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Volume Title: Training and the Private Sector

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Volume Publisher: University of Chicago Press

Volume ISBN: 0-226-49810-7

Volume URL: <http://www.nber.org/books/lync94-1>

Conference Date: December 15-17, 1991

Publication Date: January 1994

Chapter Title: Introduction to "Training and the Private Sector"

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Chapter URL: <http://www.nber.org/chapters/c8775>

Chapter pages in book: (p. 1 - 24)

Introduction

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Between 1983 and 1989 the average annual growth rate in GDP per person in employment was 1.3 percent in the United States, 2.4 percent in Germany and France, and 3.4 percent in Japan. The fact that U.S. labor productivity growth continues to lag behind that of some of its major economic competitors has renewed interest in how to stimulate the skill development of the American work force. For example, in 1989, the secretary of labor's Commission on Workforce Quality and Labor Market Efficiency concluded that in order for U.S. firms to compete internationally immediate reforms would be needed in the educational and training institutions in America. Why is there this perception that the skills of U.S. workers are not on par with the skills of workers in Europe and Japan? One possible explanation is that educational quality has declined markedly in the United States and new entrants are not as well prepared as previous generations were. In international comparisons of achievement tests given to youths, U.S. youths score lower than young people in many other countries in a variety of subjects (see Bishop 1992). However, since most workers are already in the labor market, changes in the quality of the newest entrants in the past ten to fifteen years would have only a minor impact on the overall quality of the work force.

A second possible explanation is dramatic change in the demand for workers' skills that has left those without a college degree at a disadvantage. In the past, many workers without a college degree could look forward to a good-paying job with moderate skill requirements in the manufacturing sector. The necessary skills could be acquired through a system of informal "learning-by-

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The author thanks Richard Freeman and Geoffrey Carliner for helpful suggestions on this introduction.

doing.” However, as technologies changed and new work organizations were designed to increase productivity, the need for cross-functional competencies and problem solving increased, as did the demand for multiskilled workers. Nonmanagerial workers are now expected to take on responsibilities for quality control and trouble shooting that were not associated with old, Fordist production systems. Leaner work organizations require workers to have a broader range of skills, and, given technological changes, many workers, even if they remain with the same employer, will not be working in the same jobs ten years from now. The requisite new skills are not easy to acquire informally, and they require a strong base of analytical, quantitative, and verbal skills that college graduates are more likely to have than are high school graduates. This may explain the large increase in the 1980s in the differential between earnings of U.S. high school graduates and those of college graduates (see Freeman and Katz 1993).

So work-force requirements are changing: workers must be retrainable and adaptable to new technologies and work organizations. But how do workers who have already completed their formal education acquire these new skills? In addition, how do new entrants, especially those without a college degree, make sure that they are prepared enough to obtain a high-skill/high-wage job, as opposed to a low-skill/low-wage job, when they enter the labor market? These questions suggest that explanations of the U.S. training deficit need to examine the institutional process behind the skill development of new entrants in the labor market and how workers already in the labor force acquire the new skills needed by their employers.

While there seems to be an emerging consensus that U.S. workers’ skills are not on par with those of European and Japanese workers (U.S. General Accounting Office (GAO) 1990; U.S. Congress Office of Technology Assessment (OTA) 1990; Lynch 1991a, 1993; Kochan and Osterman 1991), this consensus is based on limited direct empirical evidence of how skills and skill preparation vary from country to country. We have relatively good documentation of how education and government training programs affect labor market outcomes but much less direct evidence on how private-sector training affects wages and productivity. This volume seeks to inform the current discussion of training and competitiveness by examining new empirical evidence on what returns training provides for workers and firms, across countries.

In particular, the volume seeks to address the following questions: (1) How does the structure of training systems vary across countries? (2) How much does the amount of training provided by the private sector vary across countries? (3) What other institutional structures support these training systems, especially in Germany and Japan? (4) What impact does training have on firm productivity? (5) Who receives training, and how do different types of training affect workers’ wages and wage growth? No single paper in this volume addresses all of these questions, but each paper addresses at least one. This volume is a compilation, so that each of the papers was written and can be read

independently. While some of the papers are comparative and others focus on a single country, they can be grouped according to three major themes—alternative training systems, training outcomes for firms, and training outcomes for individuals. This introduction presents an overview of the key issues surrounding the role of the private sector in the provision of training and puts in some perspective the major findings of the following chapters in the volume. Chapters 1 through 4 present detailed studies of the training systems in Germany, Japan, and the United Kingdom and contrast them with the training system in the United States. Chapters 5 and 6 analyze the impact of formal and informal training on productivity in U.S. firms. Chapters 7 through 11 examine who receives training and the impact of different training systems on workers' wages in the United States and Europe.

The Structure of Alternative Training Systems

If there is an emerging consensus in the United States that training is necessary for competitiveness, why isn't everyone doing more of it? Part of the answer is related to the complex nature of the investment decision. Workplace training is different from other forms of human capital investment, such as education and government training, since there are two parties in the training decision—the individual (who may or may not be represented by a union) and the firm. These two agents may differ greatly in their levels of risk aversion, time horizons, information about the labor market, access to capital markets, and preferences. Therefore, we need to examine reasons why these two parties do or do not invest in training.

Firms may not provide more training, especially more general training, even though they might wish to do so, for a variety of reasons. For example, a firm may be reluctant to invest in training if employee turnover is high. In addition, training may itself contribute to employee turnover: if new skills are of value to other employers, the firm risks having the trained employee hired away (the poaching or "cherry-picking" problem). Therefore, investments in nonportable firm-specific training are more attractive to firms than are investments in general training. This would not be a problem if capital markets were perfect and workers could borrow to finance more general training, if the state subsidized general training, or if employers could pay workers lower wages during the general training periods. However, capital markets are far from perfect, and workers differ from firms in their levels of risk aversion; other institutional constraints may also result in a market failure to provide general training.

Smaller firms often have higher training costs per employee than larger firms because they cannot spread fixed costs of training over a large group of employees. In addition, the loss in production from having one worker in off-site training is probably much higher for a small firm than for a larger firm. The result is that the percentage of workers with company training in the United States is much lower for small firms than for large ones: 26 percent of workers

in large establishments report receiving formal company training, compared to 11 percent in small establishments (see Bowers and Swaim 1992).

Japan seems to have gotten around this problem of capturing the returns to training by imposing high costs on employees who quit a firm. Wage gains associated with tenure at a firm are four times greater in Japan than in the United States, so that wage gains to quitters are low (see Mincer and Higuchi 1988). In addition, firms are reluctant to hire workers away from other firms because the social costs paid by poaching firms have historically been high. This is one reason average employee tenure in Japan is much higher than in other developed economies. When product demand falls, Japanese firms are less likely to lay off workers than are their U.S. counterparts. Instead, they often use periods of slack demand to do more worker training. With lower employee turnover, firms are able to capture the returns to investments in even more general training. However, the ability of this system to sustain itself may be challenged as employee turnover in sectors such as finance and banking increases. It will be interesting to see what impact this change has on the training strategies firms in these sectors pursue in the future.

Germany's tripartite structure of employers, unions, and the government jointly determines a national strategy for training; this arrangement also appears to have solved the problem of capturing returns to training. Local chambers of commerce use moral suasion to protect firms training a large number of workers from excessive poaching. More generally, the German dual system of apprenticeship training is characterized by coinvestment in training by workers and firms, by codetermination of training program content by unions, employer associations, and the government, and by nationally recognized certification of skills on completion of training. As a result of these three components, German firms undertake a great deal of general skill training, and this generates a high-skill, high-productivity equilibrium.

Sweden and other Nordic countries have historically addressed the potential market failure in general training differently, through support for government training. This may be in the form of government-sponsored training programs in institutions developed solely for this purpose or school-based vocational training as found in Norway. Regardless of the form of delivery of government training programs, the expenditures are much larger than what is spent on government-sponsored training in the United States. For example, in 1990 the Swedish government spent approximately 0.46 percent of GDP on training programs, in contrast to just 0.09 percent spent by the U.S. government.

While this strategy may help to solve a market failure, it can be costly if the government also finances firm-specific training. There has also been mixed evidence on the effectiveness of government training programs on the employment experience of workers (see Bjorklund 1990). There is concern in Sweden that government programs are not improving workers' skills appropriately to meet private-sector demand and that some workers may be stigmatized by participating in government training programs. This latter concern has also been

raised in the U.S. discussion of the effectiveness of such programs. As a result of increasing pressure to reduce government expenditures and of the mixed evidence about how much government programs actually improve workers skills, the Swedish government is considering several proposals targeted at increasing private-sector training expenditures and decreasing public expenditures.

Some of the current policy debate in the United States has focused on the relative merits of imposing an employer's training tax to generate additional training, similar to taxes imposed in France and Australia. An employer's training tax for firms with more than 10 employees has been in place in France since 1971. Initially the tax rate was 0.8 percent of the total wage bill; it rose to 1.2 percent in 1988 and is currently 1.4 percent. This tax is called a "pay or play" tax since what is required is the expenditure not the training. Consequently, if a firm is not able to document training expenses greater than 1.4 percent of its wage bill, it must pay the difference between actual training expenditures and 1.4 percent of the wage bill. In 1990, Australia adopted a similar training tax, called the Training Guarantee. All enterprises that have a payroll greater than A\$200,000 must spend 1.5 percent of their payroll on training.

While there has been only limited evaluation of the impact of the training tax in France (and none in Australia, since the tax was just instituted), it is possible to examine how effective the French training tax has been in stimulating training, especially in small firms and for unskilled workers. Table 1 presents results from a survey of training practices of French firms in 1988 after the 1987 increase in the tax rate, from 0.8 to 1.2 percent. As shown here, even with the training tax, most formal company-provided training is still concentrated in large firms and among technical, managerial, and professional employees. What this table does not reveal is what proportion of unskilled workers or workers in smaller firms have taken advantage of public-supported training institutions or received formal training from a previous employer. Nevertheless, the efforts to stimulate training through a tax seem to have had an

Table 1 Proportion of Salaried Employees in Training: France, 1988 (%)

Skill Level	Firm Size (number of employees)					Total
	10-19	20-49	50-499	500-1,999	2,000+	
Unskilled	2	3	9	15	24	12
Skilled	4	6	14	23	41	21
Nonmanual	9	12	22	33	44	25
Managerial, technical, and professional	14	20	35	53	67	47
Total	8	11	21	34	49	29

Source: Centre d'Etudes et des Recherches sur les Qualifications (CEREQ) (1991).

uneven impact on the distribution of company-provided training across workers and firms.

The U.S. training system, in contrast to the European and the Japanese, is highly decentralized and has little formal structure (for overviews of the U.S. training system, see Carnevale, Gainer, and Villet 1990; Carey 1985; Lusterman 1977; U.S. Congress OTA 1990). Many groups offer postschool training, and no national system exists for accrediting vocational skills acquired outside formal schooling. Why do we not have training institutions as well developed as those in Europe or Japan? A small part of the answer may lie in how U.S. firms filled their training requirements in the past. When U.S. employers faced a specific skill shortage, the government could increase the immigration flow of the necessary skilled workers. One consequence of this practice was a failure to develop training and retraining institutions within the United States. Importing skilled labor has real benefits, but the need for workers with general skills and the lack of well-developed and integrated domestic training institutions means that it is difficult to continue to depend on that strategy.

Another reason postschool training is so decentralized in the United States may be that our schooling system is itself so decentralized; compared to those of Europe and Japan, our schools have an unusually high degree of local and state autonomy in schooling standards. This structure is then replicated in postschool training institutions. More generally, one might characterize the U.S. training system as one in which training needs are filled by individual workers' or individual firms' decisions to invest or not. This results in a training system which is flexible at the individual level. However, at the national level, there is not a comprehensive strategy to develop and coordinate these individual training investments to address potential market failures in the delivery of more general training.

Finally, it could be argued that a simple explanation for the decentralization of the U.S. training system is the sheer size of the U.S. work force (almost 140 million) relative to the work forces of Japan (63 million) or the individual European countries (e.g., former West Germany, 29 million). As a consequence of our large and geographically dispersed labor force, it is much harder to coordinate training efforts. However, in spite of language barriers and differences in the training delivery systems, the European Community (143 million in the labor force in 1989) is attempting to improve the coordination of skill development in member countries, to facilitate greater portability and recognition of skills across countries. It is hoped that this increased coordination will foster more rapid economic growth within Europe. So size alone does not seem to be an insurmountable barrier to the development of a comprehensive training strategy.

The various training strategies pursued by firms in the United States, Europe, and Japan are summarized in table 2. The table highlights some of the unique characteristics of each system and shows the large variance across countries in their approaches to meeting the skill requirements of their work

Table 2 **Alternative Training Systems**

System	Country	Basic Characteristics/Issues
Apprenticeship training	Germany, United Kingdom (pre-1980), The Netherlands	Codetermination (employers, unions, and government) Coinvestment Certification of skills
Low employee turnover and extensive company training	Japan	Incentives for all to do well in school Lifetime employment lowers turnover Firms provide general and specific training Training embedded in production process High degree of homogeneity in literacy and numeracy
Government-led/school-based	Sweden, Norway, United Kingdom (post-1980)	Government-funded general training Government may also fund firm-specific training
Employer training tax	France, Australia	Relevance of school-based programs Distributes costs over wide range of employers Does not guarantee training of unskilled and those in small firms
School-based/learning-by-doing	United States, Canada	Individual autonomy on training investments Multiple sources of training Few nationally recognized qualifications outside formal schooling Employer training is primarily firm specific

forces. There are a variety of contributory factors which might explain why we see, as shown in table 2, such a range of training systems across countries. For example, Oulton and Steedman (chap. 2 in this volume) present a theoretical model that shows how there can be various training equilibriums across different countries. In particular, they examine the different training equilibriums in Germany, the United Kingdom, and France. They argue that there are three important components to training investments: how and by whom training is financed, what it contains, and how it is assessed and certified. They conclude that the traditional apprenticeship systems (such as those in Britain and the United States) have failed to provide sufficient training, compared with Germany, because wages for apprentices are too high during training periods. In addition, when the British government attempted in the 1980s to establish a new training system for all unemployed young workers, it failed because the new training system appears to provide little value to the trainees. The reasons for this failure are threefold: the skill levels required for skill certificates associated with the new training programs are low, the certificates are too industry

specific, and there is no reliable measure of an individual's actual workplace skills. As a result, trainees are not willing to accept the same reduction in wages that German apprentices accept. Therefore, since new entrant wages are still higher in Britain than in Germany, British employers provide less training, and the training is more firm specific.

In contrast, training standards are high in Germany, the assessment standards that have evolved over the years are viewed as very reliable, and the content includes a general educational element. Consequently, young people in Germany find training much more attractive than do those in the United Kingdom. As a result (as Soskice describes in chap. 1), youths are willing to work hard in school to get the better apprenticeships and then to accept lower wages during the apprenticeship. The lower wages allow firms to provide more general training, and a virtuous circle is created. So in the 1980s, while the United Kingdom moved away from apprenticeship training, Germany expanded its program. The French experience lies between the British and German experiences.

Oulton and Steedman's model also suggests why it is difficult for a single firm in the United States or the United Kingdom to move out of one training equilibrium and into another. If a firm provides more general training but there is no accepted national system to recognize and certify general skills for other employers, as in Germany or France, then workers will not be willing to accept lower wages during training. As a result, a country becomes locked into a lower training equilibrium even when individual firms are willing to invest in more general training.

The Japanese training system appears to work much differently: Lifetime employment (especially for male workers), which is more common in Japan than in other countries, means that general training is feasible even without vastly lower trainee wages. With lower employee turnover, firms are able to capture the returns on even more general forms of human capital investments. There is not an apprenticeship system—as found in Germany, the Netherlands, or France—in Japan. In fact an apprenticeship system would be contrary to a fundamental premise of the Japanese system—loyalty to a firm as opposed to a specific job or occupation.

In chapter 4 of this volume, Hashimoto distinguishes between two types of complementary training in Japan: training in technical skills and training in employment relations. In particular, he emphasizes that one major difference between Japanese and U.S. training strategies is Japan's focus on producing in the schools a high degree of homogeneity in literacy and numeracy, willingness to learn and teach new skills, and ability to function as team members. This focus lowers the cost of investment in both technical and employment relations. As in Germany, school performance is very important in determining postschool employment opportunities; many firms establish explicit relationships with certain schools to help in their recruitment of new employees. Hashimoto argues that, because of the high level of basic knowledge that the

work force shares, firms can rely to a large degree on more informal learning and on individual study for technical training. So, more informal learning is not inconsistent with new work organizations per se. The key is the high level of fundamental skills possessed by workers coming into the workplace, skills that firms can then build upon. This suggests that key features of the Japanese training system include both lower employee turnover and a high level of pre-labor-market-entry general skills.

How Does the Amount of Postschool Training Vary across Countries?

While the focus of this volume is primarily on postschool training provided by the private sector, other forms of human capital investments, such as schooling, are obviously closely linked to these training investments. What happens in schools influences what employers must do and how much it will cost to achieve the skill quality they want from new entrants into the labor market. Patterns of schooling vary substantially across the United States, Europe, and Japan. Table 3 summarizes some of the basic differences in the education and training structures for young workers across a group of countries. As the column 1 shows, a very high percentage of young workers in Germany follow a vocational education track in school; 70 percent of German youths participate in apprenticeship schemes that combine on-the-job work and training with off-site classroom training. Only 30 percent of U.S. youths are in any type of vocational education, and even fewer are in apprenticeships. Although only 3 percent of non-college-bound youths begin an apprenticeship in the United States (see Blanchflower and Lynch, chap. 8 in this volume; Lynch 1992b), as column

Table 3 Education and Training of Young Workers

Country	Percentage in Vocational Education (1)	Percentage with Any Postsecondary Schooling (2)	Percentage in University or Four-year College ^a (3)
United States	30	57	36
West Germany	70	30	26
England	18	21	8
France	—	50	27
Sweden	50	37	26
Japan	28	30	24
Australia ^b	15	23	18

Sources: Various sources, but primarily U.S. GAO (1990, 12). Franch data are from CEREQ (1991).

^aFirst-year enrollment in schools conferring baccalaureate degrees, or higher.

^bData refer to 1990 activities of 18-year-olds, from Department of Education and Training, Canberra.

2 of table 3 shows, in the United States the percentage of youths that go on to postsecondary education is much higher than in other countries. This reflects a positive aspect of our education and training system; individuals have more flexibility to get onto an academic track at a later stage in their lives. The difference across countries in postsecondary education narrows but remains, when one examines first-year enrollment rates in four-year universities and their equivalents (col. 3 of table 3). However, since graduation rates from U.S. universities granting a baccalaureate or its equivalent are only approximately 25 percent, there is not such a wide difference across countries in the supply of college graduates (with the exception of the United Kingdom, where the supply is lower).

While important differences in the structure of education exist across countries, there are even wider differences in how the various systems of postschool training affect workers. Table 4 presents rough measures of the percentage of employed workers that receive training at their firm. Unfortunately, the time period over which this incidence is measured varies from country to country. For example, in the United States the incidence refers to the percentage that *ever* received formal training from their current employer, while the Japanese data refer to training in the past two years (see OECD (1991, annex 5a)). However, even though these numbers are not easily comparable across countries, there are some interesting cross-country differences. The most striking is that, even if workers are allowed to report any training they ever received in their current job instead of only training received in the past year or two, U.S. workers seem to receive much less formal training than workers in most other countries. These numbers reveal only part of the picture of the variation in training incidence across countries. For example, in Germany, as shown in table 4, approximately 13 percent of all workers receive training over a survey period of one month, but as shown in table 3, over three-quarters of all youths are in training in this survey period. In the German training system, large investments in skill development are made very early in a worker's career, with limited additional training after completion of an apprenticeship. Meanwhile, in Japan and Sweden, training is concentrated in workers who are 30 to 44 years of age and who have worked at the firm for a longer period of time. So some countries seem to concentrate their training at the beginning of workers' careers, while others follow a more curvilinear relationship.

The numbers in table 4 do not shed much light on who actually receives training. The people in the United States who receive training are primarily technical and managerial employees with university degrees (for details on the occupational distribution of training, see Bartel 1989). Only 4 percent of young workers who are not university graduates get formal training at work (for further details, see Lynch 1991b, 1992b). More generally, nonmanagerial and nontechnical workers receive very little skill-enhancing, formal training in the United States compared to their counterparts in Europe and Japan. Most training for these workers is obtained informally, as learning-by-doing.

Table 4 Enterprise-Related Training

Country	Individuals Receiving Formal Training (%)
United States: 1983	11.8 ^a
1991	16.8 ^a
Canada: 1985	6.7 ^b
West Germany: 1989	12.7 ^b
Great Britain: 1989	14.4 ^b
France: 1990	32 ^c
Netherlands: 1986	25.0 ^b
Sweden: 1987	25.4 ^b
Japan: 1989	36.7 ^d
Australia: 1989	34.9 ^e
Norway: 1989	33.1 ^b

Sources: Current Population Survey, Training Supplement (Washington, D.C.: U.S. Department of Labor, 1983, 1991); OECD (1991); CEREQ (1991); 1985 Adult Training Survey (Ottawa: Statistics Canada, 1986).

^aReceived training at any time in current job.

^bOf all employed workers.

^cOf all workers in firms employing 10 or more employees.

^dReceived training within the past two years.

^eReceived in-house training.

Because training is more informal in the United States than in Europe, one might conclude that U.S. firms do not spend as much on training as firms in other countries do. Measuring actual expenditures, however, is not straightforward. Training costs for firms can include direct costs such as materials, teachers' salaries, transportation, and other items associated with off-site training. Training costs for workers are primarily forgone earnings. The treatment of trainee wages, however, is problematic. The issue, as discussed by Mincer (1962), is whether all or just part of firm training expenditures should be counted as training costs if workers are also receiving lower wages during training periods. If the reduction in wages is exactly equal to the firm's training costs, then the worker bears all the training costs, not the firm. However, it is more likely that firms recover a large part of their training expenditures well after workers complete their training. These expenditures should be included in the direct training costs of firms. This accounting procedure would not automatically include all trainee wages in firm training costs, yet this is common practice in the measurement of training costs across countries. In addition, perhaps a larger share of costs is indirect: it results from lost output of trainees or of coworkers or supervisors during time spent training new hires. Because of measurement difficulties, these types of costs are usually not included in overall training expenditures. In sum, this discussion suggests that measuring firms' actual training expenditures is not straightforward.

Finally, it is important to note that, because of the difficulty in measuring both direct and indirect training expenditures by firms, there is no standard

accounting procedure across countries for measuring firms' training costs. Given this important caveat, table 5 presents Organisation for Economic Cooperation and Development (OECD 1991) calculations of firms' training expenditures. On average, in the United States (for larger firms), Germany, the United Kingdom, France, and Australia, it seems that firms are all spending roughly 1.5 percent or more of their total wage bill on training.

The only exception is Japan, where it appears that only 0.4 percent is spent on training. Most of the discrepancy between the reported numbers for Japan and those for the other countries exists because the Japanese cost numbers do not include trainee wages. In addition, time that supervisors spend training workers is not included, since only direct costs associated with off-site training are included. In fact, the apparently low numbers for Japan may actually show how successful Japanese firms have been in incorporating training into the production process.

While tables 3, 4, and 5 provide a general sense of cross-country variations in training, they may not fully reflect the reality of cross-country differences in postschool training. In particular, these numbers do not reveal the huge gap in spending that much of the popular discussion on U.S. training deficiencies would suggest. What might explain this apparent paradox? Another approach to studying training is to focus on specific industries and occupations across countries and to examine how workers are trained. This more micro, firm-based case-study approach can reveal differences in training content that may be more important in the competitiveness debate than crude, cross-country comparisons of expenditures. Tables 6 and 7 present firm data on two industries—automobiles and nuclear power. In the auto industry, Krafcik (1990) found that the average worker in Japan or in a Japanese-owned U.S. plant spent two to three times as much time being trained as a worker in a U.S.-owned

Table 5 Training Expenditures by Firms

Country	Average Training Expenditure (as % of total wage bill)
United States: 1988	1.8 ^a
Canada: 1985	0.9
West Germany: 1984	1.8
United Kingdom: 1984	1.3
France: 1984	1.6
1989	2.5
Netherlands: 1986	1.5
Japan: 1989	0.4 ^b
Australia (private sector): 1989	1.7

Sources: OECD (1991); for U.S. data *Training Magazine* (Alexandria, Va.: American Society for Training and Development, 1988); for Canadian data, Adult Training Survey (Ottawa: Statistics Canada, 1986), as reported by the Canadian Labour Market and Productivity Centre.

^aIncludes larger firms from *Training Magazine* survey.

^bTraining expenditures as a percentage of monthly labor costs, but excludes trainees' wages.

Table 6 Studies of Average Hours of Training: Auto Industry

Worker	Type of Plant		
	Japanese	Japanese-owned transplant	U.S.-owned
All workers	85	55	30
New-hire assembly workers	310	280	48

Source: Krafcik (1990).

plant (see row 1 of table 6). These average numbers do not control for age and experience; the smaller number of training hours in U.S.-owned plants may result from the work force's being older and more experienced here than in Japan or in the Japanese transplants. However, row 2 shows that, for new assembly workers, the gap across the three types of plants is even greater. New hires in Japan or in Japanese transplants receive approximately 300 hours of training, while their U.S. counterparts receive only 48 hours of training.

In chapter 3 of this volume Berg presents detailed comparisons of training in U.S. and German auto plants. Berg argues that, in the auto industry, training for both skilled and unskilled workers can be divided into three main categories: product and process awareness training, teamwork training, and technical training. In the first two forms of training there is little difference across U.S. and German auto firms. Indeed, U.S. workers spend slightly more time in product awareness training than their German counterparts. But these two types of training constitute a very small proportion of overall training. Most employee development is in technical training, and here there are large differences across the United States and Germany. German firms spend 1.5 to 10 times more time in technical training than comparable U.S. firms. However, even in Germany there are wide differences among firms. In fact, German firms that provide less technical training are characterized by less employee flexibility and look more like U.S. auto firms. Firms in either country that provide considerable training appear to be able to deploy their workers more flexibly at the workplace.

While the auto industry is an appealing industry to study because we have accurately measured inputs and outputs, it is not particularly representative of industry as a whole. Mason's study (1990) on cross-country differences in nuclear power industry training provides insight into a very different sector—one that is interesting partly because the technology is identical in many countries. It is also a highly regulated industry that spends large amounts on worker training to ensure the safe operation of facilities, and in the United States it is considered an industry with a highly developed training program.

Mason's study may solve the paradox we have been noting: U.S. training expenditures are not smaller than those of other developed countries, and yet we sense a training deficit in the United States. It appears that workers in the U.S. nuclear industry are receiving amounts of training similar to those received by their European counterparts (excluding German technicians in plant

Table 7 Studies of Hours of Training: Nuclear Power Technicians

Type of Training	Germany ^a	France	United States
Total ^b	560/1340	460	640
Fundamentals, basic technology, and site familiarization	240/40	0	520

Source: Mason (1990).

^aFirst number is for maintenance workers; second number is for plant-operations workers.

^bIncludes fundamentals, basic technology, site familiarization, basic nuclear technology, plant systems, integrated operation, and administrative procedures.

operations). However, half of all technician training in the U.S. nuclear industry is spent on fundamentals (including remedial education), whereas European technicians use training hours for much more advanced study of nuclear engineering and plant administration. This difference reflects the very different level of preparedness possessed by German and French workers coming into this industry. This curriculum difference may affect workers' abilities to respond to situations outside the parameters of simulations they have been trained on. In addition, firms that can bypass fundamental training can hire fewer supervisors, since the more advanced training allows technicians to work with less supervision. So, while the expenditures and hours may be similar across countries, the content and results vary dramatically. This factor may be an important part of the perceived training deficit in the United States.

In summary, when we look at aggregate estimates of training across countries, we are left with a mixed sense of the differences. On one hand, it appears that the United States does not spend less than other countries on training. On the other hand, there seem to be important differences in firms' training needs, depending on the initial skill level of workers. These initial levels are influenced by the education that workers receive before entering the work force and by the training available to workers in the early years of their employment. So, in some sectors, for the same level of expenditures, U.S. firms do not end up with employees as well qualified as those of their European and Japanese competitors. Consequently, underinvestment in training in the United States may take two forms. First, in certain sectors, U.S. firms may be spending less and providing their nontechnical or nonmanagerial employees with more limited training than competitors in other countries. Second, in other sectors, the level of expenditures or number of training hours may be the same but, because of lower initial skill levels, still not sufficient to achieve the skill proficiencies found in countries such as Japan and Germany.

Institutional Supports to Alternative Training Systems in Germany and Japan

Training systems do not develop or operate in a vacuum. They can be supported and influenced by a range of institutions. For example, one of the more

important characteristics that affects the evolution of the German training system is the percentage of the work force that is unionized and the role of unions in the organization of work. Union density in Germany in 1988 was over 40 percent. Unions in Germany, through their legislatively mandated representation on works councils in most firms, can be actively involved in codetermining with employers the content of apprenticeship training and retraining programs targeted at adult workers. In addition, Soskice argues in chapter 1 of this volume that, in order to understand why and how German companies train workers, one must make a distinction between the training strategies that medium-sized and large firms pursue and those that smaller, artisanal companies pursue. These various training strategies are supported by a wide range of institutional structures, including the school system, banks, local chambers of commerce, employer associations, and works councils.

More specifically, Soskice explains that there is a clear ranking in the quality and status of the various apprenticeships available. The better apprenticeships go to students who perform well in school, which gives students who are not preparing for university an incentive to work hard. Larger firms with well-developed internal labor markets carefully select and train young workers. They do this partly because bank lending policies allow firms to make longer-term investments and because local chambers of commerce work to minimize other firms' poaching of trained workers. The local chambers of commerce provide valuable training expertise to firms and use moral suasion and social pressure to minimize poaching. The majority of apprentices in these firms remain after completion of their apprenticeships. In contrast, in the artisanal sector there is much higher apprentice turnover at the completion of training. Even with this high turnover, firms are still willing to hire apprentices because they can pay lower wages than they would for adult, unskilled labor. German trade unions' success in obtaining high wages in larger firms has had two consequences for apprentice training. Larger firms pursue a high-quality, innovative product market strategy that requires a highly skilled work force, while firms in the artisanal sector maintain lower labor costs by hiring apprentices.

In Japan, as in Germany, there is a set of institutions which supports the training structures we observe. As already mentioned, there are established links between employers and schools. Students realize that through these links their school performance will influence their ability to obtain certain types of jobs. Schools in Japan do not focus on teaching technical skills; rather, they concentrate on developing math, science, reading, and what Hashimoto calls "citizenship skills." Hashimoto argues in chapter 4 that these citizenship skills help workers communicate better when they are members of teams in the workplace.

Other institutional supports operate to sustain the Japanese training system. For example, the government subsidizes in-house training, especially for smaller firms. In addition, there is a national trade skill test system. These tests are set to government standards but are mainly in manufacturing and construction. Passing these tests is not usually a condition of employment; however,

many firms provide special bonuses to workers who pass these examinations. Banks, as in Germany, have traditionally taken a longer view toward firms' investments in R&D and training than have their U.S. counterparts. Finally, the well-documented links between large companies and their suppliers extend to training as well. Many large firms will train the workers of their smaller suppliers. This maintains quality standards in the large firms and overcomes constraints smaller firms may face in training their own workers.

If one component of the Japanese system is a high degree of shared basic knowledge, how easy is it to transfer this training system to the United States? Hashimoto documents how Japanese auto transplants have adapted their training system to function within the U.S. educational and training structure. In particular, he shows that, because there are no well-developed relationships between employers and schools, Japanese transplants have had to closely screen new hires. In addition, they have had to provide much more formal training than is required in Japan, both in technical skills and in employment relations skills.

In summary, a variety of training equilibriums are supported by a range of institutions including schools, banks, employer groups, and unions. The training equilibrium is affected by the pattern of wages and the degree to which skills are certified. In particular, both Japan and Germany—through very different systems—have been able to create performance incentives for youths who do not obtain a university degree. These countries have developed training institutions that appear to overcome the potential market failure in the provision of general training. However, Japanese transplants preferred to modify the Japanese training system when operating in the United States rather than to try to replicate the Japanese system. Even with these modifications, the transplants (at least in the auto industry) still devote on average more time to training workers than do most of their U.S. counterparts.¹

Training Outcomes: Returns to Firms

An underlying assumption in the current training debate in the United States is that the more rapid aggregate growth rates in German and Japanese manufacturing labor productivity in the 1970s and 1980s were in large part the result of the training systems described here. However, this assumption has not been tested. In addition, no one has studied the impact of training on productivity in nonmanufacturing sectors. Unfortunately, the primary reason this assumption has not been tested in Germany and Japan is the lack of a representative sample of firms that can provide information on their training strategies and productivity. Fortunately, in the United States we are beginning to see more firm-based surveys, so that chapters 5 and 6 of this volume present new findings on training and firm productivity within the United States.

1. One important exception is GM's Saturn plant, where there is extensive training of all workers.

Before evaluating the returns to firm productivity due to formal training, it is useful to have a benchmark for the impact of traditional informal, learning-by-doing skill development. In the current debate on training, some have argued that the apparent U.S. training deficit is the result of our relative reliance on informal on-the-job training. Cross-country comparisons that use data on formal training, the argument goes, will underestimate the actual amount of training that occurs in the United States. In chapter 5 of this volume Weiss uses a unique data set from the United States: new-hire output in three electronics assembly plants that have no formal training programs in place for new hires is monitored over a six-to-eight-month period. Even in the absence of formal training programs, Weiss shows that the U.S. system of informal learning-by-doing generates rapid productivity growth during the first month of employment. However, six months later there is little evidence of any positive productivity changes associated with learning-by-doing. This finding suggests that overreliance on informal training may be one reason for our lower productivity growth in the United States.

So how do more formal training programs affect the productivity of firms? This is the key question in much of the current policy debate on training, yet there is a dearth of information available. In one study, Bartel (1992), using a survey of U.S. manufacturing firms in 1983 and 1986, finds that training programs resulted in increases in firm productivity on the order of 17 percent.

In chapter 6, Bishop provides additional evidence on the relationship between training and firm productivity. His work is unique in that it focuses on small and medium-sized firms across all sectors of the economy. Bishop examines a variety of issues, including the following: Are training costs lower if a worker has received relevant training at a school or in a previous job? What are the links between employee turnover and previous training? Are firms more profitable if they recruit previously trained workers? Is worker productivity higher with more training? Which types of training increase profits the most? Which types of training are linked with more innovations? Bishop segments training into current on-the-job training, previous relevant employer training (both formal and informal), previous "irrelevant" employer training (both formal and informal), and current and previous off-the-job training. He focuses on the experience of new hires within a firm and asks how portable previous on-the-job and off-the-job training is. This study measured productivity by asking employers to rate their most recent hire's productivity, on a scale of 0–100, during the first two weeks of employment, during the next eleven weeks, and at the time of the interview. There appear to be sharp differences between the returns from formal on-the-job training and from off-the-job training, as workers switch employers. Formal on-the-job training received from a previous employer has little effect on a worker's current wage (as might be expected given the absence of certification), but it increases a worker's current productivity by an estimated 9.5 percent and lowers the amount of training that the new firm must give the worker for the worker to do their job. However, if the worker receives no additional training from the current employer, the im-

pact of training from a previous employer diminishes over time. Company-sponsored off-the-job training has a more lasting effect on wages, worker productivity, and a measure of innovation; it raises productivity by 16 percent and makes workers more innovative on the job.

In summary, this section suggests that, in the United States, informal training, or learning-by-doing, has relatively little impact on longer-term productivity growth in a firm (see Weiss, chap. 5), while more formal training increases productivity and a worker's ability to be innovative (see Bishop, chap. 6).

Training Outcomes: Returns to Individuals

Studies using firm-based data provide a great deal of insight into what returns firms see from training. However, these studies do not tell us much about what returns workers receive, especially if there is a great deal of employee mobility, as is the case in the United States. The remaining chapters of the book examine the impact of training on individuals' wages and wage growth across countries. While we have household and individual data across countries that is more comparable than our firm-based data, it is still difficult to obtain information on a representative sample of individuals in Japan and Germany. Nevertheless, this section does provide information on how training affects wages in the United States, Great Britain, the Netherlands, and Norway. Specifically, it allows us to compare how different types of training—employer-led, government-led, and school-based—seem to affect wages and wage growth, especially those of new entrants who are not university graduates.

Many theories have attempted to explain why individual wages vary and why wages rise with seniority. Becker (1964) and Mincer (1974) argue that starting wages are higher for more highly educated workers since the stock of human capital for these workers is higher when they enter the labor market. Wages then increase as human capital or skills are acquired either on or off the job in formal and/or informal training or through work experience. Workers may acquire two types of training in the work force—general and firm specific. Firm-specific training will raise a worker's wage as a premium paid to reduce turnover, but this premium may not be as large as the premium paid for general training, since by definition specific training is not easily portable to other employers. Therefore, the impact of training on wages will depend in part on how specific the training is and in part on who pays for it.

Until recently, because of data limitations, it has not been possible to directly observe the relationship between periods of training and wages. Researchers had been forced to examine the links among tenure, work experience, and wages: they inferred training investments from the coefficients on tenure and experience. Unfortunately, human capital theory is not the only explanation for wages rising with tenure and experience in employment. Theories of job matching, shirking, and turnover provide alternative explanations. However,

these models of compensation are not mutually exclusive. To sort out the real returns to human capital investments and the specificity of these investments, we need longitudinal data on individuals, including data on the timing of investments in human capital and employment and earnings data. Recently U.S. researchers have used newly available data to examine this issue. Examples include Barron, Black, and Loewenstein (1987), Booth (1991), Brown (1989), Lillard and Tan (1986), Lynch (1991b, 1992a, 1992b), and Mincer (1983, 1988). This section of the volume contributes to this growing literature.

Empirical studies of the returns to training may be affected by selection bias, since individuals are not randomly assigned to training. Employers are more likely to train workers who seem trainable, and highly motivated individuals are more likely to acquire off-the-job training. Therefore, estimates of the returns to training may be biased upward unless the observed and unobserved characteristics of those who receive training are properly controlled for. Heckman and Robb (1986) summarize alternative ways to address this selection bias. Several of the papers described below, which use longitudinal data, adopt one of the empirical strategies summarized by Heckman and Robb (1986) to control for time-invariant, unobserved individual characteristics in the returns to training.

The discussion of selection bias highlights how important it is to understand the characteristics of those in training. For instance, in the United States the determinants of receiving company-provided training for non-college-graduate youths include years of schooling, being white and male, and being covered by a union contract (Lynch 1992b). Women and minorities are more likely to have participated in off-the-job training provided by for-profit proprietary institutions than in company training. The link between schooling and postschool training in the United States means that dropping out of high school lowers not only starting wages but also the long-term career prospects of workers.

In many European countries it is difficult for youths to reenter the educational system once they have decided to stop their studies. However, in the United States, even for high school dropouts it is possible to “get back on track” even after many years out of school. In chapter 7 Cameron and Heckman use the detailed information available in the U.S. National Longitudinal Survey Youth Cohort (NLSY) to examine the factors influencing decisions to invest in additional schooling and training. In particular, they look at the impact of dropping out of high school, high school graduation, and GED certification on young males’ subsequent academic and nonacademic schooling and training choices. The GED certificate, administered by the private sector, allows high school dropouts to obtain, through examination, a certificate of high school equivalency. While previous work by Cameron and Heckman has shown that GED recipients are not equivalent to high school graduates in the probability that they will attend college, this paper shows that GED recipients are more likely to obtain additional private-sector training than are noncertified high school dropouts. Their work also shows that youths from families with

lower incomes are more likely to participate in formal off-the-job vocational training.

Blanchflower and Lynch (chap. 8) compare two similar cohorts of young U.S. and British workers who are not college graduates and who acquire their training from different sources. They document differences across the two countries in the incidence of training and then look at the impact this training has on wages and wage growth. They also examine how the decision in the 1980s by the U.K. government to revamp youth training has affected the quality of the training provided. While the labor markets in the United States and Great Britain are structured differently, Blanchflower and Lynch argue that there are more similarities between these two countries than between the United States and Germany or between the United States and Japan.

Blanchflower and Lynch find significant wage gains associated with employer-provided training in the United States. As in Lynch (1992b), current employer-provided training raises wages of U.S. workers, while previous employer-provided training has little impact. Traditional apprenticeship training programs in Great Britain also raise wages, but not by the same amount as apprenticeship programs in the United States. The primary difference in training, however, is in its incidence: British youths are much more likely to obtain postschool training than their U.S. counterparts. This gap is highest for males: British males are twice as likely to receive postschool training as U.S. males. A second difference lies in the certification of skills. While the gains associated with completing an apprenticeship are significant but small in Great Britain, gains are much higher if the apprentice also passes a nationally recognized qualification exam. Such exams do not exist in the United States.

The paper goes on to examine what happened in Britain in the 1980s when the government decided to restructure training for youths by abolishing the traditional apprenticeships program and switching to a government-led youth training program. Youth training became shorter in duration, and as a result young people were less likely to pass vocational qualification exams. In chapter 9, Dolton, Makepeace, and Treble examine the impact of this training reform on young workers' wages. They look at the impact on wages of government-led training and compare it with the impact of training acquired on the job or off the job from the private sector. Government training alone has small or even negative effects on young workers' wages. However, on-the-job training provided by an employer and off-the-job training obtained from the private sector both have a significant impact on wages. The wage gains associated with the youth training scheme seem to be lower than the wage gains from the traditional apprenticeship system it replaced, as shown by Blanchflower and Lynch. This change may reflect significant alterations in the content of the training program, which are also implied by the lower pass rates for vocational qualifications exams. In summary, the papers by Blanchflower and Lynch (chap. 8) and Dolton et al. (chap. 9) provide some interesting documentation

of what happened in one country, the United Kingdom, when it attempted to alter the delivery system for the provision of training for young workers.

The volume concludes with chapters by Elias, Hernaes, and Baker (chap. 10) and by Groot, Hartog, and Oosterbeek (chap. 11). The contributions provide additional estimates of the wage gains associated with training in Britain, Norway, and the Netherlands. Elias et al. examine whether vocational skills obtained from a school-based system that is de-linked from the demand for labor provide a lower rate of return than skills obtained through an employer-based system. They use the same data on Britain that Blanchflower and Lynch use (although they examine a more restricted sample), and they use longitudinal data on youths in Norway. They consider the pre-1980s apprenticeship scheme in Britain as an example of employer-based training; Norway, in contrast, has relied on school-based vocational training. As do Blanchflower and Lynch, they find significant wage gains associated with completing an apprenticeship in Britain; they find no discernable gains from school-based training in Norway. The results from Norway are similar to findings in the United States that school-based vocational education has low returns.

While it is difficult to obtain data on individual workers to estimate the returns to training for apprentices in Germany, the returns to training in the Netherlands (which has a training system similar to Germany's), as shown by Groot et al., are high. In the Netherlands there are numerous training funds, jointly administered by unions and employers, especially designed to assist small and medium-sized firms to train their workers. Youths in the Netherlands receive training that has a large component of workplace training, in addition to school training, and the training is linked to employment in a firm. In chapter 11 Groot et al. show that wage gains associated with firm-provided training are on the order of 4–16 percent. In other work, Groot (1993) has found that productivity in firms that have formal training programs is 11–20 percent higher than in similar firms without training.

In summary, significant wage gains are associated with employer-provided training. These gains are larger than those associated with school-based vocational training. In addition, gains from employer-provided training are larger if they are associated with passing nationally recognized vocational qualification exams. Having employers provide training seems to increase the probability that it will be demand related, while certifying skills through a nationally recognized process increases the portability of skills as well as worker willingness to accept lower wages during periods of general training.

Conclusion

This volume demonstrates that employer-provided training creates significant gains for both workers and firms. Productivity is higher in firms with a better-trained work force, and wages are higher for individuals who acquire

Table 8 Returns to Training in the United States (%)

Type of Training	Firm Productivity	Wages
Informal Learning-by-Doing	Rapid increase, then flat or falling (Weiss), chap. 5 in this volume)	Mimics productivity gains (Weiss, chap. 5 in this volume)
Formal Training		
Current on-the-job training	17 (Bartel 1992) 16 (Bishop, chap. 6 in this volume)	7 (Lynch 1992b) 11 (Lillard and Tan 1986) 4.4 (Mincer 1988) 4.7 (Holzer 1989)
Previous on-the-job training	9.5 (Bishop, chap. 6 in this volume)	0 (Lynch 1992b) 0 (Bishop, chap. 6 in this volume)
Previous-off-the-job training	—	5 (Lynch 1992b)
Apprenticeship	—	13 (Lynch 1992b; Blanchflower and Lynch, chap. 8 in this volume)

postschool training, especially general training. Estimates of these returns to training for firms and individuals in the United States are summarized in table 8.

As can be seen in table 8, after training periods, individuals earn substantially more, and firms appear to experience even larger increases in their productivity. We return, then, to a question raised earlier. If the returns to training are so high, why isn't everybody training? The best answer we have is that different systems are more or less successful in overcoming potential market failures in the provision of general training and that it is difficult for single firms to move unilaterally from one training system to another. The papers in this volume provide some insight into the variety of institutional arrangements that appear to provide general training more successfully.

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