

How young workers get their training: A survey of Germany versus the United States

Rainer Winkelmann

University of Canterbury, Department of Economics, PB4800, Christchurch, New Zealand
(Fax: 00 64 33 64 26 35, e-mail: r.winkelmann@econ.canterbury.ac.nz)

Received December 14, 1995 / Accepted February 19, 1996

Abstract. The recent economic literature on the incidence of various forms of post-secondary on-the-job and off-the-job training in Germany and the United States, as well as on the effects of training on wages, inequality, and labor mobility is surveyed. Young workers in Germany receive substantially more company-based (apprenticeship) training than United States workers. In the United States, high turnover deters firms from investing in general skills while it results in improved job matches. The received literature consents that key institutional elements required to make the German apprenticeship system work are absent in the United States.

JEL classification: I2, J3, J24

Key words: Vocational training, apprenticeship, earnings

1. Introduction

How much and what type of training to obtain are among the most important decisions that a young individual faces. Parameters affecting these decisions are the available spectrum of training programs, financial resources, and expected returns, to name but a few. The United States and Germany differ substantially with respect to the menu of post-secondary training options, financing of training, returns, and the actual choices of their youths.

Financial support from the German Marshall Fund of the United States and helpful comments by Klaus F. Zimmermann and two referees are gratefully acknowledged. *Responsible editor:* Klaus F. Zimmermann.

Relative to Germany, the United States has more labor market entrants with higher education, fewer entrants with vocational qualifications and more unskilled entrants. Labor market outcomes differ as well. It has been argued that the United States has high youth unemployment rates and a widening earnings gap between college graduates and non-college graduates whereas Germany has low youth unemployment rates and stable earnings differentials.

This survey focuses on recent evidence on the role of post-secondary training for the labor market performance of young workers in Germany and in the United States. Until recently, the economic literature on educational attainment has been preoccupied with academic post-secondary schooling and training. Indeed, a large number of workers in the United States, and an increasing number in Germany, receive their training at universities. However, this focus on higher education begs the question of the fate of the non-college bound youth. Researchers are beginning to recognize that individuals select from a broader menu of post-secondary training options, vocational training being one of them. Such training is obtained either formally in post-secondary technical and trade schools or less formally in on-the-job training programs. The interest in the economics of vocational training in the United States has been stimulated by the emergence of a political agenda for post-secondary educational reform that attempts to enhance the system of vocational training (Heckman 1993, 1994).

In Germany vocational training, and apprenticeship training in particular, have always been the main pillar of post-secondary education. 72% of all workers receive such training and very few workers enter the labor force without any post-secondary training (Berufsbildungsbericht 1993). References to an early English-language literature on vocational training in Germany can be found in Steedman (1993), Franz and Soskice (1993), and Winkelmann (1996b). The recent re-emergence of academic interest in the German approach to vocational training draws its impetus both from the aforementioned proposals that use the German system as a model for educational reform elsewhere, and from growing concern that the German system itself is in a crisis and in need of reform. The apprenticeship system appears to be decreasingly able to attract young individuals who prefer to enroll in academic training instead.

The recent literature can be classified into two categories: studies that deal with the United States or the German labor market exclusively, and studies that are explicitly comparative in nature. Examples for comparative studies are Büchtemann et al. (1993, 1994), Couch (1994), Lynch (1994), Haarhoff and Kane (1994), and Heckman (1993, 1994). Both types of evidence are evaluated in this survey. In Sect. 2, results from various studies are combined to obtain a general picture of the incidence of training in the two countries. Section 3 presents evidence of wage effects of training, while Sect. 4 considers mobility effects. Section 5 summarizes the lessons of the existing literature for alternative training strategies.

2. Incidence of training

In contrast to the incidence of general schooling and pre-labor market academic or vocational training, the incidence of company-related training is more difficult to pin down. Such training may be formal or informal, on-the-job or off-the-job, firm specific or general. The duration may vary from a single event to a year long program. Important issues are: Who provides the training? Who pays for the training? and Who gets trained? (For instance, new workers or workers with longer tenure, skilled or unskilled workers. . .). The diversity of programs causes substantial difficulties in obtaining a precise assessment of training incidence. This is true in particular for the United States where informal training plays a more prominent role than in Germany.

Measures of training incidence are generally based on survey data and give an estimate of the proportion of a certain population that received training. Two populations of particular interest are cohorts of school graduates and the labor force as a whole. Cohort studies follow individuals over time and record their training experience over the life-cycle whereas labor force studies give a snapshot of the human capital stock and composition at one point in time. One implication of looking at a cross section of the labor force rather than a youth cohort is that changes in training patterns will affect the cross section only gradually whereas they immediately affect the cohort. The distinction between the two approaches is blurred if labor force data are disaggregated by age cohort.

Datasources used in United States training studies are the monthly Current Population Survey (CPS), the Panel Study of Income Dynamics (PSID), the National Longitudinal Survey for the Youth (NLSY), and the High School and Beyond Survey (HSB). While the CPS samples a representative cross section of the United States population, the other three datasets are panel studies that follow age cohorts over time. The NLSY and the HSB are best suited for training studies since they sample high school seniors (the 1972 and 1979 cohorts in the NLSY and the 1980 cohort in the HSB) and follow these young individuals during their transition to the labor market, a period of time in which most of the training occurs. In Germany, the main longitudinal household survey with general access to researchers is the German Socio-Economic Panel (GSOEP). In addition, the Research Institute of the Federal Labor Office (IAB) and the Federal Institute for Vocational Training (BIBB) conduct a "Qualification and Career Survey".

Büchtemann et al. (1993) compare the incidence of formal training in Germany and the United States using PSID and GSOEP cohort data. Table 1 shows the exposure to training for two matched cohorts of school-graduates in Germany and the United States. One year after leaving secondary education, one third of each cohort is enrolled in formal post-secondary schooling, 52.1% are working in the United States and 56.3% in Germany. The main difference between Germany and the United States is that 4 out of 5 employed youngsters in Germany are employed in apprenticeship programs and thus receive formal training. In terms of training incidence this means that one year after leaving school 79% of German secondary school graduates, more than twice as many as in the United States, receive some

Table 1. Post-secondary education one year, 5 years and 12 years after leaving secondary education^a

	One year		Five years		Twelve years	
	US	Germany	US	Germany	US	Germany
In school	33.6	33.7	9.3	21.6	5.5	3.9
In apprenticeship		45.3		19.1		
Working ^b	52.1	56.3	71.2	72.7	77.9	80.0
Unemployed	9.7	3.9	8.2	1.9	4.6	3.0
Not in labor-force	4.6	6.1	11.3	3.8	13.7	13.1

Notes:

^a Source: Büchtemann et al. (1993) All numbers in percent.

^b Including military service and apprenticeship training.

type of post-secondary training. This “training gap” between Germany and the United States widens over time. After five years, the share of youngsters in post-secondary schooling has dropped to 9.3% in the United States, while, in Germany, 40% of the original cohort still receive either apprenticeship or other post-secondary training. Only twelve years after leaving school, the two cohorts have converged, with about 83% in the labor force in both countries.

While the size of the training gap between the two countries appears dramatic, it might overstate the true differences in the receipt of training. A bias is possible since the above numbers do not take into account formal on-the-job or off-the-job training received by young workers in the United States. A more detailed analysis is precluded with the PSID data. Alternative evidence on the incidence of such training is scattered. The NLSY contains questions on such post-secondary training. Originally the questionnaire distinguished between on-the-job training, off-the-job training and apprenticeship training. Only training spells of at least four weeks duration were reported. Later, the time requirement was abandoned and the nature of the off-the-job training was given in greater detail.

Lynch (1992) reports that of those aged 25 or below in 1983, 14.7% had received off-the-job training, 4.2% on-the-job training and 1.8% apprenticeship training since they started working. Her study excludes all individuals with college education. Veum (1995) finds a higher incidence of company provided on-the-job training. In his sample, 18% have received such training, compared to 16% with off-the-job training and 1% with apprenticeship training. While the low incidence of apprenticeship training is uniform (Hilton 1991, reports that apprenticeship training accounts only for 0.2% of training for the United States workforce), the diverging estimates of the incidence of on-the-job training deserve some explanation. Three factors contribute to the lower estimate in Lynch (1992). Her sample includes younger workers, non-college graduates only, and training of a minimum duration. But on-the-job training is frequently of short duration and concentrated among older workers and college graduates.

An alternative datasource for assessing the training incidence in the United States is the January 1991 supplement to the CPS (United States

Department of Labor, 1992). In this supplement, training is classified into school-based and (formal or informal) company-based training. Table 2 shows the relative frequencies of the responses from the CPS. Only 12% of all respondents receive their qualifying training through formal company training and 43% of all workers state that their present job does not require qualifying training at all. While substantial uncertainty about the amount of company training received by young workers in the United States remains the existing evidence suggests that at most one out of five young workers receives some kind of formal company training.

Table 3 displays the incidence of various training programs in the German labor force. 12% of the German labor force have received academic training, either in four-years technical colleges or in universities. The vast majority of non-college bound individuals has received vocational training, either through apprenticeships, or through post-secondary vocational schools. Apprenticeships combine workplace-based training with classroom training and last from two to three and a half years. Upon successfully passing a final examination, apprentices receive a nationally recognized certification. A typical individual starts apprenticeship training immediately after finishing general school. Apprenticeship wages are around one third of the beginner's wages in the occupation.

Post-secondary vocational schools exist for a variety of occupations. They last from one to three years and, in general, require full-time attendance. The high incidence of vocational training is reflected in a low pro-

Table 2. Sources of qualifying training in the United States (in percent)^a

High school vocational education	4
Post-secondary vocational education ^b	11
4+years college program	20
Formal company program	12
Informal on-the-job training ^c	27
Other (armed forces, correspondence courses. . .)	10
All ^d	57

Notes:

^a *Source:* United States Department of Labor (1992); Data from the January 1991 supplement to the CPS.

^b 2-year college and vocational technical schools.

^c In current job or previous job(s).

^d Because some workers took more than one type of training, individual items do not sum up to totals.

Table 3. Training of the German labor force 1991

Apprenticeship (Dual system)	72
Specialized vocational school	16
Technical college	4
University	8
No formal degree	16

Source: Berufsbildungsbericht 1993, Multiple answers are possible.

portion of workers without any formal post-secondary degree. Only 16% of the labor force are unskilled, and the majority of unskilled workers are immigrants. A similar proportion can be obtained from the GSOEP. For instance, among all full-time employed individuals at age 25, only 14% have unskilled worker status ($N=580$, own calculations). Overall, Germans receive much more formal post-secondary training than United States workers. The non-college bound youth in particular has a wide menu of post-secondary vocational training programs to choose from.

The two countries differ as well in the way in which training is financed. In Germany, both government and employers provide large contributions to vocational training. In the United States, the role of the government and employers in sponsoring training is limited. According to the CPS data, 14.7% of school training is sponsored partially or fully by employers. The major source of government support is the Job Training Partnership Act (JTPA). The JTPA provides job training and related services (institutional and on-the-job training, job search assistance, counseling, and other job-related services) for economically disadvantaged individuals and provides employment related services to dislocated workers. Its reach is limited, and only 3.4% of post-secondary school training and 4.4% of formal company training are sponsored by this program (United States Department of Labor 1992).

There are few studies assessing the determinants of post-secondary vocational training choices. For the United States, Lynch (1992) finds that women and non-whites are less likely to receive company-based training. Hotchkiss (1993) and Veum (1995) report that workers with higher education have a significantly larger incidence of on-the-job training. For Germany, there has been no recent empirical analysis of the determinants of training choices of young workers. However, it is clear from published cross-tabulations (Berufsbildungsbericht 1993) that women and foreigners are underrepresented among apprentices.

3. Training and wages

The most widely used theoretical framework for the analysis of training and wages is the human capital theory (Becker 1964). According to this theory, age-earnings profiles are upward sloped as human capital or skills increase with experience. Also, as a worker acquires more training, the individual's productivity and, consequently, earnings should increase. While the human capital approach sees training as the main determinant of wages, alternative theories have emphasized other factors unrelated to training. The importance of the human capital approach stems from the possibility to infer the usefulness of a particular training program directly from observed wage differentials for otherwise similar workers with and without training. Hundreds of such studies have been conducted for United States and German data, most of them measuring the effect of general schooling and university training or, alternatively, cumulative years of schooling (see, for instance, Willis 1986). The attention has turned only recently to the specific

wage effects of other types of training, including vocational training, and it is these studies that are reviewed here.

Before surveying the empirical evidence, it is necessary to point out some specification issues common to such wage studies. Three major problems have been identified in the literature. First, estimated returns might be subject to selectivity bias. The choice of training is based on expected wages, inducing endogeneity between wages and training. There is some evidence that vocational training is chosen typically by less able students. Ignoring this self-selection leads to an underestimate of the true return of vocational training for those who chose it (Heckman 1979). Second, if vocational programs are really effective in increasing productivity, supply side adjustments will cause enrollment shifts which in turn reduce the apparent returns (Gustman and Steinmeier 1982a). Unless one is willing to model supply and demand in a structural model, disentangling these effects requires some arbitrary identifying assumptions. Third, training might give access to otherwise restricted occupations. If training slots are limited, or if the supply of trained workers in a particular occupation is fixed in the short run, the returns to training are rents rather than productivity gains (Winkelmann 1996a). While this distinction is irrelevant from the viewpoint of the individual worker, it matters for the design of social policy.

3.1 High school vocational training

Early studies for the United States have focused on the effects of high school vocational training on earnings after graduation. These studies observe either the proportion of classwork which is vocational in nature, or a student's self assessment on whether or not the high school education is primarily vocational, general, or college preparatory. The peculiar feature of high school vocational training (i.e. a choice of vocational courses instead of general courses, say) is that it does not constitute an investment different from that of any high school curriculum. Learning vocational skills takes place at the expense of other, presumably more basic, skills. Whether vocational skills are more valuable to the employer than general skills is an empirical question.

Meyer and Wise (1982) use data from the NLSY 72. They find no significant wage effect of high school vocational training over other high school training. The studies by Gustman and Steinmeier (1982) using the NLSY 72, and Couch (1994) using the NLSY 79, find some evidence for positive effects of high school vocational training. Couch (1994) corrects for self-selection and finds that less able students have a relative advantage in vocational programs. The latter two studies are subject to a second type of potential selectivity bias since they select workers with exactly 12 years of schooling but do not control for it. Such workers take no further post-secondary training but rather enter the labor market immediately after graduating from high school. This decision is very likely correlated with other individual unobservables that matter for earnings as well.

Other studies control for the match between training and occupation. Rumberger and Daymont (1984) allow for a differential effect for matched training and unmatched training on earnings. Not surprisingly, they conclude that training related to one's job does increase earnings, but unrelated training

does not. Hotchkiss (1993), using the HSB survey, finds that the training-job match effect disappears once he allows for wage differentials among jobs by including occupation dummies. Given a particular job, high school vocational training, whether related or unrelated, has no effect on earnings.

Overall, the evidence for the United States is mixed and the wage effects are marginal. There are no comparable studies for Germany. Secondary schooling in Germany has very few vocational components, and vocational training is mostly post-secondary.

3.2 Post-secondary vocational training

Among recent studies on the effects of off-the-job post-secondary vocational training in the United States, Hollenbeck (1994) finds that a vocational degree increases wages by 7% and a Bachelor's degree by 18%. Kane and Rouse (1995) compare the returns to two-year colleges with the returns to four-year colleges and report that they are in the same range. Veum (1995) show that the effects of different types of off-the-job training are by no means homogeneous: While vocational and technical schools have significant wage effects, correspondence and business courses have not. The above studies control for self-selection. For Germany, Abraham and Houseman (1994) and Winkelmann (1994) find that the annual returns to post-secondary schooling lie between 7% and 14%.

3.3 Company-based programs

Company-based programs encompass formal and informal on-the-job training in the United States and apprenticeship training in Germany. There is evidence for a high payoff of formal training for individuals in the form of higher wages and for firms in the form of productivity. Estimates for the United States range from 4.4 to 11% (Lynch 1994). The returns to apprenticeship training in Germany are in the same range (Winkelmann 1994). However, other company-based training (or "continuous training") in Germany appears to yield no return for workers (Pischke 1994).

Related United States studies also find that formal on-the-job training from a previous job does not raise wages in the current job (see Lynch 1994, 1992). One possible explanation is that the training is firm-specific. Alternatively, this finding might reflect the lack of skill-certification that would provide information about these skills.

3.4 Government-sponsored programs

Most of the existing vocational training programs receives some type of government funding as long as they are not exclusively company based. For instance, in Germany apprentices visit state-sponsored vocational schools. A narrower definition of government-sponsored programs includes programs for which the government pays all or most of the investment cost (except for the opportunity cost of trainee time). Such programs have been introduced in the United States under the JTPA. Empirical evidence on earnings effect of training received under JTPA programs show that the returns are very low or even negative (Heckman 1994).

3.5 *Training and inequality*

Evidence in Lerman and Lane (1994) and in Abraham and Houseman (1994) suggests that the training system might be instrumental in explaining why the United States experienced a pronounced increase in earnings inequality during the 1970's and 1980's, whereas Germany did not. Abraham and Houseman (1994) show that in Germany, while skill differentials have risen slightly, wage differentials across education groups have remained relatively constant and differentials within education groups have decreased, contributing to an overall slight decrease in inequality. They suggest that, because the German training institutions provide broad training opportunities for most young individuals, they might have done a better job accommodating the increased demand for skilled labor during the period. Lerman and Lane (1994) point out that the main contributor to the overall higher inequality in the United States is the much higher within group-inequality. While the wage differential between college graduates and apprentices in Germany is much smaller than the college wage premium in the United States, the within group distributions have less variance and, as a consequence, workers with apprenticeship degree are unlikely to penetrate the wage distribution of college graduates. The highly regulated labor market institutions are reflected in a high degree of stratification and a lack of wage mobility.

4. **Training and job turnover**

The high mobility of young workers in the United States is documented in Hall (1982) and Topel and Ward (1992). Hall (1982) has estimated that approximately two-thirds out of 10 estimated lifetime job changes occur during the first 10 years of an individual's working career. Topel and Ward (1992) report that over half of young male new entrants hold six or more jobs over the first 10 years of their work experience. The mobility of young workers is markedly lower in Germany. Winkelmann (1994) found that male Germans hold an average of 4 lifetime jobs. Approximately half of all lifetime job changes occur during the first 10 years of ones career.

It is natural to ask a) why young workers are more mobile than older ones, and b) whether, and to what extent, the mobility patterns in the two countries can be explained by differences in the training young workers receive. Theoretical explanations for mobility behavior fall into three categories: job search models, job match models, and human capital models. Lynch (1991) provides a discussion of the relative merits of these models in explaining job turnover. Recent empirical research on the link between training and mobility has estimated either duration models or count data models to establish the role of training and other factors in predicting the probability of leaving an employer. For the United States, Lynch (1991) reports that on-the-job training reduces mobility, in particular for women, whereas off-the-job training increases the turnover probability.

These findings are refined in Veum (1996). Veum (1996) distinguishes training by both location (on-the-job and off-the-job) and by source of financing (company or other). Moreover, he uses instrumental variable tech-

niques to account for the potential endogeneity of training receipt and finds only limited evidence that company training reduces turnover. However, training which is not financed by employers increases job mobility. In conjunction with the finding that the probability of company-financed training increases with tenure, a cautious interpretation is that the empirical evidence supports job matching models rather than human capital models.

There is less detailed empirical evidence for Germany. Winkelmann (1994) considers the determinants of job mobility during the first five career years. Completed apprenticeship training lowers the probability that a male young worker leaves his employer. For female no such effect can be found. Moreover, full-time vocational school and academic training have no effect on the probability of turnover for either male or female workers.

Overall, the empirical results on training and mobility are compatible with an argument put forward in Harhoff and Kane (1993): The underlying mechanism for the United States labor market rewards mobility and job matching while the German labor market thrives on human capital investment and relative lack of mobility.

5. Lessons for alternative training policies

The current debate on the training of young workers is mainly about non-academic post-secondary training. Such training comes in two types: off-the-job training in vocational schools, correspondence course and the like; and on-the-job training. While it is a common belief that on-site training with an employer has greater pedagogical value, the empirical studies reviewed in Sect. 3 provide no clear-cut answer as to the relative merits of the two types of training. More research is needed to discriminate between the wage and mobility effects of on-the-job and off-the-job training.

The second issue is how firms can be made to invest in marketable skills, as they apparently do in Germany but not in the United States. The key issue is that of labor mobility and poaching (Harhoff and Kane 1994; Franz and Soskice 1995). In Germany, mobility is low for a variety of reasons. The studies reviewed in Sect. 3.5 documented a compressed wage structure in Germany. But with a low variance of wage offers, the expected benefits of job search are low. Other factors contributing to low mobility are narrow skill requirements for a particular job and the role that work councils play. German firms also have positive incentives to invest in general skills. Firstly, it may be a cost effective way to learn about an employee's ability in a world of asymmetric information and high firing costs. Secondly, the costs of training apprentices in specific skills may be lower than the costs of training an externally hired worker in those skills, and firm-specific skills may be needed to make transferable skills productive (Franz and Soskice 1995).

The institutional elements that are necessary to make the apprenticeship system work in Germany are likely to be absent in the United States. The United States has high labor mobility, flexible wages, and low firing costs. Heckman (1993, 1994) has forcefully made the point that such an environment is beneficial since it enables young workers to go through a trial and

error job-shopping process during which they can find their optimal match. While there is indisputable evidence that during this process they receive much less formal training than their German counterparts, it is also clear that they have similar or larger wage gains (Topel and Ward 1992).

While there is a consensus that a simple transfer of elements of the two systems cannot work, the debate on their relative merits is ongoing. For instance, Hamilton and Hurrelmann (1994) pointed out that the informal school-to-work transition, as well as the lack of a nationally recognized vocational skill certificate, in the United States might have adverse consequences for young workers since it reduces the incentive for the non-college bound youth to acquire general skills in high school and to invest in vocational skills afterwards. According to this view, the frequently deplored lack of motivation and achievement in United States secondary education is caused by a lack of a visible causal link between achievement in high school and success in the labor market.

Whether the German system has resolved this problem is an open question and there is no clear empirical evidence. Other questions for future research are how minorities fare in the two systems, and how the relatively rigid German system can respond to the current technology-driven changes in labor demand.

References

- Abraham KG, Houseman SN (1994) Earnings Inequality in Germany. In: Freeman RB, Katz LF (eds) *Differences and Changes in Wage Structures*. Chicago, University of Chicago Press for NBER
- Becker GS (1964) *Human Capital: A Theoretical Analysis with Special Reference to Education*. New York, Columbia University Press for NBER
- Berufsbildungsbericht (1993) Der Bundesminister für Bildung und Wissenschaft (ed), Bonn
- Blanchflower DG, Lynch LM (1994) Training at Work: A Comparison of United States and British Youth. In: Lynch LM (ed) *Training and the Private Sector: International Comparisons*. University of Chicago Press for NBER, Chicago
- Büchtemann CF, Schupp J, Soloff D (1993) Roads to Work: School-to-Work Transition Patterns in Germany and the United States. *Industrial Relations Journal* 24 (2):97–111
- Büchtemann CF, Schupp J, Soloff D (1994) From School to Work: Patterns in Germany and the United States. In: Schwarze J, Buttler F, Wagner GG (eds) *Labour Market Dynamics in Present Day Germany*. Campus/Westview, Frankfurt and Boulder, Colorado
- Couch KA (1994) High School Vocational Education, Apprenticeship, and Earnings: A Comparison of Germany and the United States. In: Burkhauser RV, Wagner GG (eds) *Proceedings of the 1993 International Conference of German Socio-Economic Panel Study Users*. Vierteljahreshefte zur Wirtschaftsforschung, pp 10–18
- Franz W, Soskice D (1995) The German Apprenticeship System. In: Buttler F, Franz W, Schettkat R (eds) *Institutional Frameworks and Labor Market Performance*. Routledge, London
- Gustman AL, Steinmeier TL (1982a) Labor Markets and Evaluations of Vocational Training Programs in the Public High Schools – Toward a Framework for Analysis. *Southern Economic Journal* 49:185–200
- Gustman AL, Steinmeier TL (1982b) The Relation Between Vocational Training in High School and Economic Outcomes. *Industrial and Labor Relations Review* 36:73–87
- Hall RW (1982) The Importance of Lifetime Jobs in the US Economy. *American Economic Review* 72:716–724
- Hamilton SF, Hurrelmann K (1994) The School-to-Career Transition in Germany and the United States. *Teacher College Record* 96 (2):329–344

- Harhoff D, Kane TJ (1994) *Financing Apprenticeship Training: Evidence from Germany*. NBER Working Paper # 4557
- Heckman JJ (1979) Sample Selection Bias as Specification Error. *Econometrica* 47 (1):153–161
- Heckman JJ (1993) *Assessing Clinton's Program on Job Training, Workforce, and Education in the Workplace*. NBER Working Paper # 4428
- Heckman JJ (1994) Is Job Training Oversold? *The Public Interest* 115 (Spring):91–115
- Hilton M (1991) Shared Training: Learning from Germany. *Monthly Labor Review* (March) 1991:33–37
- Hollenbeck K (1993) Postsecondary Education as Triage: Returns to Academic and Technical Programs. *Economics of Education Review* 12(3):213–232
- Hotchkiss L (1993) Effects of Training, Occupation, and Training-Occupation Match on Wage. *Journal of Human Resources* 28(3):482–496
- Kane TJ, Rouse CE (1995) Labor-Market Returns to Two- and Four-Year College. *American Economic Review* 85(3):600–614
- Lerman RI, Lane JI (1994) Training Differences and Earnings Inequality: A Comparative Study of German and United States Youth. In: Burkhauser RV, Wagner GG (eds) *Proceedings of the 1993 International Conference of German Socio-Economic Panel Study Users*. Vierteljahreshefte zur Wirtschaftsforschung 19:26
- Lynch LM (1991) The Role of Off-the-Job vs. On-the-job Training for the Mobility of Women Workers. *American Economic Review* 81(2):151–156
- Lynch LM (1992) Private Sector Training and the Earnings of Young Workers. *American Economic Review* 82(1):299–312
- Lynch LM (1994) Payoffs to Alternative Training Strategies at Work. In: Freeman RB (ed) *Working under Different Rules*. Russel Sage Foundation for NBER
- Meyer RH, Wise DA (1982) High School Preparation and Early Labor Force Experience. In: Freeman RB, Wise DA (eds) *The Youth Labor Market Problem: Its Nature, Causes, and Consequences*. University of Chicago Press for NBER, Chicago
- Pischke JS (1994) Continuous Training in Germany. Mimeo, MIT
- Rumberger R, Daymont TN (1984) Economic Value of High-School Vocational Training Acquired in High School. In: Borus ME (ed) *Youth and the Labor Market*. The W.E. Upjohn Institute for Employment Research, Kalamazoo, Mich
- Soskice D (1994) Reconciling Markets and Institutions: The German Apprenticeship System. In: Lynch LM (ed) *Training and the Private Sector: International Comparisons*. University of Chicago Press for NBER, Chicago
- Steedman H (1993) The Economics of Youth Training in Germany. *Economic Journal* 103: 1279–1291
- Topel RH, Ward MP (1992) Job Mobility and the Careers of Young Men. *Quarterly Journal of Economics* 106(2):439–479
- United States Department of Labor (1992) How Workers get Their Training: A 1991 Update. Bureau of Labor Statistics Bulletin 2407
- Veum JR (1995) Sources of Training and Their Impact on Wages. *Industrial and Labor Relations Review* 48(4):812–826
- Veum JR (1996) Training and Job Mobility Among Young Workers. (manuscript)
- Willis RJ (1986) Wage Determinants: A Survey and Reinterpretation of Human Capital Earnings Functions. In: Ashenfelter OC, Layard R (eds) *Handbook of Labor Economics*. North-Holland, Amsterdam
- Winkelmann R (1994) Training, Earnings, and Mobility in Germany. CEPR Discussion Paper no 982
- Winkelmann R (1996a) Unskilled Labor and Wage Determination: A Panel Data Analysis for Germany. *Journal of Population Economics* 9:161–173
- Winkelmann R (1996b) Employment Prospects and Skill Acquisition of Apprenticeship-Trained Workers in Germany. *Industrial and Labor Relations Review* (in press)