	.057[c]	-.002	.026[c]	.009
Postgraduates	.093[c]	.032[c]	.006	.041[c]	.011
B. NCDS4 nonapprentices					
O levels	.173[c]	.026[c]	.084[c]	.073[c]	—
A levels	.296[c]	.041[c]	.116[c]	.125[c]	—
1st degree	.413[c]	.081[c]	.161[c]	.151[c]	—
C. NCDS4 apprentices					
O levels	.200[c]	.001	.217[c]	.010[c]	—
A levels	.275[c]	.013	.249[c]	.025[c]	—
1st degree	.590[c]	.039[d]	.550[c]	.003	—
D. ALS nonapprentices					
12 years of school	.068[c]	.154[c]	040[c]	—	—
Other postsecondary	.059[c]	.080[c]	016	—	—
Diploma/certificate	.033	.087[c]	.011	—	—
1st degree	.051[d]	.158[c]	-.017	—	—
E. ALS apprentices					
10–11 years of school	.146[c]	-.024	.189[c]	—	—
12 years of school	.047	.059	.059	—	—
Other postsecondary	.259[c]	.133[c]	.155[c]	—	—
Diploma/certificate	.210[c]	.076	.230[c]	—	—

[a]See Sec. 2 for a discussion of noncompany sources of training in the NCDS4 and ALS.
[b]Models control for a variety of other training determinants.
[c]Statistically significant at the 1 percent level.
[d]Statistically significant at the 5 percent level.

NCDS4 is less clear cut in the ALS. With the possible exception of Australia, education and training appear to be strongly complementary forms of human capital investments.[3] One implication of this complementarity is that individuals with low schooling attainment face limited training opportunities in the workplace and, if training augments productivity, slower wage growth prospects as well.

[3]This positive correlation may also reflect the effects of unobserved ability and wealth, both of which are related to greater propensities to get more schooling and training.

The aggregate (any) training measure conceals marked differences in the kinds of training received by each educational group. For example, while overall training probabilities in the NLS rise linearly with schooling, these probabilities peak at different schooling levels for each training source—college graduates for company training, those with some college education for training from business-technical institutes and from other miscellaneous sources, and postgraduates for school-based training. The likelihood of training from each source also varies by apprenticeship status in the NCDS4 and ALS. In Great Britain and Australia, apprentices are typically more likely to report off the job formal training (perhaps as part of their apprenticeship program) than their nonapprentice counterparts, who are more likely to receive company and school-based training as their schooling increases. These behavioral differences by training source carry over into the other training determinants as well.

INDUSTRY RATE OF TECHNOLOGICAL CHANGE

Table 4 reports the effects of industry rates of technological change on the probability of training by level of schooling. Slightly different specifications of TFP are used in the three surveys. In the NLS, TFP is interacted with each level of schooling attainment, yielding a schooling group-specific TFP effect on training. In the other surveys, TFP enters by itself (the "main effect") and as interactions with each educational level except the omitted schooling group. The effects of technology on each level of schooling, comparable to those estimated for the NLS, are simply calculated by adding the main effect to the TFP parameter estimated for each schooling group.[4]

A striking pattern of technical change effects on training by source emerges from Table 4 for both the NLS and NCDS4. First, the likelihood of company training is greater in high-TFP industries ("high-tech jobs"), especially for groups with more education. For NLS college graduates and postgraduates, the increased receipt of company training with TFP growth is statistically significant (see Panel A). Similarly, as shown in Panels B and C, as TFP growth increases the probability of getting company training in the NCDS4 rises with level of schooling attainment to a peak at first degree holders for nonapprentices and at "A" level qualifications for apprentices. Further-

[4]The t-statistics associated with the two TFP specifications test slightly different hypotheses. For a given schooling level, the null hypothesis in the NLS is that there is no TFP effect; in the other surveys, the null hypothesis is that the TFP effect is not different from that in the omitted schooling group.

Table 4

Technol[illegible]al Change and Training[a]

Sample/TFP and Interactions with Level of Schooling Attainment	Partial Derivatives of Probit Model[b]				
	Any Training	Company Training	Outside Training	School Courses	Other
A. NLS young men					
TFP × Nongraduates	.009	−.002	−.003	−.001	.009
TFP × HS graduates	−.004	.004	−.002	.000	−.005[d]
TFP × Some college	−.013[c]	.001	−.002	−.004[d]	−.006[d]
TFP × College graduates	−.003	.006[d]	−.008	−.000	−.008[d]
TFP × Postgraduates	−.016[c]	.010[c]	−.002	−.008[c]	−.013[c]
B. NCDS4 nonapprentices					
TFP	.016	−.011	.009	.030[c]	—
TFP × O levels	.021	.033[d]	.006	−.028	—
TFP × A levels	.171[c]	.051[d]	.102[c]	−.006	—
TFP × 1st degree	−.009	.095[c]	−.032	−.066[c]	—
C. NCDS4 apprentices					
TFP	−.018	−.017[c]	−.044[d]	.019[c]	—
TFP × O levels	.013	.059[c]	−.027	−.006	—
TFP × A levels	.088	.096[c]	−.054	.014	—
TFP × 1st degree	.169	.025	−.201	.034	—
D. ALS nonapprentices					
TFP	−.037[c]	−.017[c]	−.023[c]	—	—
TFP × 12 years	.026[c]	.009	.005	—	—
TFP × other postsecondary	.025[d]	.020	.007	—	—
TFP × diploma/certificate	.045[c]	.004	.031[d]	—	—
TFP × 1st degree	.023	−.007	.027	—	—
E. ALS apprentices					
TFP	.010	.017	.003	—	—
TFP × 10–11 years	.000	−.030	.011	—	—
TFP × 12 years	.103[c]	.062[d]	.037	—	—
TFP × other postsecondary	.047	.005	.007	—	—
TFP × diploma/certificate	.014	.017	−.023	—	—

[a]See Sec. 2 for a discussion of noncompany sources of training in the NCDS4 and ALS.
[b]Models control for a variety of other training determinants.
[c]Statistically significant at the 1 percent level.
[d]Statistically significant at the 5 percent level.

more, we can infer from the negative TFP parameters that rapid technical change penalizes NCDS4 early school-leavers; they are less likely to get company training than their counterparts in jobs with stable or unchanging technologies, a result that is particularly strong for NCDS4 apprentices. Second, and in contrast to company training, high-tech jobs in the NLS and NCDS4 are associated with a lower

likelihood of outside training, effects that are usually larger for the highly educated groups. In the NLS, higher TFP growth reduces probabilities of outside training from schools, business and technical institutes, and miscellaneous other sources. In the NCDS4, the relationship between TFP and outside training is mixed, with a lower likelihood of off the job training for apprentices and fewer schooling courses for nonapprentices.

Together, these NLS and NCDS4 results suggest that in a growing and technologically progressive environment, employers rely more on company training for skill needs and place less reliance on schools and other outside sources for job-related training. We interpret these findings as providing empirical support for both the technology-specific skills model of Tan (1980) and the "allocative efficiency" hypothesis of Welch (1970). Furthermore, studies using a composite training measure miss important behavioral relationships between technological change and training from company-based and outside sources.

There is little support for the technical change hypotheses in the ALS. See Panels D and E of Table 4. As in the other surveys, the main effect of TFP on company and off the job training is significantly negative among nonapprentices. This suggests that higher rates of TFP growth reduce the likelihood of training among Australian males with less than 12 years of schooling, but technological change is not associated with systematically higher probabilities of training among more highly educated youth. Except for those with a postsecondary diploma or certificate, the TFP effect (sum of the main effect and the schooling parameter) is just barely positive (-0.23 plus 0.31) for off the job training. In the apprentice group, the relationship between technological change and training by level of schooling is at best mixed, being positive and statistically significant only for those with 12 years of schooling.

How can these Australian results be reconciled with the findings for the United States and Great Britain? One potential explanation may lie in the level of aggregation of Australian TFP estimates; finer TFP disaggregations by industry may be needed to tease out the hypothesized relationship. An alternative explanation, alluded to by commentators of the Australian labor market (Borland, Chapman, and Rimmer, 1990), is that flexibility at the firm level to respond to technological change has been greatly inhibited on one hand by binding minimum award wage legislation preventing firms from capturing returns to their investments in workers' specific training and, on the

other, by craft or occupation-based unions whose work rules and strict job demarcation restrict provision of company training and multiskilling. Such an environment has few incentives for employers to provide (and workers to get) differential amounts of training in response to the skill requirements of technological change. We speculate that these economic responses have, in turn, resulted in lower rates of productivity growth in Australia.

LABOR MARKET EXPERIENCE

Table 5 summarizes the patterns of job training with time in the labor market. Two experience measures are used: a quadratic specification of years of potential experience since schooling completion, and years of job tenure with the current employer. In the NLS and NCDS4, tenure is measured by several spline variables that allow tenure effects to vary flexibly within tenure intervals. In the ALS, job tenure is measured simply with a quadratic specification.

The training effects of labor market experience are broadly consistent with the training-experience profiles described earlier for the three countries. These results, however, allow us to distinguish between the effects of general work experience and job tenure, controlling for other covariates. First, consider the training effects of general work experience, holding job tenure constant. For the NLS, Panel A indicates that the probability of training from all sources rises with years of work experience, though at a diminished rate over time. For the NCDS4 and (to a lesser extent) the ALS, only company-based training appears to rise initially with work experience before declining; the likelihood of training from most other outside sources falls continuously with work experience after entry into the labor market.

The job tenure effects on training by source also vary across surveys, suggesting that employers use different training strategies in the three countries. In the NLS, after an initial training period in the first year on the job, training from schools and from business-technical institutes falls off with time in the current job, while company-based training and training from other sources continues to rise slightly with tenure. These tenure effects suggest a pattern of substitution of company training for broad-based general skills supplied by outside academic and vocational institutions as American youth advance into their work careers. In contrast, the NCDS4 results suggest that British employers tend to rely on outside training sources. For both NCDS4 samples, the probability of company

Table 5

Labor Market Experience and Training[a]

	Survey/Measures of Labor Market Experience	Partial Derivatives of Probit Model[b]				
		Any Training	Company Training	Outside Training	School Courses	Other
A.	NLS young men					
	Years of experience	.016[c]	.006[c]	.000	.003[d]	.006[c]
	Experience^2	-.001[c]	-.000[c]	-.000	-.000[c]	-.000[c]
	0–1 years tenure	.240[c]	.055	.049	.048	.109[c]
	1–2 years tenure	.008	.008	-.004	-.010	.012[d]
	2–3 years tenure	.001	.007[d]	-.007[d]	-.007[d]	.005
	Over three years tenure	-.002	.002	-.003[d]	-.004[c]	.002
B.	NCDS4 nonapprentices					
	Years of experience	-.030[c]	.011[c]	-.027[c]	-.014[c]	—
	Experience^2	.001	-.001[c]	.002[d]	.001[d]	—
	0–5 months tenure	-.305[c]	-.004	-.209[c]	-.135[c]	—
	6–12 months tenure	.054	-.049[c]	.068[c]	.071[c]	—
	1–2 years tenure	.013	-.026[c]	.029[c]	.005	—
	2–3 years tenure	.017	-.007	.015[d]	.014[d]	—
	Over three years tenure	-.011[c]	-.002	-.013[c]	.002	—
C.	NCDS4 apprentices					
	Years of experience	-.073[c]	.020[c]	-.075[c]	.007[d]	—
	Experience^2	-.013[c]	-.002[c]	-.014[c]	-.000	—
	0–5 months tenure	-.716[c]	.015	-.852[c]	-.029	—
	6–12 months tenure	.323[c]	-.006	.345[c]	.001	—
	1–2 years tenure	.164[c]	-.019[c]	.183[c]	-.009	—
	2–3 years tenure	.268[c]	-.003	.316[c]	-.004	—
	Over three years tenure	-.075[c]	-.002	-.075[c]	.004[c]	—
D.	ALS nonapprentices					
	Years of experience	-.016[c]	.005	-.018[c]	—	—
	Experience^2	-.002[c]	-.001[c]	-.002[c]	—	—
	Years of tenure	.065[c]	.039[c]	.058[c]	—	—
	Tenure^2	-.004[c]	-.002[c]	-.004[c]	—	—
E.	ALS apprentices					
	Years of experience	-.070[c]	-.022	-.077[c]	—	—
	Experience^2	.002	.000	.003	—	—
	Years of tenure	.073[c]	.039[c]	.067[c]	—	—
	Tenure^2	-.004[c]	-.002	-.004[c]	—	—

[a]See Sec. 2 for a discussion of noncompany sources of training in the NCDS4 and ALS.

[b]Models control for a variety of other training determinants.

[c]Statistically significant at the 1 percent level.

[d]Statistically significant at the 5 percent level.

training falls continuously with job tenure, while off the job training and training from schools rise initially and then begins to decline after the second year on the job. This suggests that other than some entry-level company training, British employers tend to rely on outside training sources to augment their workers' skills. The ALS tenure-related patterns of training by inhouse or outside sources more closely resemble those of the NCDS4 than of the NLS. Panels D and E suggest that company and off the job training in the ALS both rise and then decline with job tenure. However, because the tenure effects of company training are smaller, we conclude that Australian employers are also more likely to augment the skills of their workers from outside sources.[5]

UNION MEMBERSHIP OR COVERAGE

We expected to find a lower probability of job training among union members or employees covered by collective bargaining agreements. In unionized firms, employer incentives to provide training are thought to be low because of high union-negotiated wages, restrictive union work and job demarcation rules, and problems in introducing new, skill-intensive technologies that threaten union jobs. We did not find any empirical support for this hypothesis, at least with the formal training measures that we use.

On the contrary, the results in Table 6 suggest that union membership or union coverage in all three countries is usually associated with a greater likelihood of formal training from most sources. Panel A shows that union members in the NLS get more training from the company, business and technical institutes, and school sources. Panels B and C also point to similar kinds of union effects in Britain, but the statistical significance varies by training source and by apprenticeship status. For both NCDS4 samples, unions are associated with a greater likelihood of school-based training. However, union effects are mixed for the other training sources; nonapprentices are more likely to get company-based training but not off the job training, while apprentices are more likely to get training from off the job sources but less company training. In the ALS (Panels D and E), union effects on formal training by source and apprenticeship status closely resemble those in the NCDS4. These results suggest a more

[5]In both ALS samples, the partial derivatives of tenure are larger for off the job training than for company training. For example, among nonapprentices, the tenure effect for off the job training is about one-third larger—5.8 percent for off the job training and 3.9 percent for company training.

Table 6

Other Training Determinants[a]

	Survey/Other Training Determinants	Partial Derivatives of Probit Model[b] Any Training	Company Training	Outside Training	School Courses	Other
A.	NLS young men					
	Ever union member	.017[c]	.006[d]	.001	.009[c]	.000
	Schooling break	.024[d]	.009	−.006	−.015[d]	.026[c]
	Started new job	−.100[c]	−.015	−.025	−.043[d]	−.033[d]
	Nonwhite	−.010	.003	.003	−.003	−.014[c]
	Unemployment rate	.006[c]	.001	.002[d]	.001	.002
B.	NCDS4 nonapprentices					
	Union coverage	−.010	.004	−.017[c]	.008	—
	Worked before entry	−.064[c]	−.011[c]	−.029[c]	−.016[c]	—
	Over three previous jobs	−.027[d]	.001	−.032[c]	−.006	—
	Medium size firm	.052[c]	.008	.031[c]	.013	—
	Large firm	.063[c]	.029[c]	.030[c]	.003	—
	Very large firm	.051[c]	.026[c]	.011	.013	—
	Private sector job	−.092[c]	−.053[c]	−.044[c]	.013	—
	Unemployment rate	−.013[c]	−.006[c]	−.009[c]	.001	—
C.	NCDS4 apprentices					
	Union coverage	−.003	−.024[c]	.074[c]	.010[c]	—
	Worked before entry	−.085[c]	.002	−.107[c]	.009[c]	—
	Over three previous jobs	−.071[c]	.005	−.125[c]	−.013[c]	—
	Medium size firm	.058[c]	.024[c]	.060[c]	.009[d]	—
	Large firm	.087[c]	.015[c]	.107[c]	.015[c]	—
	Very large firm	.116[c]	.029[c]	.118[c]	.015[c]	—
	Private sector job	−.070[c]	−.042[c]	.038[c]	−.003	—
	Unemployment rate	.032[c]	−.002	.010	.001	—
D.	ALS nonapprentices					
	Union member	.047[c]	.092[c]	−.042[c]	—	—
	Public sector job	.172[c]	.187[c]	.067[c]	—	—
	English speaking	.034	.051[d]	−.015	—	—
	Other country origin	−.020	−.033	−.021	—	—
E.	ALS apprentices					
	Union member	.071[c]	.055[c]	.037	—	—
	Public sector job	.080	.093[d]	−.010	—	—
	English speaking	−.029	.017	−.002	—	—
	Other country origin	−.032	−.003	.067	—	—

[a]See Sec. 2 for a discussion of noncompany sources of training in the NCDS4 and ALS.

[b]Models control for a variety of other training determinants.

[c]Statistically significant at the 1 percent level

[d]Statistically significant at the 5 percent level.

complex training role for trade unions than is usually believed. Unions may give rise to more formal training because of union-negotiated agreements or through sponsorship of apprenticeship programs. Unions may inhibit less formal kinds of on the job training, perhaps through job demarcation and work rules, but this issue cannot be addressed here because informal training measures are not available or are of poor quality. We take up this issue in the next section when we compare wage-tenure effects across countries, which we interpret as largely reflecting the returns to informal learning.

OTHER TRAINING DETERMINANTS

The remaining determinants of training, reported in Table 6, may be summarized briefly as follows: First, in the NLS and NCDS4, the probability of training from most sources is usually diminished for those with work experience gained before schooling completion, for those with more than three previous jobs (NCDS4), or for recent job changers (NLS), possibly because many are bringing skills to the new job from previous employers. Second, when we control for other factors, nonwhites in the NLS are not different from whites in their access to formal training, with the possible exception of miscellaneous other training that nonwhites are less likely to get. In the ALS, immigrants from English-speaking and other countries do not appear to be different from native-born Australians (the omitted group) in their propensities to get job training. Third, high unemployment increases the likelihood of training from business and technical institutes in the NLS; in the NCDS4, high unemployment rates significantly reduce training for nonapprentices from both company and outside sources. Fourth, NCDS4 respondents in large firms are more likely to get formal training from all sources. While information on employer size is not available in the NLS, others have found similar firm-size training effects in the United States (for examples, see Barron, Black, and Lowenstein, 1987). Finally, private sector employment in both Britain and Australia is usually associated with a lower likelihood of training, with some exceptions by training source and sample.

To summarize, we have found many similarities and differences in the determinants of postschool training in the United States, Britain, and Australia. In all countries, the probability of training from most sources increases with the level of educational attainment. Strikingly similar training patterns—a greater likelihood of company training and reduced training from outside sources varying with the industry

rate of technical change—were found in both the United States and Britain, but not in Australia. Surprisingly, unions were found to be associated with more formal training from most sources. We found marked differences across countries in the effects of work experience and tenure on training. Compared with British and Australian youth, young men in the United States report little training upon joining the workforce; over time, however, they accumulate training at a much more rapid pace. Indeed, with time on the current job, their likelihood of getting additional company training remains high, whereas that of British and Australian youth is diminished.

4. LABOR MARKET CONSEQUENCES OF TRAINING

Having identified the most important training determinants, we now turn to the effects of training. We consider two labor market outcomes, the logarithm of weekly wages and the probability of unemployment. We are interested in whether postschool training enhances worker productivity (as measured by wage growth), in identifying the sources of training that contribute the most to worker productivity, and, if trained workers are indeed more valuable to employers, in whether they are less likely to become unemployed subsequently. Answers to these questions may yield insights into training incentives in the three countries.

The panel nature of the NLS, NCDS4, and ALS datasets allows us to investigate the dynamic pattern of training effects. We will allow training to affect wages (and unemployment) in three ways: (1) whether trained in the past year, (2) number of training episodes since labor market entry, and (3) time since receipt of training. First, training in the current period may reduce wages through lowered productivity while in training, or may simply reflect the fact that workers "pay" for training through acceptance of a lower wage. Second, if the occurrence of both current and past training events raises worker productivity and shifts up the wage function, then outcomes are affected by the total number of training events taken since labor market entry. We assume that each training event enhances wages by the same proportion, though each training source may have a different effect. Finally, if skill depreciation (or obsolescence) is important, the size of the wage effect from a training event will depend upon how long ago it occurred. We allow obsolescence to differ by training source and include a measure of elapsed time since receipt of each training event, cumulated over all events, by source of training.

Together, these training measures form the basis of our analysis of the wage effects of training. Unemployment outcomes are treated in an analogous way. If postschool training enhances worker productivity, we might also expect the incidence of current and all past training events to reduce the likelihood of unemployment; however, we might expect these unemployment ameliorating effects to dissipate with time since training receipt. We hypothesize, therefore, that training has similar effects on wages and unemployment, but of

opposite signs. In the following section, we report the results of estimating wage models that relate the logarithm of weekly wages to these training measures, controlling for a variety of personal and job attributes, geographic location, and labor market conditions. Similar model specifications are used in our probit model estimates of the likelihood that an individual experiences a spell of unemployment over a given 12-month period.

We are aware that the decision to offer or to receive training may be endogenous and thus subject to "self-selection" problems.[1] The worker's decision to get training will depend in part upon the expected benefits and costs of training and in part on his own observed and unobserved (to the analyst) attributes. Similarly, the employer's decision to provide training will depend on judgments of the worker's ability to learn and his future productivity in the firm. Furthermore, these decisions are likely to vary with training source, which, depending on whether training is general or firm-specific, may determine who pays for and benefits from training. The main difficulty here in addressing the selectivity issue is the econometric treatment of multiple episodes of training from multiple training sources, occurring at different points in time over the early work career (see Lillard and Kumbhakar, 1986). These issues have not been raised in the literature, much less resolved. Our approach is to treat these training sequences as if they were exogenous and to document training patterns and their outcomes for use in developing future econometric models.[2]

WAGE EFFECTS OF TRAINING

Each survey has unique features that influenced the choice of samples and wage analyses attempted. For the NLS, we pool observations from cross-sections of years 1967 through 1969, 1973, 1975, and 1980, when fairly clean data were available on weekly wages (this variable was calculated from reported annual wages and weeks worked over the past year). The result was a sample of 9100 NLS observations. For the NCDS4, we examine weekly wages at the current or last job in 1981, because the NCDS4 elicited wage

[1]There is by now a substantial literature on this subject. For example, see the references cited in Madalla (1983) and discussions of econometric approaches to addressing this broad class of problems.

[2]Ongoing research by Lillard suggests that while selectivity bias is present, the returns to training reported in this report are quite close to those estimated by more complex hazard models that account for self-selection and personal heterogeneity.

information only for first and last jobs. However, the training measures are constructed from information contained in the entire NCDS4 panel. The final sample comprised 4537 males who had completed schooling and were observed in wage and salaried employment in 1981. In the ALS, information on weekly wages is reported for all four years of the panel. We pool across years for an ALS sample of about 8200 males with usable wage data.

Several wage models were estimated for each sample. For the NLS and NCDS4, we estimated two model specifications: first, a conventional human capital earnings model relating the natural log of weekly wages to a variety of personal characteristics, job attributes, and labor market conditions; second, a specification that added the three training measures by source of training. No training duration measures were included in the models estimated for the NCDS4. In results not reported here, we determined that sensible training effects could not be estimated for the NCDS4 because of a high correlation between training duration and sum variables; this made it necessary to exclude one set of variables.[3] For the ALS, we experimented with an alternative, flexible specification of training. We include indicator variables for whether training from each source was taken one, two, three, or four years ago. This functional form imposes no restrictions on the levels or time-path of training effects, unlike the aggregative (training sum) and linearity (elapsed time since training) assumptions implicit in the training measures we use for the NLS and NCDS4.[4] The results are reported in the first two columns of Tables 7, 8, and 9 for the NLS, NCDS4 and ALS samples, respectively.

Many of the schooling and work experience results are broadly similar to those reported elsewhere in the literature and can be summarized briefly. Compared with the omitted schooling group, returns to additional schooling generally rise with the level of schooling attainment in all three countries. In the NLS, wages exhibit the familiar quadratic shape, rising with both work experience and job tenure, though at a slower pace at higher experience levels. The NCDS4

[3]This collinear probably arises because most training episodes in the NCDS4 are concentrated in the first (or second) year, so that the training sum variable is often simply a multiple of the training duration measure. In the NLS, this is apparently less an issue since training is distributed more evenly over time in the labor market.

[4]For long panels with multiple sources of training, such as the NLS and NCDS4, the three training measures are a parsimonious way of summarizing a great deal of information about an individual's training history. Given these data attributes, the training indicator variable approach is clearly not a feasible alternative for the NLS or NCDS4.

Table 7

Labor Market Effects of Training: NLS Young Men

Explanatory Variables	Log (weekly wages) (a)	Log (weekly wages) (b)	Unemployment Probability
Intercept	4.868[c]	4.895[c]	-.051[d]
Educational attainment			
High school graduates	.085[c]	.066[d]	-.090[c]
Some college	.166[c]	.142[c]	-.127[c]
College graduates	.348[c]	.320[c]	-.215[c]
Postgraduate degree	.550[c]	.534[c]	-.293[c]
Labor market experience			
Years of experience	.059[c]	.049[c]	-.020[c]
Experience^2	-.002[c]	-.002[c]	-.000
Years of job tenure	.039[c]	.038[c]	-.095[c]
Tenure^2	-.002[c]	-.002[c]	.006[c]
Technological change (TFP)			
TFP × Nongraduates	.005	.004	-.000
TFP × HS graduates	.006	.006	-.027[c]
TFP × Some college	.011	.015	-.003
TFP × College graduates	.056[c]	.054[c]	-.016
TFP × Postgraduates	.072[c]	.073[c]	.040[c]
Nonwhites	-.114[c]	-.109[c]	.096[c]
Ever union member	.131[c]	.129[c]	.024[c]
Local unemployment rate	.003	.003	.032[c]
Training in current period			
Company training		.048	.030
Business-technical schools		-.105	.056
Regular schools		.019	.014
Other sources		.066	.030
Number of training events			
Company training		.186[c]	-.105[d]
Business-technical schools		.123[d]	-.064
Regular schools		.067	.005
Other sources		.099[d]	-.003
Time since training			
Company training		-.011	.011
Business-technical schools		-.011	.000
Regular schools		-.007	-.016
Other sources		-.006	-.003

[a]R^2 = 0.2262.
[b]R^2 = 0.2374.
[c]Statistically significant at the 1 percent level.
[d]Statistically significant at the 5 percent level.

Table 8

Labor Market Effects of Training: NCDS4 Young Men[a]

Explanatory Variables	Logarithm of 1981 Weekly Wages		Unemployment Probability	
	(b)	(c)	Apprentices	Nonapprentices
Intercept	4.016[d]	4.048[d]	-.048[e]	-.008
Educational attainment				
O levels	090[d]	.075[d]	-.024[d]	-.039[d]
A levels	.199[d]	.183[d]	-.053[e]	-.038[d]
First degree	.342[d]	.316[d]	-.099	-.068[d]
Labor market experience				
Work experience	.056[d]	.040[e]	.018[d]	-.000
Experience^2	.001	.002	.002[e]	.003[d]
Years of tenure	.005	.010	-.142[d]	-.253[d]
Tenure^2	-.002	-.002	.014[d]	.025[d]
Number of previous jobs	.001	.002	-.053[d]	-.113[d]
Preentry certificate	.081[d]	.068[d]	-.010	-.034[d]
Technological change (TFP)				
TFP 1954–1982	-.090[d]	-.088[d]	-.010	.016
TFP × O levels	.060	.048	.018	-.008
TFP × A levels	.015	-.006	.032	-.003
TFP × 1st degree	.206[d]	.193[d]	—	-.053
Job characteristics				
Private sector	.008	.024[e]	.020[e]	.013
Medium size firm	.046[d]	.041[d]	-.005	-.006
Large firm	.094[d]	.092[d]	-.004	-.024[e]
Very large firm	.152[d]	.145[d]	-.002	-.036[d]
Unionized firm	.103[d]	.103[d]	.018[d]	.058[d]
Unemployment rate	—	—	-.012[d]	-.004
Currently in training				
Company		-.058	-.017	-.069[d]
Off the job		-.103[d]	-.019[e]	-.047[d]
At schools		-.034	-.034	-.242[d]
Number of training events				
Company		.071[d]	-.034[d]	.009
Off the job		.041[d]	-.031[d]	-.026[d]
At schools		.001	-.004	-.008

[a]Models also included indicator variables for marital status, missing values, and location.

[b]$R^2 = 0.1509$.

[c]$R^2 = 0.1644$.

[d]Statistically significant at the 1 percent level.

[e]Statistically significant at the 5 percent level.

Table 9

Labor Market Effects of Training: ALS Young Men[a]

Explanatory Variables	Log (Weekly Wages)		Prob(Unemployment)	
	Apprentice[b]	Non-apprentice[c]	Apprentice	Non-apprentice
Intercept	4.040[d]	3.680[d]	-.068[d]	-.099[d]
Educational attainment				
10–11 years school	-.052			
12 years school	.004	.112[d]		-.049[d]
Other postsecondary	.087[d]	.126[d]	-.029	-.009
Diploma/certificate	.070[e]	.198[d]	-.061	-.080[d]
1st degree	.231	.492[d]	-.265	-.167[d]
Labor market experience				
Years of experience	.113[d]	.124[d]	-.015[e]	-.023[d]
Experience^2	-.006[d]	-.006[d]	.001	.013[d]
Years of tenure	.007	-.007		
Tenure^2	-.001	.001		
Technological change TFP				
TFP	-.023[d]	-.005		
TFP × 10–11 years	.010	—		
TFP × 12 years	.014	.006		
TFP × Other postsecondary	-.025	.012		
TFP × Diploma	-.032	.007		
TFP × 1st degree	.024	.041[d]		
Union member	.121[d]	.098[d]		
Company training				
This past year	.093[d]	.070[d]	-.038[e]	-.114[d]
Two years ago	.078[d]	.053[d]	-.023	-.043[d]
Three years ago	.039	.027	- 004	-.024
Four years ago	.017	.009	.032	-.023
Off the job training				
This past year	-.035[e]	-.024[e]	-.038[d]	-.173[d]
Two years ago	.001	-.009	-.011	-.061[d]
Three years ago	-.011	.013	-.000	-.073[d]
Four years ago	.081[d]	-.001	.006	-.079[d]

[a]The models also included indicator variables for marital status, missing values, health limitations, country of origin, and year dummy variables.

[b]R^2 = 0.4312.

[c]R^2 = 0.6923.

[d]Statistically significant at the 1 percent level.

[e]Statistically significant at the 5 percent level.

results suggest that each year of work experience increases wages by about the same amount as the American sample (5.6 percent rather than 5.9 percent in the NLS). Job tenure, however, has no statistically significant effect on weekly wages (Baker, 1990, and Booth, 1989, also report a similar finding for Britain). In the ALS, wages grow rapidly with years of work experience (between 11 and 12 percent each year), but these effects taper off very quickly because of the strongly quadratic experience term, which reduces wage growth by half (to 5 percent) after five years of experience. Like the NCDS4, the tenure-wage effects estimated for the ALS are small and statistically insignificant (Chapman and Alston, 1989, report similar results for Australia using a different data source).

Together, these experience and tenure results imply that wage profiles of American youth are much steeper than those in either Britain or Australia. Since tenure effects are positive (about 4 percent) in the NLS, but not in the NCDS4 or ALS, much of the cross-national difference in wage profiles stems solely from the larger wage-tenure effects in the United States. These models already control for formal training, so the residual wage-tenure effects probably reflect (at least in part) investments in informal on the job training.[5] If so, the results suggest that there is considerably more informal on the job training in the United States than in Britain or Australia. This finding is consistent with the patterns of training described in Secs. 2 and 3 and may suggest that labor market institutions have had less of an inhibiting effect on training, both formal and informal, in the United States than in Britain and Australia, where craft-based unions and award minimum wage laws (in the case of Australia) are more developed and have higher coverage.

A comparison of the two wage-model specifications yields two additional insights into the wage effects of schooling and experience. First, when training measures are included, schooling coefficients decline, but differentially by level of educational attainment. In general, declines might be expected since schooling variables will reflect the effects of training (with which it is positively correlated) in wage equations that exclude training measures. Declines, however, are proportionately larger for the less educated in the NLS and NCDS4

[5]Some part of this wage-tenure effect may also reflect the quality of the worker-firm match. Several recent studies, including Altonji and Shakotko, 1987, and Abraham and Farber, 1987, argue that the estimated wage-tenure effects are due entirely to job matching. These claims are disputed by Topel, 1986, who continues to find positive (and roughly similar) wage-tenure effects even after including appropriate controls for job matching.

(though not reported, similar results are found for the ALS as well). When we compare models (1) and (2) in Table 7, the schooling coefficient for high school graduates in the NLS falls from 0.08 to 0.06 when training variables are included, while the coefficient for post-graduates is only marginally smaller (0.55 and 0.53). Similarly, Table 8 shows a proportionately larger decline from 0.09 to 0.07 for NCDS4 males with "O" level qualifications, compared with a 0.34 to 0.32 decline for first degree holders. Training appears to yield higher marginal returns to labor market entrants with low initial stocks of human capital, suggesting greater substitutability between training and education at lower levels of schooling attainment. Second, the inclusion of training measures also appears to reduce the coefficient of general experience but not job tenure. In Tables 7 and 8, the coefficient of general work experience falls from 0.059 to 0.049 for the NLS, and from 0.056 to 0.04 for the NCDS4, while the wage-tenure effect is virtually unchanged. We interpret this result to mean that a large part of training is in general, transferable skills related more to time in the labor market than to job tenure.

The results also indicate that the returns to schooling are higher if the individual worked in a high-technology industry. For the NLS sample in Table 7, the estimated interactions between education and TFP are invariably positive, and they are statistically significant for the two most educated groups. A percentage increase in the rate of technological change raises the returns to a college degree by 5.6 percent; the corresponding figure is over 7 percent for someone with a postgraduate degree. Broadly similar results are found in the NCDS4 and ALS. In Table 8, the main effect of the TFP variable suggests that NCDS4 males with little formal schooling receive wages that are about 9 percent lower in industries experiencing rapid technological change. However, the same TFP increase raises the returns to schooling of first degree holders. They earn 10 percent higher returns (-0.09 plus 0.19) than their counterparts employed elsewhere. The ALS results in Table 9 also suggest a similar pattern of TFP-schooling wage effects. Technological change reduces the wages of the least educated. The reduction of 2.3 percent is statistically significant for the least educated ALS apprentices. It raises the wages of non-apprentice first degree holders by 3.6 percent (.041 minus .005). These findings, which persist even after the inclusion of training measures, suggest that better-educated workers in all three countries are more adept at responding to technological change, more productive, and consequently more highly rewarded.

Finally, the wage effects of several other control variables may be noted in passing. In the NLS, nonwhites earn about 10 percent less than other racial groups. In all countries, union members (or those in jobs covered by collective bargaining) receive sizable wage premiums, about 12 to 13 percent in the NLS, 10 to 14 percent in the NCDS4, and 8 to 12 percent in the ALS; but it is unclear if these reflect economic "rents" or the effects of unobserved worker attributes. Finally, we find evidence that large firms pay higher wages. Compared with workers in firms with 25 or fewer workers, NCDS4 respondents are paid wages that are 9 percent higher in firms with 100–500 employees and 15 percent higher in firms with over 500 workers. Similar firm size effects (not reported here) were also found in the ALS. Wage models estimated using the 1988 ALS cross-section where firm size information was elicited confirmed that firm size matters; those employed in very small firms (with fewer than 10 employees) earn about 10 percent less than the others, and those employed in very large firms (with more than 500 employees) earn about 5 percent more.[6]

In general, training appears to have the hypothesized wage effects in all three countries. First, consider the NLS results in column 2 of Table 7 where the conventional wage model is expanded to include the three summary measures of training by source. Training taken in the current period has no apparent effect on current wage growth. However, the parameters of the cumulative training variables suggest that each training event raises subsequent wages by between 7 and 18 percent, depending on training source. Company-based training has the largest influence on wages by far (over 18 percent annually) followed by training from business and technical institutes (12 percent) and from miscellaneous other sources (10 percent). Training courses taken in schools after completion of schooling have no apparent effect on wages. Finally, the passage of time appears to reduce this wage effect by 1 percent or less each year, depending on training source, but the training duration measures are not very precisely estimated. These declining wage effects may reflect either skill obsolescence (Mincer, 1989) or the loss of firm-specific skills from job mobility.

The results for Britain and Australia are very similar in terms of the relative productivity of training from each source. For the NCDS4,

[6]No firm size information is reported in the NLS Young Men survey. However, using a different dataset, Barron, Black, and Lowenstein (1987) find firm size effects in the United States of comparable magnitude.

Table 8 indicates that company training has the largest effect on wage growth (7 percent) followed by off the job training (4 percent). Like the U.S. results, school-based courses yield no measurable effect on wage growth. No training depreciation effects were estimated for the NCDS4 because of the high correlation between training sum and duration variables. The ALS estimates in Table 9 also suggest that company training has a large effect on wages (off the job training effects are not measured with any precision) and that the wage effects of training are diminished over time. Recall that the short ALS panel allowed us to estimate a fairly unconstrained time-path for the wage effects of training over each of the past four years. Depending on the ALS sample, current weekly wages are increased by between 7 and 9 percent if company training occurred within the past one year; within three years, well over half of this wage effect disappears; for all intents and purposes, it is reduced to zero by the end of the fourth year. Off the job training, in contrast, is typically associated with no measurable wage effect. The exception—ALS apprentices whose wages rise 8 percent from off the job training received four years earlier—may simply reflect pay increases on completion of formal apprenticeship programs.

How do we interpret the NLS and ALS findings that wage effects decline with elapsed time since training receipt? This may reflect either the effects of skill obsolescence or the loss of firm-specific skills from mobility, or the combined effects of both. To identify the importance of the two effects, we exploited the panel nature of the NLS and ALS surveys and distinguished between training taken in the current job and in all previous jobs.[7] Since the issue of firm-specificity is most relevant to company-based training, we concentrated on company-based training and all outside training combined that was received in the current job or in previous jobs.

We estimated expanded wage models for the NLS and ALS that included training measures by source in both current and past jobs.[8] In general, the results for both surveys suggest that company-based training is only partly firm-specific. For the NLS, the initial wage effect of company training in the current job is about 22 percent, which may be compared with the 17 percent effect for company

[7]We do not include the NCDS4 for two reasons. First, for reasons already discussed, we were unable to estimate training duration effects for the NCDS4. More important, wage information is reported for only the last or current job in 1981, and repeated wage data of the kind available in the NLS and ALS may be critical in disentangling the wage effects of training in current and past jobs.

[8]The complete results are available on request from the authors.

training taken in previous jobs. In the ALS, the corresponding wage effects of company training are 8 and 4 percent for nonapprentices. For ALS apprentices, company training in the current job increases initial wages by 10 percent, w e that from previous jobs raises wages by 6 percent (but this is not statistically significant). Thus, only between one-half and one-quarter of company training is firm-specific and therefore lost with job change. Similar calculations for outside training in the NLS revealed small initial differences in the wage effects of training from current and past employers—9.8 and 8.4 percent, respectively. For the ALS, no wage effect was found for off the job training taken in both current and past jobs (a similar result was reported in Table 9). At least for the NLS, therefore, outside training taken in schools or business and technical institutes is largely general and readily transferable across employers with little wage penalty. Finally, while skills appear to depreciate over time (many training duration parameters have negative signs), these effects are not measured with any precision in both surveys.

Finally, although these results suggest many cross-national similarities in the wage effects of training, they also point to large differences in the size of training returns in the three countries.[9] They indicate that the wage effects of formal training in the United States are roughly twice those in Britain and Australia. If these are the price signals facing employers and workers making training decisions, it is clear why neither group in Britain or Australia has had much incentive to get (or provide) training. The returns to training are probably low compared with the returns from alternative forms of investment, including schooling.[10] Clearly, more comparative research is needed

[9]The cross-national differences in the wage effects of training are robust with regard to included variables. For example, in results not reported here, training effects for the NCDS4 were estimated excluding firm size, which may be correlated with training and with other worker attributes. However, this model specification yielded only marginally larger wage effects. The effect of company training in the NCDS4 rises from 7.1 to 7.5 percent, and that of off the job training rises from 4.1 to 4.3 percent. Experiments with other variables yielded essentially the same results.

[10]These wage effects cannot strictly be interpreted as the returns to training without several adjustments to incorporate the effects of training duration and intensity, depreciation, and expected job tenure (Mincer, 1989). Data limitations precluded such an exercise in this study. Training courses in the NCDS4 are generally of longer duration than those reported in the NLS, which means that any adjustments for training duration would tend to increase, not reduce, the relative wage returns to training in the two countries. Among NCDS4 males, average duration of training is 4.4 months for company training, 12.6 months for off the job training, and 18.5 months for training from schools. The corresponding NLS figures are 4.8 months for company training, 7.9 months for courses from business-technical institutes, 6.4 months for training from regular academic institutions, and 7.1 months for other training courses. In the ALS, no information is reported about training duration, though the inclusion of brief train-

to better identify the systemic factors associated with low training demand in Britain and Australia as reflected in the low estimated returns to job training.

TRAINING AND UNEMPLOYMENT PROBABILITY

A second outcome measure that we consider is the effect of training on employment stability in the NLS, NCDS4, and ALS. The issue is whether training reduces the likelihood that an individual experiences a subsequent spell of unemployment. Are some kinds of training more effective than others in reducing youth unemployment? Another issue of policy interest is whether rapid technological change results in higher youth unemployment. If technical change is labor saving, is the effect of new technologies neutral with respect to educational attainment or worker skills? We address these issues by estimating a probit model that relates the probability of unemployment to the same explanatory variables used in the previous wage analyses. (The probit model for the ALS uses a more limited set of explanatory variables, and these results should therefore be interpreted as tentative.) For these unemployment analyses, all three samples are broadened to include both employed and unemployed young men.[11]

The probit estimates of the unemployment model are reported in the remaining columns of Tables 7 through 9. Before discussing training, we note that the estimated unemployment effects of other control variables resemble those commonly reported in the labor turnover literature and are readily summarized below. In all three countries, the likelihood of experiencing a spell of unemployment in a given year is lower for those with higher schooling attainment and for those with more general work experience and longer job tenure (NLS and NCDS4 only). Similarly, trade unions in all three countries are associated with a higher likelihood of unemployment. In addition, the NCDS4 results in Table 8 suggest that employment in large firms is usually associated with greater employment stability and private

ing episodes probably biases downward the estimated returns to training. It is doubtful that any reasonable correction for length of training would eliminate the U.S.-Australian differential.

[11]The NCDS4 analysis of unemployment relies on a different dataset than that used in the previous wage analysis (the 1981 cross-section). Since unemployment status is recorded for each year in the NCDS4 panel, we use pooled-period data augmented to include both employed and unemployed young men. This resulted in samples of 17,523 apprentices and 24,083 nonapprentices.

sector employment with less stability. For the most part, higher industry rates of technical change in the NLS and NCDS4 samples are associated with a lower likelihood of unemployment, though this relationship is significantly negative only for selected schooling groups in the NLS. For these samples of young men in the United States and Britain, we may thus discount policy concerns that have been raised about technology-induced youth unemployment.

Is postschool training effective in inhibiting youth unemployment? Our probit results suggest that training reduces the likelihood of unemployment in all three countries. In Table 7, the effects of training in the NLS are not measured precisely, the exception being company training. However, the estimated parameter for the number of company training events is statistically significant, suggesting that each training episode lowers the probability of future unemployment by 10 percent. This effect is ameliorated over time, as evidenced by the estimated positive parameter (0.011) of its training duration variable. The period over which company training has this effect (10 years) can be calculated by dividing the parameters (-0.105/.011) of cumulated training and training duration. In the NCDS4, Table 8 shows that the likelihood of experiencing unemployment is reduced if the individual got any kind of training over the past year. The total number of training events received to date also inhibits unemployment, but these effects are statistically significant only for job-related training in the case of apprentices and off the job training for nonapprentices. Unlike the NLS, where company training is most important, the NCDS4 has no clear ranking: training from most sources appears to reduce unemployment probabilities by between 2 and 3 percent. For the ALS, Table 9 suggests that both company and off the job training are equally effective in inhibiting unemployment. This training effect appears to taper off with the passage of time but remains an important deterrent to unemployment for nonapprentices even after four years.

5. SUMMARY AND CONCLUSIONS

Training measures in the NLS, NCDS4, and ALS were used to study the determinants and labor market outcomes of postschool training received by young men in the United States, Britain, and Australia. Our analyses were restricted to formal training events reported by respondents and excluded potentially important investments in informal training or learning on the job. Through comparisons of three countries with very different institutions, we have sought to gain insights into several questions: How do patterns of formal training in the United States compare with those of other developed countries? Are the determinants of postschool training and their labor market consequences similar or different in the three countries? What insights do these analyses provide about the common education and training issues confronting U.S. policymakers and other national governments?

CROSS-NATIONAL DIFFERENCES IN YOUTH TRAINING

How do American youth fare in comparison with their counterparts in Britain and Australia? Our data suggest that American youth get less formal training upon entry into the labor market, but more formal job training with time in the labor market. Just 12 percent of them report getting any formal training in the first year after labor market entry. In comparison, between 30 and 40 percent of nonapprentices in Britain and Australia report some formal training; these figures rise to between 50 and 60 percent for apprentices. The U.S. training situation is less bleak if youth are followed over time. As they acquire work experience, a high (and rising) proportion of American youth report receiving training, while job training in Britain and Australia proceeds at a slower pace.

Policymakers have raised concerns about low levels of youth training in the United States (compared with those of its major competitors) and have offered a wide variety of strategies to remedy this perceived training deficiency (see U.S. Department of Labor, 1989; Office of Technology Assessment, 1990). International comparisons can potentially be misleading, especially if they focus only on entry-level training. Institutional differences, such as the wide availability of youth apprenticeship programs and public training and job placement

schemes in Britain and Australia, are probably responsible for the high levels of reported training in these countries. The low U.S. training figures also reflect differences in educational systems; they exclude job-relevant training from public and private voc-ed institutions that, in many other countries, are provided to school-leavers through youth apprenticeship programs and technical institutes (in the NLS this training is treated as formal schooling). As we note above, American youth subsequently accumulate job training at a much faster pace than their counterparts in Britain or Australia.

In addition to training incidence, it is also important to compare the kinds of postschool training received by youth. In the United States, employers provide workers with training that is increasingly company based, relying less on outside training sources as workers acquire job tenure. Such a continuing process of firm-based learning and job training is critical if companies are to successfully adapt and use new technologies (Bailey and Noyelle, 1988). In Britain and Australia, employers appear to provide little company training or retraining beyond the entry point, relying instead on outside training sources. In this regard, reported patterns of youth training in the United States are reassuring, especially when coupled with the finding that employer-provided training in the United States is responsive to the pace of technical change in the industry. For the other two countries, Australia in particular, concerns about the adequacy of youth training may be justified given the slower pace of skill upgrading, the reliance on outside providers, and the small wage effects from training.

EDUCATION AND POSTSCHOOL TRAINING

Our analyses confirmed the findings of other research that the level of schooling attainment is an important predictor of postschool training and labor market success. For all three countries, better-educated youth were considerably more likely to get training, especially company training, which has the greatest influence on raising wages and reducing the likelihood of unemployment. We have little firm evidence about why such a strong relationship exists. School attainment may reflect group differences in innate ability, resources to finance further education and training, discipline and other traits desirable to employers, literacy, communications, technical knowledge, and broad problem solving skills imparted by education, all of which complement job training. Our knowledge about schooling decisionmaking, generic skills provided by schools (Stasz et. al, 1990), and postschool

training is compartmentalized. Integrating these areas of research has promise of illuminating recent proposals for school reform and our understanding of the role of education in the workplace.

Nonetheless, given this education-training link, current high dropout rates among American youth, particularly black and hispanic youth, have disturbing implications for policymakers. Our analyses indicate that less educated and less trained youth are more likely to experience spells of unemployment. Jobs not requiring a high school or college education may also get increasingly scarcer because of rapid technical change. Together, these trends are likely to exacerbate the gap between the educated and less educated, and between whites and racial minorities.

SKILL REQUIREMENTS OF TECHNOLOGICAL CHANGE

We found some confirmation for the view that technical change plays a critical intermediating role in raising educational and skill requirements. In both the United States and Britain, our results pointed to statistically significant interaction effects between educational attainment and the likelihood of training in industries experiencing rapid rates of technical change. Rapid technical change increased the likelihood of getting company training, especially for youth with the most education, and generally reduced training from schools and other offsite sources. This pattern of training by source, which has been found for other demographic groups in the United States (Lillard and Tan, 1986), is consistent with the hypothesis that technological change increases demand for highly skilled and educated workers able to respond to the vagaries of new technologies (Tan, 1980). In Australia, the technology training nexus is less apparent. Binding occupation-based minimum award wage laws and restrictive work practices of craft-based unions may have inhibited the ability of employers to flexibly adjust personnel and training policies in response to technical change (Borland, Chapman, and Rimmer, 1990). Training, and the ability of employers to adopt and adapt new technologies, may not be forthcoming without more flexible personnel policies and new forms of work organization (Office of Technology Assessment, 1990).

Technological change is also likely to have adverse distributional consequences for the least educated youth in the United States, high school dropouts in particular. We noted earlier that less educated youth in all three countries received little formal postschool training.

They were also less likely to get training in industries experiencing rapid technical change, where average skill requirements tend to be high. Technological change is therefore likely to exacerbate the labor market problems of poorly educated youth, who already face bleak job prospects (with low pay and employment instability). This conclusion reinforces the need for remedial programs targeted at low education groups already in the labor market and for preventive policies to reduce high school dropout rates, improve academic achievement, and raise schooling continuation rates for those still in the educational pipeline.

UNIONS AND TRAINING

We found evidence contrary to the commonly held view that trade unions inhibit job training. An argument often made by economists is that by bidding up wages for their members, unions reduce the incentives for employers to provide training through payment of a (low) training wage. In all three countries, union membership (or employment in jobs covered by collective bargaining) was associated with an increased probability of training. Among nonapprentices, youth employed in unionized jobs were more likely to get both company and school-based training, but less off the job training. In Britain (but not Australia), apprentices in unionized jobs were more likely to get training off the job than from company sources. These findings may be the result of union training and retraining contracts negotiated with their employers, or of trade union sponsorship of a variety of apprenticeship programs.

However, these results pertain only to formal training programs, and unions may have the predicted effect on more informal (but not easily measured) forms of training on the job. Unions may inhibit informal training (and hence productivity growth) in complex ways, such as through restrictive work practices, job demarcation, and opposition to the introduction of labor-saving technologies and new forms of work organization. Wage-tenure effects from wage models provide an indirect measure of investments in informal training. We found large wage-tenure effects in the United States but none in either Australia or Britain. Perhaps not coincidentally, the United States has low union coverage rates (less than 20 percent) compared with between 40 and 55 percent in the other two countries.

LABOR MARKET EFFECTS OF COMPANY AND NONCOMPANY TRAINING

In all three countries, we found that company-based training had by far the largest quantitative influence on raising youth wages (and reducing unemployment), followed by training off the job. In general, the wage effects from outside training (excluding schools) were about one-half to two-thirds as large as those from company training. Surprisingly, controlling for level of schooling attainment, training taken in schools after labor market entry had no measurable wage effects in either the United States or Britain (school-based training in Australia was not separately identified). The findings, however, are too preliminary to draw firm policy conclusions. Should public training funds be better spent on firm-based training or on existing programs, such as the Job Training and Partnership Act, that rely on community colleges and private vocational and technical schools?

Policymakers must first confront such issues as the relative importance to be placed on efficiency versus equity criteria (some disadvantaged groups may not get company training under such a scheme) and whether public funds should be used to finance firm-specific, nontransferable kinds of training. Our preliminary results indicate that company training is only partially transferable to other employers. Simple comparisons of the returns to company and outside training returns are potentially misleading; both categories encompass very heterogeneous kinds of training, serving very different skill needs and youth populations. More research is required to identify types of training that are more appropriately provided through existing public or private educational institutions, or by employers. Training also has benefits extending beyond wage gains, such as employability and job stability, and these latter outcomes need to be reflected in any policy assessment. Finally, many measurement issues remain, including potential biases in the estimated returns to the different training types. Biases arising from unmeasured individual traits and self-selection into different training programs may overstate the potential gains from expanding access to company training in the general youth population.

Finally, we found considerable differences in the size of training effects across the three countries. The wage effects of formal training in the United States were roughly twice those in Britain and Australia; company training was associated with an initial increase in wages of 18 percent in the United States, between 7 and 9 percent in Australia, and roughly 7 percent in Great Britain. Clearly, more research is

needed to identify the causes of low training demand in Britain and Australia, as reflected in these low returns. The answers should be of interest not only to policymakers in Britain and Australia, but also to policymakers in this country.

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