Volume Title: Training and the Private Sector

Volume Author/Editor: Lisa M. Lynch

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: Reconciling Markets and Institutions: The German Apprenticeship System

Chapter Author: David Soskice

Chapter URL: http://www.nber.org/chapters/c8776

Chapter pages in book: (p. 25 - 60)

1 Reconciling Markets and Institutions: The German Apprenticeship System

David Soskice

1.1 Overview of the Apprenticeship System

A great deal of research has been done on the German apprenticeship system. This includes excellent accounts of the operation of the system: Hayes and Fonda (1984) still provide the best overall picture in English. The European Centre for the Development of Vocational Training (CEDEFOP) monograph on vocational training in Germany contains a wealth of information, including a treatment of the legal aspects (Munch 1991). Casey (1991) and Lane (1991) have useful analyses of more recent developments, the latter relating the system to changes in the patterns of work organization. Streeck et al. (1987) is authoritative on the role of institutions. Finally, and most important, is the series of articles produced by the research group (Prais, Steedman, Wagner, and others) at the National Institute for Economic and Social Research in London: based on comparative research with the United Kingdom, these provide a wide range of insights into the operation of the German training system within companies, the impact of skills on company performance, apprenticeship examination procedures and standards, and prior educational performance (Steedman, Mason, and Wagner 1991; Steedman and Wagner 1987; Prais 1987, 1981; Prais, Jarvis, and Wagner 1989; Prais and Wagner 1988, 1985, 1983; Daly, Hitchens, and Wagner 1985). All of the above literature discusses the system as it has operated in the former West Germany, and this paper will also concentrate attention on the former West.

This literature, however, does not systematically examine the apprenticeship

David Soskice is director of the Labour Economics Unit of the Social Science Research Center, Berlin (WZB), and emeritus fellow in economics, University College, Oxford.

The author is extremely grateful to Christoph Büchtemann, Lisa Lynch, Hilary Steedman, and Karin Wagner for extensive written comments and to Michael Burda, Colin Crouch, David Finegold, Wolfgang Franz, and Mari Sako for very useful discussions.

system from the perspective of the incentives which face the different actors.[1] It does not show how infrastructural institutions are able to develop incentives for companies and individuals which resolve the standard market-failure problems involved in training in marketable skills. Nor does it discuss how the system functions as an equilibrium, in which the actors have no incentive to behave differently.[2] The purpose of this paper is to redress this imbalance and to provide a simplified and stylized model of the system, which does not intend to do justice to its complexities. Instead it seeks to understand the system's more important incentive structures and the role of infrastructural institutions in generating them.

This leads to an important qualification about the paper. Because it seeks to understand behavior in rational-actor terms, it focuses on some questions (particularly those about the opportunity costs involved in certain courses of action) which do not appear to have been the subject of serious empirical research in Germany. In consequence, at several points in the paper we resort to back-of-the-envelope calculations. The paper should therefore be seen as a treatment of future research directions, as well as an essay on how the system works.

1.1.1 A Brief Description of the System

Though the figures are slowly changing, over 60 percent of each cohort go into apprenticeships, about 30 percent go into higher education, and about 5 percent drop out. Apprentices start between the ages of 16 and 19, after secondary education, and participate three to four years. The apprenticeship is a legal contract between employer and apprentice: there is an initial probationary period of one to three months, and subsequent termination by the employer before the completion of the apprenticeship is legally difficult and is, in fact, unusual. Secondary education takes two broad forms: schools mainly for those going into apprenticeships at age 16 (*Hauptschule* and *Realschule*), with the *Hauptschule* at a lower academic level than the *Realschule;* and schools mainly for those going into higher education, (*Gymnasia*). Recent years have seen a steady increase in the number of apprentices with a university entry certificate (*Abitur*); in 1989, 14 percent of apprentices held an *Abitur,* 32 percent graduated from *Realschule,* and 35 percent graduated from *Hauptschule.*

Apprenticeships cover a wide range of occupations, and there is, hardly surprisingly, a strong gender bias. In 1989, the five most common apprenticeships for men were:

1. The notable exception to this is Franz (1982). This paper develops his approach to the endogeneity of quits.

2. Some of these concepts are suggested in Finegold and Soskice (1988) in a comparative context, in particular the distinction between a "high-skill, quality production" equilibrium characterizing Germany and a "low-skill, standardized production" equilibrium characterizing the United Kingdom.

- auto mechanic (7.8 percent of all male apprentices),
- electrician (5.2 percent),
- joiner (3.2 percent),
- clerical worker—wholesale and trade (3.2 percent), and
- bank clerk (2.9 percent);

for women, the five most common apprenticeships were:

- hairdresser (7.7 percent of all female apprentices),
- clerical worker—small shop (6.9 percent),
- clerical worker—office (6.8 percent),
- medical assistant (6.3 percent), and
- clerical worker—industry (6.0 percent) (Bundesministerium für Bildung und Wissenschaft [BMBW] 1991, 30).

These figures should not be equated with the prestige of different apprenticeships. Prestige can be loosely determined by looking at the educational background of young people entering different apprenticeships. For instance, in 1989, the five apprenticeships with the highest proportions of *Abitur* holders were:

- clerical worker—insurance (60.4 percent, or 8,200, were *Abitur* holders),
- bank clerk (59.0 percent, or 3,190),
- social insurance worker (42.2 percent, or 4,200),
- clerical worker—industry (41.2 percent, or 9,000), and
- clerical worker—shipping (40.6 percent, or 5,000).

By contrast, in 1989, the five apprenticeships with the highest proportions of *Hauptschule* dropouts were:

- homehelp (51.8 percent, or 1,400, were *Hauptschule* dropouts),
- housepainter (12.9 percent, or 3,600),
- butcher (11.8 percent, or 1,300),
- blacksmith (11.0 percent, or 2,300), and
- baker (9.3 percent, 2,000) (BMBW 1991).

Apprenticeship is often known as the "dual" system, since apprentices receive training both within the companies to which they are apprenticed and within publically run vocational schools. These schools generally supply the more theoretical aspects of training: apprentices spend one to two days a week in vocational school. Within companies, particularly the larger ones, a high portion of the training may be in company training shops, rather than on the job. In smaller companies, off-the-job training is often provided in group train-

ing centers, each used by a group of companies. The apprenticeship program is highly structured, with minimum legal requirements for material which must be covered; there is an external examination at the end of the apprenticeship, in both theoretical and practical knowledge, and a worker must pass this to gain a skilled worker's certificate (there is about a 10 percent failure rate). The company is legally responsible for the adequacy of its arrangements for apprentice training, and companies can only gain approval to undertake such training if they can show inter alia that they have properly qualified trainers.[3]

Employees of companies that train represent about 70 percent of total employment. Nearly all large and most medium-sized companies undertake apprenticeship training. The proportion of small companies that do so is much lower, though in aggregate these companies make almost as great a contribution. There is an important institutional distinction in Germany between the *handwerk,* or craft/artisanal, sector (which includes auto repair shops, bakeries, small electrical concerns, and hairdressers) and the industrial/commercial sector; this roughly separates small concerns from medium-sized and larger ones. Of total apprenticeships in 1989, 50.4 percent were in the industrial/commercial sector, and 34.3 percent in the *handwerk* sector. (In addition to these two, there are three other, smaller, but significant apprenticeship sectors: agriculture with 2.2 percent of apprentices in 1989, civil service with 4.0 percent, and assistantships in the "free professions," such as accountancy and law, with 8.3 percent; we do not discuss these areas in this paper.)

Buttressing the apprenticeship system is a complex of institutions. The most important of these are the sectoral employer associations and the local employer associations, the chambers of industry and commerce, and the *handwerk* chambers. The main roles of the employer associations are in developing new apprenticeships and modifying existing ones, as well as in advising larger companies; the chambers are responsible for organizing the local apprenticeship system, approving and monitoring company training, and running the examination system. The industrial unions work closely both with sectoral associations and with the chambers, and within companies, the employee-elected works councils are entitled to influence and monitor apprenticeship programs, extensively. The regional governments are responsible for vocational schools, though these responsibilities are, in practice, carried out in close cooperation with the employer associations and the unions. The regional governments coordinate, with each other, curricular developments concerning vocational schools; here again the social partners are heavily involved. Finally, the federal government is responsible for the framework legislation relating to training within companies; it also devotes major resources to research and policy for-

3. Trainers require a certificate showing that they have undergone training to be a trainer. This is usually done as part of the course of studies leading to a supervisory (*meister*) qualification; this qualification is only open to already skilled workers and serves to deepen their technical competence, as well as to impart organizational capacities.

mation, through the Federal Institute for Vocational Training (the BiBB) (Streeck et al. 1987).

1.1.2 Solving Market-Failure Problems

Since Becker's classic statement of the distinction between company-specific skills and marketable skills, it has been generally accepted that a socially optimal provision of marketable skills will be reached by competitive markets only under assumptions which are unlikely to hold (Becker 1964). Thus, no company will be prepared to invest in training its employees in marketable skills, since after training, *either* the company pays its employees the market wage for the skills, in which case it will be less costly to hire the skills from the market, *or* the company pays its employees less than the market rate, in which case its employees quit. Thus, in equilibrium, individuals have to finance fully any training in marketable skills—which leads to the second problem: the greater the cost to individuals of such an investment, the more likely it is that they will have to resort to borrowing.[4] Financial markets face adverse selection difficulties from such borrowing, because, if banks set premiums reflecting average success rates, individuals who believe they have a higher-than-average probability of successfully acquiring the skills will choose to pay a larger proportion of the cost themselves—thus forcing the banks to finance a greater proportion of the riskier trainees.[5] These "classic" problems are visible in both the United Kingdom and the United States, where relatively few companies are prepared to spend substantial resources on the initial training of lower-level employees and where banks do not finance apprentices.

A second problem area is the existence of an equilibrium. Assume that the Becker problem can be solved (by whatever means) as long as the cost to companies of providing training in marketable skills is low enough. A central element in keeping costs low is the educational level of apprentices. Specifically, assume that companies are prepared to invest in training if the academic level of potential apprentices is high enough. Also assume that schoolchildren are prepared to invest in effort at school to attain this academic level if the probability of getting an apprenticeship is high enough, that is, if enough apprenticeships are offered by companies. Then there may be two possible equilibria, one in which companies offer apprenticeships and schoolchildren work hard and one in which companies do not offer apprenticeships and children do not work hard. Clearly the "low-skill" equilibrium does not exist under standard conditions of perfect competition, if both children and companies prefer the "high-skill" equilibrium. But if (among many possible explanations) search costs for potential apprentices depend on the number of apprenticeships being

4. Along an optimal income-consumption path with standard conditions, the investment would always be financed partly by borrowing.

5. There are also likely to be moral hazard problems. These arise if performance cannot be continually monitored and if bankruptcy costs are low for individuals.

offered and search costs for companies offering apprenticeships depend on the number of academically suitable young people, then a low-skill equilibrium is possible. Such a low-skill equilibrium can then reinforce the classic market-failure problems to which Becker pointed. The German apprenticeship system appears to solve each of these problems.

First, the costs of training young people in marketable skills are shared by the regional government, apprentices, and companies. The regional government pays for the public-education side of the training. Apprentices "pay" by accepting low salaries throughout their apprenticeships.[6] Companies pay all costs of in-company training.[7] For a range of companies (as we will see) there may be a net current profit from apprenticeships. But for apprenticeships in higher-level skills, that is not the case. These companies are not legally required to train,[8] and they give every appearance of being interested in maximizing long-term profits. Successful completion of apprenticeship training leads to a skilled worker's certificate: there appears to be widespread acceptance in Germany of skill certificates, and there are active external occupational labor markets (Schettkat 1991). Thus a main question in this paper is, Why do companies invest in training apprentices in marketable skills (see sections 1.2 and 1.3)?

Second, the educational level of German children who do not go on to higher education is high by U.K. and U.S. standards. This is established both by international comparative testing and by more detailed U.K.-German comparisons of examination content and pass rates in certain subjects, notably mathematics. Moreover, the disciplinary problems which arise in many U.K. and U.S. schools do not appear to be so severe in Germany. We show in section 1.4 that there is a clear incentive structure, related to the apprenticeship system, for German children to work hard at school. Thus Germany does appear to be in a high-training, high-education equilibrium.

The German system appears to solve some of the main market-failure problems associated with marketable skills. The goal of this paper is to focus on *how* it does so, rather than on showing *that* it does so—though, as far as possible, supporting references are given. In the next two subsections, we look at elements of the structure of product and labor markets, which provide building blocks in the story, and then at critical ways in which institutions operate in relation to the apprenticeship system.

6. The market-failure problem associated with borrowing does not arise in a major way, since young people are prepared to accept low wages, and this acceptance together with company and state financing is sufficient to cover net apprenticeship costs. (The market-failure problem still exists but not in so malign a form: for the apprentice, optimal income-consumption paths generally imply spreading the apprenticeship costs between borrowing and low wages, with consumption unaltered; financial institutions generally do not allow this, so a welfare loss results.)

7. The construction industry is an exception to this: companies which do not train pay a levy instead, which then subsidizes training in other companies.

8. There may be institutional pressures of an informal nature exerted on some companies if they do not train or do not train enough, but this does not appear to be a major reason that companies run apprenticeship schemes.

Table 1.1 **Distribution of Employment Tenure of Male Employees in Selected Countries (as a % of all male employees)**

Tenure in Present Job	Germany	United Kingdom	United States	Japan (includes women)
5–10 years	18.9	21.5	12.2	18.8
10–20 years	28.8	21.9	19.2	26.1
Over 20 years	19.8	14.7	13.7	21.9
Total (over 5 years)	67.5	58.1	45.1	66.8

Source: Büchtemann (1991).

1.1.3 Product-Market and Labor-Market Structures

The Relationship between Internal and External Labor Markets

One view of German labor markets, proposed by Marsden (1990), is that they are occupational: workers' skills are largely marketable and workers lose little by moving from one company to another, just as companies lose little by having to hire new workers. Marsden contrasts occupational labor markets with internal labor markets, in which workers remain for long periods of time acquiring company-specific skills.

Marsden is correct in the view that German external labor markets for skilled occupations are effective. He is wrong, however, in his view of internal labor markets: most German companies operate internal labor markets, and we will argue in the next section that this is central to the success of the apprenticeship system. The importance of internal labor markets in Germany can be seen by looking at data on the length of workers' attachment to companies. In table 1.1, tenure rates are shown, comparing different countries, and it can be seen that tenure is significantly longer in Germany than in the United States or the United Kingdom, although tenure in Japan is even longer than in Germany. A standard difficulty with using these figures for comparative inferences about internal labor markets is the frequency of job change in the United States at the start of careers; table 1.2 avoids this difficulty by showing the probability of remaining in a company, given an existing tenure of 3–5 or 5–10 years: this confirms the view that German employees have significantly longer tenure than do American workers.

The relationship between internal and external labor markets is along the following lines, which will be developed and qualified later in the paper. The usual port of entry to skilled work in an internal labor market is via an apprenticeship. Employment security is in the interest of both management and the skilled worker, and skilled workers can normally expect long tenure.

External occupational labor markets play a secondary role, albeit a significant one. Skilled workers lose their jobs in internal labor markets because companies fail, markets decline and the company cannot avoid making redundanc-

Table 1.2 **Probability of Achieving 20+-Year Job Tenure in the United States and Germany, 1979–84 (%)**

	Current Tenure	
Age Group	3–5 Years	5–10 Years
20–24 years		
United States	29.4	19.4
Germany	37.9	50.1
25–29 years		
United States	33.3	36.7
Germany	44.9	62.2
30–34 years		
United States	33.0	48.4
Germany	38.6	72.3
35–39 years		
United States	28.1	47.5
Germany	45.7	83.5

Source: Büchtemann (1991).

ies, workers perform inadequately, or workers want to leave their employment for personal reasons. These constitute the supply to external labor markets. Companies setting up new plants, wanting to expand rapidly, or needing skills they cannot train for themselves constitute the demand.

The primary role of internal labor markets is central to the operation of the apprenticeship system, because it leads at least large and medium-sized companies to believe they can retain the apprentices they have trained and because—insofar as the apprenticeship is the main port of entry to internal labor markets—it gives young people a strong incentive to gain an apprenticeship in those companies. We will need to discuss more carefully in subsequent sections what the incentives for both companies and young people are and how they are buttressed by institutions. But as an overview, we can say: Access to the internal labor market is the primary goal of the apprenticeship, at least in most large and medium-sized companies. In those companies, the skilled worker's certificate is an insurance policy in case the need to move arises, necessitating use of the external labor market.

The Industrial/Commercial Sector and the Small-Firm Sector

Not all apprenticeships are of equal quality or standing. This is true within the same company and across companies in the same industry, or sector, as will be discussed shortly. There are also a range of industries, nearly all comprising small firms in the *handwerk* sector—including small retail establishments, restaurants, garages, bakeries, and traditional craft makers—where we can discern an apprenticeship different from that just sketched. Apprentices here typically have a worse educational background than those in larger companies, as shown in subsection 1.1.1. There is a much lower postapprenticeship rate of

"staying on" in the same company, and much of the semiskilled work force in larger companies is recruited from workers trained in this sector. Simplifying considerably, we propose a dual model and try to explain how behavior in both sectors may be rational.

Apprenticeship Entry as a Rank-Order Tournament

Apprenticeships in the industrial/commercial sector are more attractive than those in the *handwerk* sector. This is part of a more general phenomenon: School-leavers rank apprenticeships across sectors and companies, and even within companies.[9] Within a region or a locality, schoolchildren and their parents, as well as their schoolteachers, will usually have a clear idea of the best companies with which to apprentice and of how companies compare. The attitude toward potential apprenticeships among German schoolchildren who are not going to higher education is similar to that toward potential university places among American schoolchildren who are going on to higher education. We shall argue that the possibility of getting a better apprenticeship produces an incentive structure for German children to work hard at school, independent of their ability level. Equally, companies are interested in getting the best apprentices. Therefore they pay close attention to school performance and provide their own testing procedures, as well. This reinforces the incentive structure for schoolchildren.

1.1.4 The Role of Infrastructural Institutions

Much discussion in the Anglo-American literature on initial vocational training is devoted—quite properly—to the question of how to establish appropriate incentive structures to induce companies and young people to invest in training: these incentives range from legal requirements to a wide variety of fiscal incentives. This type of discussion is much less important in Germany. The incentives for companies and young people to invest in apprenticeships are not, for the most part, direct. The incentives stem from the need of German companies to have highly skilled work forces, the perception by many companies that it is advantageous to undertake the training themselves, and the consequent desire of young people to be trained for those careers.[10]

The Central Indirect Role of Institutions

Infrastructural institutions play a central indirect role in establishing incentives for companies to provide training. As will be discussed in the next section, the operation of the German financial system, allowing companies to adopt a long-term financial perspective, combined with the industrial relations system, making low-cost labor strategies difficult, pushes companies in com-

9. This last point—the range of apprenticeships offered by the same company, from the most sought after to those which are less attractive—has been stressed by Hilary Steedman.

10. The story for *handwerk* apprenticeships is slightly different but does not depend on direct incentives.

petitive markets toward high-quality production using highly skilled labor in internal labor markets. And the operation of the relatively coordinated wage bargaining system reinforces market incentives for most companies in competitive sectors to meet their skill needs by training rather than by using the external labor market.

Research, Advice, and Monitoring: The Direct Role of Company-friendly Institutions

Any system of company-provided-structured training leading to marketable skills requires companies to cooperate fully and openly with training institutions, both to get advice on establishing and updating training schemes and to be monitored. Where the training institution is a state agency, many companies are wary of such exposure, and where the infrastructure of vocational training is run by the state, as in France, it proves difficult to involve companies. It is of the greatest importance that in Germany the institutions concerned directly with advising and monitoring companies are primarily the chambers and sectoral employer associations and secondarily the works councils (with whom companies generally have high-trust relations).

The close relationship between companies and employer associations, in vocational training, has significant consequences for the research, development, and diffusion of new training practices and for the process of defining new and augmenting existing apprenticeships. It means that employer associations have expertise in working out training solutions for companies in many different situations, and it provides a good way of diffusing best practice. To a lesser extent, unions acquire similar expertise working with and advising works councils.

Institutions, Rules, and Sanctions

Employer associations, including chambers, have significant informal sanctioning ability over companies. The German system of government delegates as much authority as possible to private associations (of which business associations are important examples) to administer broadly defined policies.[11] Because policies are broadly defined, private associations have discretion over how they are carried out. Thus they are usually in a strong bargaining position vis-à-vis individual companies.

This does not mean that formal or informal sanctioning plays a significant direct role in the operation of the apprenticeship system. Companies are free both by law and (as far as we can see) in practice not to take part in the apprenticeship system, and many companies, including the majority of smaller ones, choose not to. If companies do take apprentices, they must accept being monitored, but most companies outside the *handwerk* sector train to above-minimum standards and so are unlikely to come into disagreement with the chambers.

11. See the important article by Streeck and Schmitter (1985).

1.2 Why Do Companies Train Apprentices?

The cost of training apprentices is partly borne by the apprentices themselves: they accept a low wage, and they bring to the apprenticeship a good academic background. The state (i.e., the regional government) pays, in that it meets the full costs of the public vocational schools to which apprentices go on day or block release. Some companies, usually small ones, get public subsidies to provide training facilities or to meet the needs of particular trainees in particular areas. In one industry, construction, there is a levy on all companies—operated by the employer association—to cover, in part, the costs of companies which carry out training. Apart from the above, the costs of in-house training are borne by the companies doing the training. If these costs are positive and if the apprenticeships result in marketable skills, why do companies finance them? As explained in the overview, this is the standard market-failure problem of training in marketable skills; it is perhaps the most widely discussed problem in the policy literature.

There is no doubt that under some circumstances, particularly during recessions, institutional pressures may be applied to companies to take apprentices. But most observers doubt this is typical: most companies which are involved in apprenticeship programs do not appear to take apprentices as a result of institutional pressure. An alternative possibility is that German companies, while responsible for the costs of in-house training, reduce the quality of the training to eliminate these costs.[12] Here again the evidence, summarized in section 1.4, suggests that German companies do not behave in this way. In any case, it is clear from table 1.3 that, at least for many companies, training costs are positive, and for some companies and sectors strongly so. The relevant figure here, in column (6) of table 1.3, is the net cost to the company incurred during the apprenticeship (i.e., on the assumption that the company gets no subsequent benefits from the apprentice).

These figures on the costs to employers of training also show wide dispersion across sectors. In explaining why companies train, this paper returns to the distinction drawn in the overview between two broad sectors of companies: medium-sized and larger companies in the industrial/commercial sector and smaller artisanal companies in the *handwerk* sector. In the first sector, responsible for about 50 percent of apprenticeships, a high proportion of apprentices are retained by their companies when their apprenticeships have been completed, as can be seen in table 1.4. Table 1.4 does not break companies down between the *handwerk* and industrial/commercial sectors but a good indication can be gained by comparing the differences between companies with more than 500 employees, all in the industrial/commercial sector, and those with fewer than 50 employees, most of which will be in the *handwerk* sector.

The *handwerk* sector trains about one-third of all apprentices; a much

12. The mathematics of how companies which can vary the relative amounts of time spent in training and time spent in productive work will reduce the amount of training to eliminate training costs is contained in Oulton and Steedman (1992).

Table 1.3 **Training Costs per Apprentice-Year, by Size/Sector of Company, 1980 (1980 DM)**

	Cost Components					
Sector/Size	Training Personnel (1)	Apprentice Wages (2)	Additional Costs (3)	Gross Costs (4)	Apprentice Output Contribution (5)	Net Costs (6)
Industrial/commercial sector						
>1,000 employees	3,467	8,944	4,303	16,714	2,404	14,310
<1,000 employees	6,036	7,292	2,330	15,658	4,695	10,963
Handwerk sector	7,605	5,960	1,006	14,571	7,323	7,248

Source: Falk (1982).
Note: (4) = (1) + (2) + (3); (6) = (4) − (5).

smaller proportion of apprentices in the *handwerk* sector remain with the company which trained them; the skill content of apprenticeships is lower, as is the educational background of the apprentices; and a significant proportion leave the sector to gain semiskilled blue- and white-collar work in larger companies.

This paper argues that profit-maximizing companies in the two sectors have different reasons for undertaking apprenticeship training and hence that it is useful to analyze the German system in two sectors. Without question this distinction is too sharply drawn: there are many high-skill small companies which provide training with high skill content, just as there are large companies which do not. Moreover, within the larger companies, there are different levels of apprenticeship. Despite these qualifications, we believe it casts light on the German system to make this sectoral distinction.

Why do larger companies bear some of the cost of training apprentices in marketable skills? This question will be answered in four parts. (1) The financial and industrial relations systems provide incentives for companies to operate internal labor markets for skilled employees; this requires companies to choose between carrying out their own training and hiring already-skilled workers on the external market. (2) The net costs to companies of apprenticeship training are relatively low because of the educational and financial investment made by apprentices and because of the supportive advice and monitoring provided by company-friendly institutions. (3) The probability that apprentices whom the company wants to retain postapprenticeship will agree to stay depends on whether other companies meet their own skill needs by training apprentices or by seeking to hire postapprentices trained elsewhere: if the former, the quit rate will be low because good positions will be hard to find; if many companies do not train, the quit rate may be higher. (4) The decision whether to meet skill needs by training apprentices depends on the costs of hiring postapprentices trained elsewhere versus the costs of training enough apprentices in-house, taking into account the potential quit rate. The

Table 1.4 **Retention Rates and Nontraining Rates by Company Size, 1985 Sample Survey**

Number of Employees	Postapprenticeship Retention Rate of Apprentices (in training companies)	Percentage of Companies without Apprentices	*N*
5–9	.56	65	143
10–49	.64	41	624
50–99	.69	22	389
100–499	.73	09	461
500–1,000	.82	0.5	372
> 1,000	.87	0.4	377

Source: Büchtemann (1989).

costs of external hiring are potentially high for two reasons: First, company-specific skills can be taught much more cheaply to one's own apprentices than to postapprentices trained elsewhere. Second, the role of unions, employer associations, and, critically, works councils in the wage bargaining system makes it difficult for companies to use wages as a means of poaching postapprentices away from companies at the same technological level. Thus companies are limited to hiring those postapprentices who positively prefer not to stay in the company in which they were trained or whom that company did not wish to retain. A company seeking to hire postapprentices trained elsewhere therefore runs a considerable risk: if the quit rate is low, the likelihood is high that the company will end up hiring postapprentices whom their training company did not wish to retain. We identify an equilibrium with a low quit rate (high retention rate of postapprentices) and a high percentage of companies with apprenticeship schemes. In this equilibrium, it pays postapprentices not to quit, because the likelihood of securing a good position elsewhere is low, and it pays companies to train their own apprentices, because the likelihood is high that a postapprentice hired elsewhere was not wanted by his training company. (This equilibrium takes as given the investment by apprentices. This is explained in section 1.4, and enables us to sketch out a full equilibrium in section 1.5.)

1.2.1 Product Market Strategies and Skill Requirements

The first part of our explanation of why companies are prepared to provide and pay the costs of high-quality apprenticeships is that they have a high demand for long-tenure employees with general, as well as company-specific, skills. Why is this the case? The direct answer lies in the product market strategies and consequent patterns of work organization which companies pursue. Medium-sized and larger German companies aim at product market segments for high-quality goods and services—segments—in which product modification, customization, multiple options, and batch production are important. Usually these segments are in markets where there is significant international

competition, where companies supply companies facing international competition, or where—as in retail banking—international competition is potential. German strength has tended to be less in what the OECD classifies as high-technology sectors (e.g., telecommunications and semiconductors) than in the application of modern technology to "medium-technology" sectors, notably machinery and engineering as well as textiles and retail banking.

Successful performance in these markets requires flexible teamwork responses to changing product specifications on the part of manual and low-level nonmanual employees, and on the part of management. It requires individual workers to have the necessary understanding to operate, program, and sometimes maintain complex machinery and requires white-collar employees to have a range of skills, including computing and appropriate financial techniques. Thus general skills—for instance, in engineering, electronics, and finance—are required. And company-specific skills—for instance, knowing how production scheduling and product modification operates organizationally in the company—are required, as well. Behind both is a suitably high level of academic competence, in terms of numeracy and literacy.[13]

By no means all manual or lower-level white-collar employees in medium-sized and larger companies are skilled to this extent: semiskilled workers may constitute a third or even a half of the work force, and we will see in the next section how they are often trained. The point here is that a substantial proportion of the work force needs to be skilled, in the ways described, in order to enable companies to be successful in markets, for high-quality goods.

It will be equally evident that companies will want to keep these skilled workers as long as possible, since their skills will improve with practice in teamwork and product modification. Thus, given their product market strategies, companies will want to establish internal labor markets in which a substantial proportion of employees have general skills. This system of production, with its link between high-quality product market strategies and skill-based work organization with internal flexibility, has been analyzed by Streeck as *diversified quality production* (Sorge and Streeck 1988).

Why do larger, medium-sized, and many small German companies choose this type of product (or service) market, and related work organization, strategy, at least if they are in broad market areas in which this strategy is feasible? To understand why this is so, it is important to examine the role played by infrastructural institutions in Germany and the framework incentive structures they set up for companies. There are three elements in the argument.

Rules on Firing and Wage-Cutting

It is difficulty for companies to adopt either a low-wage employment strategy or one which relies on flexible use of the external labor market to adjust

13. A number of studies carried out by industrial sociologists confirm this view of work organization in Germany, in particular Kern and Schumann (1989); see also Lane (1989, 1991).

the size and skill composition of their work forces. A low-wage employment strategy is ruled out by the system of wage determination.[14] Collective bargaining over wages is conducted between employer associations and unions at the industry level. These industry agreements on basic wages are de facto, and usually de jure, binding on employers. They may be supplemented by non–legally binding agreements at the company level, between the company and the works council: the latter is composed of and elected by employees and, while formally independent, usually has close ties with the industry union. Thus, as long as a company operates in Germany it cannot resort to low wages. In addition, achieving labor-cost flexibility by frequent use of redundancies is subject to institutional constraints. Works councils are given considerable legal powers to delay redundancies or to impose significant costs on employers in their event. In particular, management must, by law, agree to a "social plan" with the works council—specifying compensation, retraining plans, and possible relocation, for those made redundant (see Streeck 1984). The chairs of works councils in the larger companies have considerable access to company deliberations and information; in practice an implicit long-term understanding usually exists that as long as the works council chair is satisfied that the company is doing its best to maintain and develop markets through product development and that the company attaches high priority to retraining existing skilled employees, the works council chair will allow necessary redundancies. Companies thus have flexibility—if, for instance, markets collapse—but within the constraints of pursuing a product-oriented market strategy and a skilled labor force strategy.

Institutional Provision of Cooperation and a Skilled, Educated Work Force

In many countries the personnel strategy envisaged by diversified quality production would be difficult to pursue. It requires cooperative work among employees with both marketable and company-specific skills, with considerable employment security, and with a mode of work organization that is difficult to monitor; it also requires suitable numbers of skilled workers. In the United Kingdom and the United States, the proportion of well-educated and skilled lower-level workers is relatively low, and there are no institutional guarantees of cooperative behavior. Hence, in the United Kingdom and the United States, such requirements are usually met only by companies prepared to pay efficiency wages sufficiently over the odds, to attract skilled lower-level workers and to ensure that these workers will not risk, by uncooperative behavior, redundancy and lower wages elsewhere.

In Germany, by contrast, the individual company has access to well-educated and skilled lower-level employees, either by hiring them in the external labor market or by training them itself. (Of course, we have to explain in

14. For a detailed discussion of wage determination in Germany, see Flanagan, Soskice, and Ulman (1983) and Soskice (1990).

this section why enough companies undertake apprenticeship training for this to be the case; here all that is argued is that a skilled work force strategy is easy for the German companies to pursue, in terms of availability of skilled or trainable well-educated lower-level workers.) In addition, companies are de facto guaranteed a cooperative work force by the industrial relations system. These guarantees, especially in larger companies, come from the works council and are reinforced by the industrial union. How? The works council, close to the work force, can monitor behavior better than management can; moreover, it can sanction individual employees, as it is involved in almost all lower-level personnel decisions. Its incentive to ensure cooperative behavior is that it can bargain for work-force benefits from management, based on improved employee performance; the greater these benefits, the more secure its reelection possibilities.

The Financial System and the Provision of Long-Term Finance

Despite these institutional constraints and incentives, it is difficult, without being able to rely on a long-term financial framework, for companies to pursue product and labor market strategies which involve long-term commitment. Both large German companies and smaller ones have such a framework available, though in different ways. The German system of corporate governance of publicly quoted companies gives management security from hostile takeovers: a successful takeover requires 75 percent of the voting shares, and the high degree of coordination among the main German financial institutions, especially among the largest banks, almost always enables them to form an obstructive 25 percent minority. In fact, hardly any hostile takeovers succeeded in the past decade. In return for such security, the large financial institutions have access to company decision making and information, and they may intervene if they believe top management is inefficient or is following seriously mistaken policies.

Companies face institutional constraints and incentives conducive to internal labor market strategies, in which a significant proportion of the work force has marketable skills. Do companies have an incentive to invest in training in marketable skills themselves, or should they seek to hire them? The next two sections look at the cost to companies of apprenticeship training, and the last at the costs of hiring on the external labor market.

1.2.2 The Net Cost of Apprenticeship Training

We have already seen in table 1.3 (col. [6] on net costs) that large companies pay significant net costs for each apprentice-year. From an international comparative perspective, however, there is another question. What would an apprenticeship cost if other agents (apprentices themselves, employer associations and chambers, the public sector, works councils and unions, etc.) made no contribution? Alternatively, what contributions do these other agents make?

In this section, we consider two contributors: apprentices and employer associations and chambers. Their contributions, financial and nonfinancial, are central in reducing the gross costs to a manageable level.

Investment by Apprentices: Low Apprentice Pay and Educational Effort

The cost to companies of training is low, first, because of the investment which apprentices themselves make in education and training. Why apprentices make these investments is the subject of section 1.4. Here, we ask how much these investments reduce the costs of training. The investments are of two sorts. Directly, apprentices accept low earnings during their apprenticeships. To properly measure this investment, apprentice pay needs to be compared with the pay of an unskilled worker of that age. Appropriate figures for full-time unskilled earnings for competent 16–20-year-olds are not readily available, since there is virtually no market for such workers; the figures generally quoted are for skilled earnings in the occupation in question. However, compare the 1984–85 progression of wages with experience in auto repair shops (part of the *handwerk* sector)

- first-year apprentice—DM 400 per month,
- second-year apprentice—DM 423 per month,
- third-year apprentice—DM 477 per month,
- lowest wage-grade worker—DM 1,728 per month, and
- skilled worker—DM 2,446,

with the progression in industry

- unskilled worker—DM 2,009 per month,
- semiskilled worker (metals)—DM 2,856 per month,
- skilled worker (metals)—DM 3,312 per month,
- *Meister*—DM 3,853 per month, and
- *Obermeister*—DM 4,980.

Unskilled earnings are three to four times the apprentice wage (Streek et al. 1987, table 5; calculations based on Prais and Wagner 1988, 47).

Indirectly, apprentices invest effort in schoolwork prior to getting an apprenticeship; the evidence for this is indirect: all that needs to be noted is that Germans in the bottom 50 percent of the ability distribution at age 16 (the modal age at which young people move from school into an apprenticeship) score significantly higher on standardized tests than do the corresponding children in the United Kingdom. Moreover an increasing proportion of young people are completing an *Abitur* before seeking an apprenticeship, and some of the best apprenticeships, such as those in banking, are now making the *Abitur* an informal requirement.

The Contribution of Employer Associations and Chambers and Works Councils

Any high-quality apprenticeship scheme has significant costs for most companies, in terms of advice and supervision at the setting-up and of monitoring during operation. There are two elements in these costs. The first is *direct:* the cost of advice and consultancy. In the German system, such advice is available from local chambers and industrial employer associations, which can rely on their own research institutes and on a wealth of experience with the many problems involved in the initiation and operation of training schemes. In addition, the works council plays an important role in helping the company to operate an apprenticeship scheme. The works council, in turn, has its own access to advice from the industry union, which also conducts its own research—often in close collaboration with the employer association—and accumulates experience from advising on different situations.

The second cost is *nonfinancial,* but of central importance: For most companies (though perhaps not for the very largest) the provision of high-quality in-company training requires external advice and monitoring. For an external system of advice and monitoring to be effective, the external institutions must have full access to the company. In general, companies are wary of allowing such access, particularly if the external agencies belong to or are responsible to the public sector. Agencies can only be trusted not to misuse information they gain from the company if their incentive structure makes misuse highly unlikely. Public training advisory agencies seldom have such an incentive structure, since their paymaster is the government. Employer associations and chambers, on the other hand, at least as they operate in Germany, are considered trustworthy, presumably because they are under the collective control of companies in the sector or region. (An interesting contrast is with France, where attempts to develop in-company training are led by the state, and where businesses are suspicious of chambers for fear they are more creatures of the state than representatives of industry.) We shall see how powerful business associations play many other important roles in the German apprenticeship system: here, we stress the importance of their being trustworthy external bodies with whom companies can deal closely, thus minimizing the nonfinancial—or what might be called the "distrust" transactions—costs for companies, from external-agency advice and monitoring within the company.

A point complementary to this involves the relation of the company to the union and the works council. As with business associations, the role played by works councils and unions in the effective operation of the German apprenticeship system is of great importance and will be discussed in different contexts in the rest of this paper. At this point, we note the low distrust transactions costs to companies, arising from the advice about and monitoring of in-company training by unions and works councils. These activities complement those of business associations, particularly in medium-sized and large compa-

nies. They are necessary to guarantee to apprentices the quality and marketability of their training. The low distrust is a consequence of the generally close and high-trust relations between company management and the works council and of the fact that most of the monitoring is carried out by the works council rather than by the union. The union gives advice and research support to the works council. Companies are more suspicious of external unions than of their own works councils. Even so, unions are usually seen as partners in improving international competitiveness, and their direct involvement in company training questions, when it occurs, it not as threatening as it would be perceived to be in the United Kingdom or France.

1.2.3 The Probability That Companies Will Keep Apprentices after Training

What guarantee does a company have that its apprentices will remain after their apprenticeships are completed? It can be seen statistically that this retention rate varies with company size. In this section we are concerned only with medium-sized and large companies; small companies, with low or negative net apprenticeship costs and relatively low retention rates, are analyzed in the next section. In medium-sized and large companies, the retention rate is considerably higher on average. As can be seen in table 1.4, in large companies the retention rate is between 80 and 90 percent, with some decline with the size of the company.

There are two separate components in the retention rate, which need to be distinguished. The first is that a company may not want to retain some apprentices, who have successfully completed their apprenticeships but whose suitability for its internal labor market the company doubts. The company has two reasons to minimize the number of such "nonretentions." Most obviously, it loses the net costs of the apprenticeship. In addition, its apprenticeships become less attractive to potential apprentices, since access to the company's internal labor market seems less likely. Thus the average quality of the school-leavers it can attract declines. For both reasons, the company has a strong incentive to use the initial choice of apprentices as its key screening period; at that stage, companies subject candidates to interviews and written tests and take school performance very seriously. There is also an initial probationary period of one to three months, during which some further screening takes place. Nonretention at the end of the apprenticeship is therefore only a last resort.

The second element in nonretention is the decision by the newly graduated skilled worker to leave the company and seek employment elsewhere. Such a decision depends on the attractiveness of the offers which alternative companies might make. We will argue in the next section that the system of wage determination makes it difficult for other companies to use wage incentives to pull skilled workers away from similar companies. This means that apprentices accepting a position in a similar company will not gain higher wages. If, in addition, we assume that all non-*handwerk* companies have equally attractive

internal labor markets and that moving entails uncertainty and other costs, then postapprentices will not move.

If moving costs were positive for all postapprentices, the voluntary postapprenticeship quit rate would be zero according to the assumptions made so far. However, some postapprentices would like to move, for example because of family or locational reasons or perhaps because of some particular disadvantage they see in the training company, so that the positive moving cost assumption does not apply. Whether these postapprentices move will depend on the likelihood that they will find positions in other companies. If it is very likely, then most will try to move; if it is unlikely, most will not. Thus the quit rate is not exogenous but depends on the extent to which other comparable companies do not train apprentices or do not train enough to meet their internal labor market needs. If we call the quit rate q and the proportion of companies which train apprentices t, then (loosely) $q = q(t)$, with $q_t < 0$: the higher the proportion of training companies the lower the rate of postapprentices.

Now we can put this together with the rate of ineffective postapprentices, l (for "lemon"), where l is assumed to be exogenous and small for the purpose of this discussion. Thus the retention rate r cannot be determined exogenously: since $r = 1 - l + q(t)$, the retention rate is determined in equilibrium with t.

In conclusion, we have seen why the retention rate of medium-sized and large companies is high. First, companies do not use the apprenticeship as a major screening device. Second, as long as postapprentices face positive moving costs, the postapprenticeship quit rate will be kept low between companies with similarly attractive internal labor markets, because nontraining companies are limited in their ability to use wage strategies to induce postapprentices to transfer. However, when we include the possibility that some proportion of postapprentices may want to move, the quite rate of postapprentices and hence the retention rate of postapprentices by their training companies depend endogenously on decisions of companies to train or to hire already trained workers. We now turn therefore to decisions by companies to hire workers trained elsewhere.

1.2.4 The Costs of Hiring Previously Trained Skilled Workers

Given that companies need skilled workers who have served an apprenticeship, an alternative strategy to training apprentices in-house is to hire skilled workers who have served their apprenticeships elsewhere. As we have already mentioned, there may be circumstances in which companies follow this strategy: for instance in setting up a greenfield plant in a new area (as may be the case with incoming multinationals) or in the face of rapid expansion. Moreover there may be informal arrangements between some large companies and dependent companies whereby the large companies overtrain and then distribute trained workers (not the best ones) to these dependents. In these cases the logic is usually clear. But in general the great majority of larger companies do their own training, as is shown in the middle column of table 1.4: given the net cost

of training apprentices, this suggests there is a significant loss in hiring workers trained elsewhere, if companies are maximizing profits as we assume. Such a loss arises partly because of the cost of training in company-specific skills. It also arises for two conjoint reasons related to the constraints of the wage determination system and to the use of apprenticeships to screen out those who are inappropriate, which may lead companies to believe that, by hiring those trained elsewhere, they do not have access to the best young workers.

The Relative Costs of Company-specific Training during Apprenticeships and Subsequently

As suggested earlier in this section, company-specific skills are important in medium-sized and larger German enterprises, accounting for the role played by internal labor markets. There are at least three reasons it is cheaper to impart these skills during an apprenticeship, rather than later on hiring a skilled worker trained elsewhere. First, company-specific skills—such as procedural and organizational knowledge, production scheduling, working with particular machines or performing particular operations—can usually be taught at little cost during the apprenticeship, since the skills which must be taught can be taught within a company framework; the additional resources devoted to such instruction are likely to be small. Second, company-specific skills acquired during an apprenticeship will be taught to low-paid apprentices rather than to workers paid a skilled worker's salary. And third, company-specific skills are complementary to general skills in modern technological environments which require teamwork.

We have been unable to locate any research on the cost or length of time taken to impart adequate company-specific skills to a newly hired skilled employee. Nor is there data on the difference between the starting wage of a postapprentice with in-house training and that of a postapprentice hired after training in another company. Back-of-the-envelope calculations suggest that the order of magnitude of the cost is substantial. Assume that it takes a newly hired skilled worker one to two years to be fully conversant with machines, procedures, teams, and so forth. The annual labor cost to a company of a skilled worker, in the year covered by the apprenticeship-cost survey (1980), is around DM 45,000; these companies typically sell differentiated products and do not operate in perfectly competitive markets, so the marginal revenue product of the worker will be higher, say DM 60,000 (reflecting a price elasticity of demand of one-third). Thus, over 18 months the net contribution to profits of a skilled worker with fully effective company-specific skills would be of the order of DM 90,000. In a complex teamwork environment, the effectiveness of a skilled worker without the appropriate company-specific skills is low, because the company-specific skills are complementary to general skills. Assume, in consequence, the worker is 50 percent effective over 18 months: then the cost of acquiring the company-specific skills is DM 45,000 (leaving discounting aside). Nota bene, this is a purely hypothetical example: this area

merits careful research, which has not been undertaken (as far as we are aware) in Germany. What the example is designed to show is that, if complex company-specific skills are important and complementary in production to marketable skills and if they can be taught at low cost in an apprenticeship program, then these will be important elements in the costs of hiring externally as opposed to training internally. The example suggests that this cost may be of the same order of magnitude as the net costs of an apprenticeship.

The Constraints of the Wage Determination System

The first constraint is that it is difficult for companies to use wage strategies to poach skilled labor from other companies. Wages in Germany are determined at two levels: Industry negotiations (technically by region) between the industry union and the industry employer association set basic pay levels for different classes of workers. These are (generally) de facto binding on all companies within the industry. Subsequent negotiations at the company level, between management and the works council, add a supplement which can in principle be flexible across groups of employees. These settlements are carefully monitored by both employer association and union, to prevent leapfrogging pressures, while allowing within-company flexibility in developing internal wage structures. These internal wage structures are shaped by management, but the works council plays an important role in larger companies. It is not in the interest of the works council for these wage structures to be used to entice skilled labor from other companies (except in special circumstances, as mentioned above), because such practice undercuts the bargaining ability of the council—in particular its ability to pressure management to retrain existing skilled workers whenever possible. Nor is it in the interest of the works council to substitute skilled workers trained elsewhere for in-house apprentices: the legal role of the works council in apprenticeship training enables it to ensure the quality of future skilled workers in the company and to recruit apprentices to the union. Moreover, even if the works council were prepared to allow management to behave in this way, it could obtain approval from the employees (who elect the council) only if existing skilled workers shared the higher wages paid by management to attract new recruits; this would greatly add to the cost of such a strategy. Thus it would be difficult for management to develop wage strategies to enable it to bid for those who had just completed their apprenticeships elsewhere.

The Adverse Selection Problem

Companies are at liberty to advertise for skilled labor, subject to the type of informal constraints on wage strategies just discussed. There are active occupational labor markets, and young people who have just completed their apprenticeships are at liberty to move. But there are strong asymmetric information arguments which contribute to restraining both sides at the immediate postapprenticeship juncture, in medium-sized and larger companies.

As noted in subsection 1.2.3, in discussing the retention rates of companies, companies are not likely to retain postapprentices who for one reason or another are "difficult." These nonretained postapprentices may present screening difficulties for a company seeking to hire postapprentices in the market: they will have passed their examinations, and moreover, at the stage at which they were given apprenticeships, they passed whatever academic or other tests the training company used for selection. Thus, companies who do not train their own apprentices but instead attempt to hire those trained elsewhere will have a higher-than-average probability of ending up with less-effective skilled workers. How much higher that probability is, depends on the proportion of postapprentices who quit voluntarily. The smaller the proportion who quit, the larger the probability that hiring postapprentices trained elsewhere will result in acquiring "lemons." Thus the "lemon" probability is endogenous; we need to put the last three subsections together to get a picture of what an equilibrium might look like.

1.2.5 A High-Retention, High-Training Equilibrium

We know statistically that the percentage of training companies, t, is high for medium-sized and large companies; that the retention rate r, is high (see table 1.4); and that therefore the quit rate, q, is correspondingly low. Is this consistent with equilibrium behavior by companies and postapprentices, given that the net cost of apprenticeship training is positive?

Intuitively, characterizing the equilibrium is simple. If companies believe the quit rate will be low and thus their retention of postapprentices high, the postapprentices on the market are likely to be those that their training companies did not want to keep. Thus companies would correctly believe that hiring postapprentices trained elsewhere is likely to obtain ineffective workers. Will the implicit cost of ineffective workers plus the cost of training them in company-specific skills outweigh the cost of apprenticeships? We have already seen that the cost of training in company-specific skills may be considerable. A ballpark figure is DM 45,000 (see subsection 1.2.4). The net cost of meeting internal labor market needs through apprenticeships has two components: the net cost per apprentice, between DM 10,000 and DM 20,000 per annum for 3.5 years, comes out reasonably close to the cost of subsequent training in company-specific skills; in addition, a larger number of apprentices than needed must be trained, because not all apprentices will be retained, so the net cost needs to be multiplied by the inverse of the retention rate. If the retention rate is high (80 to 100 percent), this addition to net costs is low, of the order of 15 percent. Thus it is clear that, if companies are at all worried about the quality of postapprentices available on the market, compared to those they can hire at the apprenticeship entry stage, it makes sense to train apprentices. The cost of apprenticeships, with a high retention rate, may be higher than the cost of

company-specific training of postapprentices trained elsewhere, but they are of the same order of magnitude—and to the company-specific training cost must be added the cost of "lemons." So, if companies believe the retention rate is high, it probably pays most companies to train apprentices.

If most companies train, postapprentices will be unlikely to quit, since they will be unlikely to receive offers elsewhere. With a low quit rate, the retention rate will be high, and thus the behavior of companies and postapprentices will be in equilibrium. This does not imply that this high-retention, high-training equilibrium is the only one. It may well be that there is a low-retention, low-training equilibrium as well. This can be shown in a simple game theoretic framework.

Companies have two choices in this model, to train apprentices (train) or to hire already trained postapprentices (hire). Companies choose to train if the cost of training enough apprentices to meet internal labor market needs is less than the cost of hiring. The net cost of an apprentice, whether or not the apprentice stays with the company, is c^a. If the retention rate is r, the cost of training an apprentice who stays with the company is c^a/r. The rate r is inversely related to q, since $r = 1 - l - q$. Hence, in terms of the quit rate, the cost of a retained apprentice is $c^a/(1 - l - q)$. The cost of hiring is the cost of training in company-specific skills, c^s, plus the cost of hiring a "lemon," c^l, where the latter is positively related to the ratio of "lemons" to total postapprentice leavers: $c^s + c^l(l/(l + q))$. If the q is high, assume that

$$c^a/(1 - l - q) > c^s + c^l(l/(l + q));$$

if q is low, assume the inequality is reversed, since most postapprentices will be retained and there is therefore a high probability of hiring a "lemon."

Postapprentices can choose to quit or to stay (as long as they are not "lemons"). This choice depends on the range of alternatives: these may be significant if few companies train, and hence many seek to acquire skilled workers; they are insignificant if most companies do their own training. Call the benefit of staying with the training company B^s, and that of leaving B^e if the probability of finding the most preferred alternative externally is unity, $pr_e = 1$. Thus the payoff to leaving is $B^e \cdot pr_e$, where pr_e depends on the proportion of companies which fill their internal labor markets by training, Tr.

In table 1.5, the choices {Stay, Train} correspond to the German situation:

Table 1.5 **Apprentice Training Game**

	Companies			
Postapprentices	Train		Hire	
Stay	B^s	$-c^a/r(q^*)$	B^s	$-c^s - c^l$
Quit	$pr_e(Tr) \cdot B^e$	$c^s - c^a/r(q)$	B^e	$-c^s$

our interest is in seeing under what conditions this is a Nash equilibrium. The first condition for this equilibrium is

$$B^s > B^e \cdot pr_e(Tr).$$

This says that postapprentices will choose to stay, as long as the benefits of staying outweigh the benefits of a low probability—since most companies will meet their skill needs through their own training—of finding the most preferred job elsewhere. The second condition is

$$c^a/r(q^*) < c^s + c^l,$$

where $r(q^*)$ is the retention ratio if quits are low, and so is close to unity. This says that companies will choose to train, as long as the costs of apprenticeship training are less than subsequent company-specific training costs plus "lemon" costs: because most postapprentices choose not to quit, the "lemon" risk is high.

As long as $B^s > B^e \cdot pr_e(H)$, where $H = 1 - Tr$, this "high-skill, high-training" equilibrium is the only one. If the inequality is reversed, then {Quit, Hire} will also be a "low-skill, low-training" equilibrium.

The purpose of this section is simply to say that it makes sense that the large majority of medium-sized and large companies are prepared to spend money on training apprentices; it can be justified as an equilibrium, albeit one dependent—as we have seen in this section—on infrastructural institutions. There is a second caveat: the equilibrium here is partial; notably, it takes for granted that schoolchildren and apprentices are prepared to invest in apprenticeships through educational performance and low apprentice wages. This is major factor in keeping apprenticeship costs low. In section 1.4, we will see how the apprenticeship system sets up incentives for young people and will examine the "general" equilibrium in which companies run apprenticeships because the educational performance of young people is high and young people invest in education because of the apprenticeship system.

1.3 Training in the *Handwerk* Sector

Apprenticeship training in small companies in the handwerk sector (e.g., as garage mechanics, bakers, electricians, plumbers, painters, hairdressers) operates in ways broadly similar to those in the medium-sized and larger companies discussed in section 1.2. That is to say, the apprenticeship program is carefully structured; there are external examinations at the end, with resulting certification for successful candidates; and the dual system allows the more theoretical work to be learned in public vocational schools. While these apprenticeships are—in a sense to be noted—at a lower level than those discussed in section 1.2, there is no evidence whatsoever that they are artificial and simply a source of cheap labor for companies.

There are however major differences, at least on average, between the two sectors. These differences make it difficult to use the arguments of section 1.2 to explain why small companies train. Before setting out these difficulties, the differences can be summarized as follows: The retention rate of postapprentices is lower than in larger companies (table 1.4), 64 percent in companies with 10–49 employees versus 87 percent in companies with more than 1,000 employees. The percentage of companies which run apprenticeship programs is lower, 59 percent versus 99 percent (table 1.4). The annual net cost of apprenticeships is lower, DM 7,248 in the *handwerk* sector versus DM 14,310 among companies with more than 1,000 employees (table 1.3). The educational background of apprentices is weaker: in the *handwerk* sector in 1989, 5.4 percent had no school-leaving certificate, 55.0 percent had a *Hauptschule*-leaving certificate, 18.6 percent had a *Realschule*-leaving certificate, and 5.3 percent had an *Abitur;* this compares with 0.8, 27.9, 35.3, and 19.2 percent, respectively, in the industrial/commercial sector (BMBW 1991, 36). The proportion of the training time spent on the job is high (Munch 1991).

These differences are, of course, average differences. In reality, the contrast between the two sectors is less sharp than that which will be drawn in this paper: many small advanced companies, classified in the *handwerk* sector, train in the same way as larger companies; some larger companies, especially in retailing, follow practices closer, on average, to those of small companies; and there is a big spread within some larger companies in the level of their apprenticeships. That said, the major gross differences make it useful to construct, in effect, a two-sector model. The need to do so becomes apparent when we see that it is difficult to explain, using the same arguments as for larger companies, why companies in the *handwerk* sector train.

Let us assume that, as for larger companies, small companies have a demand for skilled labor and can choose between training apprentices and hiring postapprentices trained elsewhere, to satisfy that demand. Large companies choose to train apprentices, it was argued, because they can count on a high retention rate and because the cost of imparting company-specific skills at the postapprentice stage to those trained elsewhere is high. It is difficult to understand on this basis why small companies are prepared to invest in training apprentices. First, their retention rate is significantly lower. Taking the net cost of training of DM 7,248 per annum per apprentice and dividing this by the retention rate for companies with 10–49 employees, to get a rough idea of the net cost per annum to produce a "retained" postapprentice in the *handwerk* sector, we get a figure of DM 11,325 per annum; this compares to the net cost per annum of a "retained" postapprentice in larger companies of DM 16,448 per annum (i.e., 14, 310/.87). Large companies are prepared to bear these costs because of the cost of hiring postapprentices trained elsewhere: the "lemon" problem and the cost of company-specific training. But for small companies the "lemon" problem is unimportant, since the quit rate for small companies is high, and company-specific skills are less important in small companies. Thus

for small companies, the net cost of training apprentices is likely to be greater than the cost of hiring already trained skilled workers.

The majority of small companies do not train apprentices. But why do those who *do* train do so? There are a number of possible hypotheses: On the assumption that these companies are interested in maximizing profits, it may be that they are acting so as to avoid implicit sanctions. This cannot be ruled out for certain sectors, but as a general explanation it suffers from the fact that the majority of small companies choose not to train. We focus therefore on investigating why profit-maximizing companies might choose to train apprentices in the absence of implicit sanctions.

We have already noted that the "net cost" figures must be treated with some caution. We now explain how they were calculated and why this method of calculation is likely to exaggerate the net cost for small companies but not for large ones. The three main components of the net cost of apprenticeships are (i) the cost of the apprentice's wages and associated expenditures, (ii) the cost of wages and associated expenditures of company employees involved in training, multiplied by the fraction of their working time devoted to training, and (iii) the estimated value of the apprentice's contribution to the net output of the company. Of these three components, only (i) is straightforward to measure; the method of calculating (ii) and (iii), we will argue, makes sense for larger companies but not for small ones.

Appropriate calculations should measure the net *marginal* cost, ((i) and (ii)), or revenue, (iii), of an apprentice to the company during the apprenticeship. Item (i) measures marginal and average costs, so there is no problem. But the measure of (ii) is the *average* cost, i.e., the total cost of the employee engaged in training multiplied by the proportion of his or her time occupied in training. In small companies, training is on the job: the main trainer, the *meister,* is also the supervisor of other employees. The trainer/supervisor in a small company can switch between these functions at low cost; generally, companies have busy and less busy periods, and the trainer/supervisor might be expected to divide his or her time so as to minimize the cost of training to the company. An example is hairdressing: when a salon is busy, the trainer/supervisor will be attending clients; when it is less busy, he will be training an apprentice. Thus, insofar as the cost of switching activities is low for the trainer and as the pattern of demand has slack and busy periods, the marginal cost of the trainer may be quite low. By contrast, in a larger company, much of the training takes place off the job; with a larger number of apprentices, the cost of switching and rearranging activities is higher for the trainer/supervisor.

The method of calculating the contribution of the apprentice to the net output of the company, (iii), underestimates the marginal revenue of the apprentice in a small company. The contribution of the apprentice is calculated by taking the length of time taken by an apprentice to do a range of skilled operations as a multiple of the length of time taken by a skilled worker. The contribution of an apprentice during a year is then taken to be the annual cost of a skilled

worker, divided by this multiple, multiplied by the fraction of the apprentice's time on the job. In larger companies, this may be a reasonable approximation: the apprentice may spend a relatively small amount of time on the job, and on-the-job work may be carefully structured so that the apprentice learns skilled operations. But in small companies, the apprentice will typically do a mixture of unskilled and semiskilled work, as well as skilled work. Moreover, the skilled work can be done when it is most convenient for the company: learning to use machinery, for example, during a slack period. For a small company, the choice may be between hiring an unskilled worker and taking on an apprentice; the apprentice is fully capable of doing unskilled work, and as the apprenticeship progresses, she becomes capable of doing an increasing range of skilled and unskilled work. Thus, in a cost-minimizing environment, training takes place during slack periods; during busy times the apprentice works on unskilled, on semiskilled, and, increasingly, on those skilled tasks which the apprentice has learnt to do effectively. It may therefore may be more appropriate to value the apprentice's contribution as somewhere near that of an unskilled worker (multiplied by the proportion of the apprentice's time spent on the job).

We have been unable to find any case studies which would enable us to make precise corrections to the net cost figures along the lines suggested above. If we take these adjustments at nearly face value, we come up with calculations suggesting that *handwerk* apprenticeships do not have a net cost to the company: for instance, if an apprentice's contribution to output is valued at half that of the labor cost of an unskilled worker, it is of the order of magnitude of DM 15,000 per annum. This brings the net cost to zero. If in addition, the cost of the training personnel (DM 7,605 per annum) is halved, there is a net profit of over DM 3,500 per annum.

To conclude the argument of this section: It is difficult to understand why profit-maximizing *handwerk* companies should be prepared to take losses on apprenticeships, given the low retention rate of postapprentices. However, the figures which suggest that there is a net cost in this sector are calculated by a method which makes little sense for small companies. We do not have the data necessary to make proper adjustments to these figures: but the adjustments made in the last paragraph by way of example suggest that the more plausible hypothesis for *handwerk* companies is that apprenticeships do not lead to net losses. If this is correct, it explains why *handwerk* companies are prepared to take apprentices despite the high quit rate.

1.4 Why Young People Invest in Education and Training

Young Germans who do not go on to higher education invest in apprenticeships in two ways: Explicitly, they accept low wages during the apprenticeship, implicitly, they invest in academic performance at school. These investments were discussed in section 1.2. Why are young people prepared to make such

investments? The apprenticeship system provides a strong and clear set of incentives.

1.4.1 The Main Port of Entry to Internal Labor Markets

The apprenticeship, outside the *handwerk* sector, is the main port of entry to an internal skilled labor market in a company. It is thus the main route to skilled work. This carries with it significant wage differentials relative to semiskilled employment. Moreover, it provides secure employment prospects, typically with long tenure and a range of additional benefits. Semiskilled workers in the same companies are less well protected by works councils, which are in practice dominated by skilled workers. Further formal advancement requires both a skilled worker's certificate and work experience. Thus an apprenticeship is necessary to enter the additional training needed to qualify as a *meister* (supervisor/trainer) or as a technician, and to get analogous qualifications in commercial companies. These positions in turn carry higher salaries (see subsection 1.2.2), greater security, and the possibility of further advancement.

Apprenticeships in the *handwerk* sector are in general less advantageous. But they offer, for children with a lower educational background, better prospects than no training. Larger companies recruit their semiskilled workers from among such apprentices.[15] While semiskilled work in a company is not as well-rewarded and secure as skilled work, the semiskilled worker shares some of the benefits of the internal labor market. Alternatively, there is employment as a skilled worker in the *handwerk* sector, either in a training company or elsewhere.

1.4.2 The Skilled Worker's Certificate as Insurance Policy

Internal labor markets offer, in general, considerable employment security and good working conditions. But neither is absolute: the skilled worker's certificate is insurance against an unsatisfactory internal labor market. If a skilled employee is made redundant, the certificate enables him to obtain alternative skilled employment via the external occupational labor market.

This "insurance" function goes beyond the case of redundancy. In general, skilled employees are unlikely to quit an internal labor market. But an employee may have other reasons for moving, as family circumstances, which are not predictable at the time of apprenticeship. Or, for whatever reason, working conditions may not be good in the internal labor market: this may include problems with colleagues, *meisters,* the works council, or the like. The possession

15. We have not discussed why larger companies hire skilled *handwerk* postapprentices for their semiskilled work forces, as opposed to training them themselves, and we have not discovered any research on the relative costs. It is not difficult to believe, however, that the training which larger companies want their semiskilled workers to have had involves personal work organization, cooperative behavior, and so on, and that this can be taught more effectively in a small company with its greater personal supervision of trainees. This is an area which merits more research.

of a skilled worker's certificate acts as an insurance policy to guard against such eventualities. Either it enables the employee to look for new employment without too much loss. Or, because of this possibility, it gives the employee enough power to deal with the situation—for instance, to complain about harassment by a supervisor without fear that such a complaint will make the situation worse.

1.4.3 The Opportunity Cost: Unskilled Wages and Limited Subsequent Possibilities for Apprenticeship Entry

What are the alternatives to an apprenticeship? In subsection 1.2.2 we showed the level of pay for an unskilled worker. This can be compared with the pay of a skilled worker (if the potential apprenticeship is in a larger company) or with that of a semiskilled worker (if the potential apprenticeship is in the *handwerk* sector).

This difference underestimates the cost of not having an apprenticeship in two ways: first, the security of employment is significantly less for an unskilled worker. Second, the apprenticeship system is set up so that it is difficult to enter at a later stage. This point is critical; the apprenticeship decision is one that is difficult to put off. The selection procedures of companies are geared toward choosing apprentices from school-leavers or from those who have spent additional time at a full-time vocational school. While it is possible to enter an apprenticeship later, it is less likely to be a good one.

1.4.4 The Incentive to Invest in Educational Performance: Competition for Good Apprenticeships

In order to explain the high level of effort and seriousness attached to academic work by those going into apprenticeships, the first point to make is that school-leavers have no entitlement to apprenticeships. School-leavers have to persuade companies to give them apprenticeships. This depends on interviews, school examination performance, the company's informal contacts with the school, and in some large companies, written examinations. In turn, this reflects the competition among companies, noted at the end of section 1.2, to get the most able apprentices they can. Thus the general reason the apprenticeship system creates an incentive for children to work hard at school is that school performance is an important element in gaining an apprenticeship place.

The incentives to work hard provided by the apprenticeship selection process are sharply reinforced by differences in the attractiveness of different apprenticeship schemes. If there were no difference, so that all companies demanded the same level of performance, children above a certain level of ability would have no incentive to work harder at school, since without effort they could attain the necessary standard; children under a certain (lower) level of ability would be unable to reach the standard and therefore would also have no incentive to work harder. Prais (1987) made the argument, in relation to Japa-

nese schoolchildren, that the ranking of training and internal labor markets in Japanese companies, and the care taken by companies to get the best school-leavers, gives an incentive to children to work hard at school no matter where they are on the age-ability range. This is because at any point on the ability range, somewhat better performance will lead to somewhat better company placement. It therefore pays schoolchildren of all abilities to work hard and seriously at school. While there are formal differences between the school/labor market interfaces in Germany and Japan, the countries are similar in ways relevant for Prais's argument. The contrast is with systems such as the British and the American, where improved school performance only marginally improves employment prospects for non-higher-education school-leavers. Since companies only want semiskilled or unskilled labor at age 16 (or 18) and seldom offer either prolonged training or internal labor markets, differences in employment prospects between companies are much more limited, and the incentives to work hard academically are therefore limited for young people with little chance of getting into higher education.

To summarize this section, the German apprenticeship system is one in which young people have an incentive to invest by accepting low wages. They also have an incentive to work hard at school in order to compete effectively for a good apprenticeship, given their underlying ability.

1.5 Summary and Conclusion

In section 1.1, we posed three problems for the optimal provision of marketable or general training: (1) the classic problem of Becker, that companies have no incentive to invest in training, and the related difficulty of young people to finance it themselves; (2) the difficulty of reconciling companies to the intrusion of infrastructural training institutions, necessary for advice, monitoring, certification, and diffusion of best practice; and (3) the problem of providing effective incentives for young people, to ensure that they invest sufficiently through low apprenticeship wages and prior educational effort, in turn necessary to keep the costs to companies of apprenticeships sufficiently low. How, then, given these problems do we explain an apprenticeship system in which companies are under no obligation to run apprenticeship schemes, but the great majority of medium-sized and large companies do, and moreover they make significant net investments in them. Young people are under no obligation to enter apprenticeships, yet most young people who do not go on to higher education (and even some who do) go into three-and-a-half-year apprenticeships. Remarkably, less than 10 percent of each age group go through neither apprenticeship nor higher education. Young people accept low wages during their apprenticeships, and they come to the apprenticeship with a high level of prior academic performance. The German system is thus an example of a "high skill" equilibrium, in which companies train well-educated apprentices in mar-

ketable skills. how are incentives structured to support such an equilibrium, and by whom? We summarize the key points in the argument and finish with a brief discussion of the role of institutions.

1.5.1 Large and Medium-sized Companies

Almost all of these companies run apprenticeship schemes and incur more or less significant net costs during the course of the apprenticeship. The argument in section 1.2 as to why they did this had four steps:

1. The underlying constraints of the industrial-relations systems rule out low cost labor strategies and guarantee work force cooperation; the financial system allows companies to operate within a long-run framework. This makes it sensible for companies to pursue high-quality and innovative product market strategies, requiring a work force with high company-specific and general skills. Companies therefore must either train employees in general skills or hire already skilled workers who have been trained elsewhere.

2. The costs to a company of apprenticeship training, though positive, are kept low by the good education of apprentices and their low apprenticeship wages. In addition, the necessary advice about and monitoring of a company's training performance is carried out by institutions which management generally trusts, notably the employer associations and chambers and the employee-elected and employee-composed works councils.

3. The cost of training post apprentices trained elsewhere in company-specific skills is significantly higher than the cost of imparting such skills to apprentices. This is because company-specific skills themselves—particularly related to teamwork, production-scheduling, and implementing product modification—may take longer to acquire for someone trained elsewhere to do such things differently; apprentice wages are one-third those of a skilled worker, so apprentices can be taught more cheaply; and there are economies of scope between the training of general and company-specific skills during an apprenticeship, since the general skills can be imparted within the context of the company's methods of operation.

4. Finally, if all other companies train their own apprentices, it pays each company to do so as well because of the operation of the wage determination system; this system makes it difficult to use individually tailored packages to persuade workers to leave comparable companies: thus the postapprentices which a nontraining company will be likely to hire are those whom their training companies have chosen not to keep. Hiring these potential "lemons" is a costly strategy.

The conclusion of this argument is that it will be long-run-profit maximizing for companies to train their own apprentices to meet their own internal labor market needs for skilled employees. But there is a further conclusion of relevance: When the company chooses its apprentices, it is choosing the skilled members of its internal labor market. Thus the choice is a critical one. The consequence is that companies compete to choose the best apprentices. The

investment which companies put into screening potential apprentices, at this stage, in turn structures the incentives for school-children to work effectively at school.

1.5.2 *Handwerk*-Sector Companies

Large and medium-sized companies do not, of course, only employ skilled workers. Semiskilled employees are also employed, and these companies prefer to hire such employees after they have completed apprenticeships in small companies in the *handwerk* sector. Why then do *handwerk* companies run apprenticeship schemes? Less than half the companies in this sector train. Those that do retain only about half of their apprentices at the end of the apprenticeship: a substantial proportion of those leaving go on to semiskilled positions in the medium-sized/large-company sector. Therefore, it is difficult to understand why companies in the *handwerk* sector should train apprentices unless they can do so at a profit or without sustaining losses during the apprenticeship itself. However, the statistics collected at the start of the 1980s showed an apprenticeship to be a net cost in this sector.

We argued in section 1.3 that the way in which net costs were calculated was sensible for medium-sized and large companies but exaggerated net costs for *handwerk*-sector companies. This was because small companies, if concerned to minimize cost, could often schedule training to occur during slack periods and could use apprentices as at least unskilled labor during busy periods. Thus the shadow price of the trainer's time might be very low, as compared to the assumption in the statistics that it is the full cost of the trainer during the time spent training. And the shadow value of the apprentice in terms of net output may be estimated at or above that of an unskilled worker, rather than assessed as a proportion of the skills the apprentice can perform. We concluded that these statistics should not be taken at their face value for the *handwerk* sector and that a plausible hypothesis is that these companies were behaving in a profit-maximizing way.

1.5.3 Young People and the Competition for Good Apprenticeships

Young people invest in apprenticeships in two ways: They accept low wages during their apprenticeships and they work hard at school to achieve good academic performance and good references from their teachers—for reliability, and so forth. In large and medium-sized companies, apprenticeships are attractive for the following reasons:

1. The apprenticeship is almost a necessary condition for skilled employment in internal labor markets. These offer considerably better rewards, including employment security, than semiskilled or unskilled employment. Moreover, an apprenticeship is a necessary condition for further advancement to supervisory and other grades. This is as true of white-collar as of blue-collar employment.

2. So long as an apprentice works reliably and effectively through the ap-

prenticeship, he is likely to receive an offer of employment in the training company. Thus the apprenticeship is a clear bridge from education to good employment.

3. The skilled worker's certificate is an insurance policy against a worker's having to leave the internal labor market.

An apprenticeship in the *handwerk* sector is generally inferior to one in a larger company in industry or services. But larger companies attach importance to such apprenticeships in hiring semiskilled workers, who obtain some of the same advantages as skilled workers from internal labor markets. And *handwerk* apprenticeships are a necessary condition for skilled employment in the *handwerk* sector.

The attractiveness of apprenticeships establishes why young people are prepared to accept low wages during the apprenticeship. Why do they work hard at school? First, and critically, the apprenticeship system caters to people in the 16–19 age group: thus failure at this stage is unlikely to be remedied by success later. Second, young people rank the desirability of different apprenticeships. In general, to be accepted into a more desirable apprenticeship, better school performance is required. Hence there is a strong incentive to improve school performance at any ability level, since such improvement may lead to a better apprenticeship. There is a contrast with lower ability levels in the United Kingdom and the United States, where marginal improvements in school performance have little impact on subsequent employment and training and where there is no disincentive to devote resources to training and education later.

1.5.4 A High-Skill, High-Education Equilibrium

The German apprenticeship system provides incentive structures for companies and young people which support an equilibrium in which companies provide high-quality training, in part because the academic ability of apprentices keeps the costs of training sufficiently low, and in which young people take school education seriously because it leads to good training possibilities. Critical to the incentives for companies and young people is the fact that neither side must miss out on the "apprenticeship fair." It is common knowledge among companies that this is where the best school-leavers gain entry to internal labor markets: if companies miss out at this stage, they are less likely to get such good entrants later. Hence companies invest in attracting and screening applicants. This sets up a clear incentive structure for young people to invest sufficiently in school performance, to get apprenticeships at the best possible companies. Young people likewise know that to miss out at this stage makes subsequent entry much harder.

References

Becker, G. 1964. *Human capital.* New York: Columbia University Press.

Büchtemann, Christoph. 1989. *Befriste Arbeitsvertrage nach dem Beschäftigungsförderungsgesetz.* Forschungsvorhaben im Auftrag des Bundesministerium für Arbeit und Sozialordnung (BMA). Bonn: BMA.

———. 1991. *Employment security and labor markets: Assumptions, international evidence, and theoretrical implications.* Wissenschaftszentrum Berlin für Sozialforschung Discussion Paper FS I 91–1. Berlin.

Bundesministerium für Bildung und Wissenschaft (BMBW). 1991. *Grundlagen Perspektiven: Berufsbildungsbericht 1991,* no. 28. Bonn: BMBW.

Casey, B. 1991. Recent developments in the German apprenticeship system. *British Journal of Industrial Relations* 29 (June): 205–22.

Daly, A., D. Hitchens, and K. Wagner. 1985. Productivity, manufacturing and skills in a sample of manufacturing plants in Britain and Germany. *National Institute Economic Review,* no. 111: 48–69.

Falk, R. 1982. Kosten der betrieblichen Aus- und Weiterbildung. In *Berichte zur Bildungspolitik 1982/83 des Instituts der Deutschen Wirtschaft,* ed. U. Gobel and W. Schlaffke. Koln: Deutscher Instituts-Verlag.

Finegold, D., and D. Soskice. 1988. The failure of training in Britain: Analysis and prescription. *Oxford Review of Economic Policy* 4 (3): 21–53.

Flanagan, R., D. Soskice, and Lloyd Ulman. 1983. *Unionism, economic stabilisation and incomes policies: European experience.* Washington, D.C.: Brookings Institution.

Franz, W. 1982. *Youth unemployment in the Federal Republic of Germany.* Tubingen: J. C. B. Mohr.

Hayes, C., and N. Fonda. 1984. *Competence and competition.* London: Institute for Manpower Studies.

Katz, E., and A. Ziderman. 1990. Investment in general training: The role of information and labour mobility. *Economic Journal* 100 (December): 1147–58.

Kern, H., and M. Schumann. 1989. New concepts of production in German plants. In *The third West German republic,* ed. P. Katzenstein. Ithaca, N.Y.: Cornell University Press.

Lane, C. 1989. *Management and labour in Europe: The industrial enterprise in Germany, France and Britain.* Aldershot: Edward Elgar.

———. 1991. Vocational training and new production concepts in Germany: Some lessons for Britain. *Industrial Relations Journal* 21 (4): 247–59.

Marsden, D. 1990. Institutions and labor mobility: Occupational and internal labour markets in Britain, France, Italy and West Germany. In *Markets, institutions and cooperation: Labour relations and economic performance,* ed. R. Brunetta and C. Dell'Aringa. London: Macmillan.

Munch, J. 1991. *Vocational training in the FRG,* 3d ed. Berlin: European Centre for the Development of Vocational Training (CEDEFOP).

Oulton, N., and H. Steedman. 1992. The British system of youth training: A comparison with Germany. London: National Institute for Economic and Social Research. Mimeograph.

Prais, S. 1981. Vocational qualifications of the labour force in Britain and Germany. *National Institute Economic Review,* no.98 (November): 47–59.

———. 1987. Educating for productivity: Comparisons of Japanese and English schooling and vocational preparation. *National Institute Economic Review,* no. 119: 40–56.

Prais, S., V. Jarvis, and K. Wagner. 1989. Productivity and vocational skills in services in Britain and Germany. *National Institute Economic Review*, no. 130: 52–74.

Prais, S., and K. Wagner. 1983. Some practical aspects of human capital investment: Training standards in five occupations in Britain and Germany. *National Institute Economic Review*, no. 105 (August): 46–65.

———. 1985. Schooling standards in England and Germany: Some summary comparisons bearing on economic performance. *National Institute Economic Review*, no. 112: 53–76.

———. 1988. Productivity and management: The training of foremen in Britain and Germany. *National Institute Economic Review*, no. 123 (February): 34–74.

Schettkat, R. 1992. *The labor market dynamics of economic restructuring: The United States and Germany in transition.* New York: Praeger.

Sorge, A., and W. Streeck. 1988. Industrial relations and technical change: The case for an extended perspective. In *New technology and industrial relations*, ed. R. Hyman and W. Streeck. Oxford: Basil Blackwell.

Soskice, D. 1990. Wage determination: The changing role of institutions in advanced industrialised countries. *Oxford Review of Economic Policy* 6, no. 4 (November): 36–61.

Steedman, H., G. Mason, and K. Wagner. 1991. Intermediate skills in the workplace: Deployment, standards and supply in Britain, France and Germany. *National Institute Economic Review*, no. 136: 60–76.

Steedman, H., and K. Wagner. 1987. A second look at productivity, machinery and skills in Britain and Germany. *National Institute Economic Review*, no. 122: 84–96.

Streeck, W. 1984. Co-determination: The fourth decade. In *International perspectives on organisational democracy*, ed. B. Wilpert and A. Sorge. Chichester, John Wiley.

Streeck, W., J. Hilbert, K.-H. van Kevelaer, F. Maier, and H. Weber. 1987. *The role of the social partners in vocational and further training in the Federal Republic of Germany.* Berlin: European Centre for the Development of Vocational Training (CEDEFOP).

Streeck, W., and P. Schmitter. 1985. Community, market, state—and associations? The prospective contribution of interest governance to social order. In *Private interest government: Beyond market and state*, ed. W. Streeck and P. Schmitter. London and Beverly Hills, Calif.: Sage.