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FINANCING APPRENTICESHIP TRAINING: EVIDENCE FROM GERMANY

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ABSTRACT

Much of the current discussion promoting apprenticeship programs in the U.S. proceeds as if it is simply a matter of historical accident or lack of imagination which has hindered human capital investment by U.S. firms. However, the cause may be rooted more deeply in our labor market institutions. This paper discusses the structure of incentives undergirding the German system of apprenticeship training. Many German firms face large net costs of apprenticeship training. Yet they continue to provide such training in spite of considerable worker turnover upon completion of the training. The simplest human capital model suggests that employers would be willing to finance only firm-specific training. Rather than engage in a futile debate over the general or specific nature of the skills being provided, we first describe and evaluate 3 characteristics of the German labor market which may lead firms to accept part of the cost of general training even in the face of worker turnover. We then attempt to understand why German workers and firms may be more willing to invest even in firm-specific skills than in the U.S.. Finally, we discuss some implications of these results for the current vocational training debate in the U.S..

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I. Introduction

Rising wage inequality, particularly the decline in the labor market prospects for those without a college education, has generated a renewed interest in human capital investment in the United States. The dual system of apprenticeship training in Germany has been mentioned as a model in these discussions.[1] However, despite its resiliency in the face of technological change and other labor market developments, the structure of incentives undergirding the German system itself is not well understood. Given that the success of any significant reforms in the U.S. will require employer involvement, this is a fundamental gap in our understanding. In this paper, we will analyze alternative explanations of employers' willingness to finance apprenticeship training in the face of worker turnover in Germany. In doing so, we consult evidence from two large German cross-sectional surveys and draw implications for the current debate in the U.S..

In our review of the German data, we find three salient points:

First, German employers-- at least in larger, industrial firms-- face substantial net costs in the training of apprentices. This seems to be true even after accounting for worker output: In 1972 and 1980, two commissions in Germany generated similarly large estimates of net costs for these large firms.

Second, retention rates of these apprentices are often quite low. Apprenticeships are certainly not the beginning of a lifelong relationship between apprentices and firms as the popular literature often suggests. Roughly 70 per cent of graduating apprentices leave their training enterprise within 5 years. The departure rate is lower for large firms in the industrial sector (50%), but still higher than widely believed.

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[1]For instance, see the Copmmission on the Skills of the American Workforce (1990), and Kinzer, New York Times, June 2, 1993.

Third, those who leave the firms where they were trained within the first year have current earnings roughly 9% higher than those who remained with the training firm.

To the extent that the training generates general skills useful at other firms, these facts provide a puzzle: Why might German employers bear the cost of general training if many of their apprentices leave? On the other hand, even a simple human capital model would predict that an employer may be willing to accept part of the cost of firm-specific training. Unfortunately, there is no way in these data to identify whether such training is general or specific. Rather than resort to tautology in concluding that such training must be firm-specific, we first describe three characteristics of German labor markets which may lead firms to be willing to accept part of the cost of general training. The following mechanisms are described and investigated:

Union Collusion and Restricted Mobility: Soskice (1993) suggests that through their influence over plant-level works councils, unions may limit poaching and thereby provide a market within which firms are willing to make loans to workers to finance general training.

Inflexible Wages, High Firing Costs and Option Value: The combination of industry-wide agreements specifying minimum wages for various jobs and high firing costs bestows a high value on information regarding a particular worker's productivity. Apprenticeship training programs may therefore serve as an extended employment test for which employers are willing to share part of the cost.

Unobserved Heterogeneity in Worker Costs of Mobility: In the presence of high mobility costs for some apprentices, a short-term equilibrium may be reached where the workers who remain with the training firm pay for the training of the apprentices who leave. This is a potentially important explanation for some firms, since a surprising 80% of all German workers report that they have never moved to take another job.

As mentioned above, even a simple human capital investment model would predict that German firms would be willing to share the costs of firm-specific training. However, this

explanation presents a second puzzle: Why might we not observe U.S. firms investing to the same extent in specific skills? Although we do not have the data with which to distinguish it from other hypotheses, we propose one explanation which is consistent with the data:

> *Compressed Wage Structure and Firm-Specific Human Capital Investment:* Due to the compressed wage structure generated by centralized bargaining, the payoff to job search may be limited in Germany. The less likely that a particular worker is to find a better match elsewhere, the more willing firms and workers may be to make firm-specific investments.

Others, such as Kochan and Osterman (1991), have pointed to the high turnover rates among U.S. workers as an impediment to human capital investment. However, as Becker (1964) and Lazear (1981) have suggested, the extent of worker turnover is endogenous: firms can entice workers to remain by deferring compensation until later in their workers' careers. The characteristic of the German labor market which generates these low turnover rates remains to be identified. As we suggest, the explanation may lie in the wage structure. As a result of centralized wage bargaining, the wage distribution is much more compressed in Germany than in the U.S. This would have implications for the payoff to job search: the narrower the variance in wage offers, the lower the expected return to search. Therefore, the increased willingness of German firms and workers to invest in firm-specific skills may simply be due to the relatively tight distribution of wages Germany.

Indeed, the age-earnings profiles of U.S. male high school graduates very closely match those of German apprentices. This is a provocative fact given the much cited differences in human capital investment in the two countries. The two different regimes-- active search with low specific investment and less search with more specific investment-- could generate similar outcomes.

Below, we provide some institutional detail on the German system in section II. In section III, we review the evidence regarding the employers' costs of providing apprenticeship training. In section IV, we evaluate each of the three potential reasons for firms' financing of investment in general skills. Although our data do not allow us to rule out any one, the evidence identifies some as more compelling than others. In section V, we propose one potential explanation for international differences in specific investment. In the final section, we discuss current policy options for the United States.

II. Institutional Detail

The German educational system is much more explicitly differentiated than the U.S. system. Though we will not provide a detailed explanation here, there are basically five paths that students follow, as summarized in Table 1:

- o No post-secondary training at all.
- o Apprenticeship training in the dual system (potentially with additional training as a technician or master craftsman).
- o Three-year technical university programs
- o Four-year (or longer) university training
- o Other postsecondary training such as in health or public administration.

Table 1 displays the educational background of three age cohorts of male German workers. The portion of the workforce without any post-secondary training has been declining steadily in Germany. While 17 per cent of those turning 18 between 1955 and 1962 did not have any post-secondary training, this share had fallen to below 10 per cent in the Seventies. In contrast to the United States, however, very few of these students attended university:

Academic or technical university graduates represented only 14% of even the youngest age cohort in 1985.[2] Rather, the largest group-- about two-thirds of the workforce-- completed a 2-3.5 year apprenticeship in the dual system. (Roughly 11 percent (8% of the population) of these apprentices go on to become master craftsmen or technicians after completing their apprenticeships.[3]) It is this ability of the German system to provide training to the non-college-bound which has attracted the attention of U.S. policy-makers.

The second panel of Table 1 summarizes the average monthly wages of male workers by educational attainment and age cohort. In comparison to workers with fewer than 11 years of schooling and no apprenticeship training in 1986, former apprentices earned a wage premium of approximately 5 per cent in the youngest cohort and of about 18 per cent in the cohort of workers who turned 18 between 1955 and 1962.[4] Still, it is clear that former apprentices do not fare nearly as well as college graduates in Germany. University graduates earned 33% more than former apprentices (with no master certificate) among the youngest workers and 47% more among the middle-aged workers.

There has been some disagreement in the literature regarding the effect of compulsory schooling laws on the proportion of youth "choosing" to complete apprenticeships. Taken literally, state laws seem to require youth to attend school through age 18. Since general

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[2]University enrollment has grown rapidly during the Eighties, however.

[3]Note that the share of master craftsmen or technicians is relatively low in the youngest cohort, since training associated with it usually takes place after workers have completed their thirtieth birthday.

[4]It is only a rather small group of about 1.5 per cent of the total workforce that sidesteps apprenticeship training or other post-secondary schooling altogether after 11 or more years of schooling. These workers who earn wages higher than those of former apprentices are a highly select and small group that emerges as a result of the early tracking in the German educational system.

schooling is usually completed at age 15, the "willingness" of youth to participate in apprenticeships has been attributed to these compulsory schooling requirements. In practice, though, most states allow youth to fulfill the further schooling requirement by attending one year of vocational college, usually between age 15 and 16.[5] Therefore, high participation in apprenticeship training cannot be explained by such legal coercion alone.

Training which occurs at a firm is only one part of the expense involved in the German dual system of apprenticship training. The adjective, "dual," is due to the fact that apprentices typically attend publicly-funded vocational schools 1-2 days a week in addition to working at the firms. Further, there are a host of coordinating activities performed by the federal Bundesinstitut fur Berufsbildung (BiBB) and industry organizations or "chambers", the latter funded by membership taxes which all firms in an industry are legally required to pay. For instance, training firms have to demonstrate that their trainers fulfill certain minimum requirements and that the enterprise can provide the training for the respective occupations. Therefore, the vocational schools themselves and much of the coordinating functions are shared collectively through various taxes. However, in this paper, we will explore the financing of the portion of the dual system training occuring on employers' premises[6]

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[5]For more on this, see Hillary Steedman, "Youth Training in Germany," Economic Journal (1993) Vol. 103,pp. 1279-1291.

[6]A few small industries, such as construction, have resorted to taxing members of industrial chambers to pay for the centralized training centers where apprentices are trained. This is the exception, however. See Timmermann (1993).

III. Net Costs of Training to Firms: Do Apprentices Pay the Bill?

To start, we analyze whether there is anything of interest to be explained, i.e. whether the German system reflects the textbook example in which workers pay for their training by accepting wages below their productivity.[7] As Becker (1964) argues in his classic work, the party writing the trainer's check need not be paying for the training. Trainees could compensate their employers by accepting wages less than the value of the products they produce. Indeed, since an apprentice's wage is typically less than a third of that of a skilled worker, Heckman (1993) has conjectured that net costs to firms of providing apprenticeship training may indeed be zero. In accordance with Soskice(1993) and Steedman (1993), we conclude that this hypothesis is only partially correct. Among smaller craft firms, the costs of apprenticeship training to employers have probably been overstated and may be close to zero. However, many of the large, industrial firms continue to make substantial investments in apprenticeships which require explanation.

Since 1970, there have been two attempts to answer this question in Germany.[8] Both studies have attempted to account for the various types of costs and benefits involved for firms. The simplest component of costs to measure are materials costs and apprentices' wages. However, the remaining portion is much more difficult to capture. For instance, one must account for the wage costs of training personnel. This is a straightforward

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[7]For instance, see Heckman (1993).

[8]See the Edding Commission (1972) and Noll *et. al.* (1983). A third attempt is currently under way at the Federal Institute for Vocational Training (BiBB), but no results have been published so far.

measurement at larger firms which often employ full-time training personnel. At smaller craft firms, however, it is a much more difficult task, since the apprentice may often be looking over the shoulder of the master craftsman engaged in productive work. Both studies simply asked supervisors to estimate how much time they spent instructing apprentices, which, when multiplied by the wage of such instructors, provided an estimate of the training personnel costs. Finally, investigators attempted to measure the value of apprentice production during the course of their training. Employers were asked to report the amount of time apprentices spent in production, the amount of time it took a skilled worker to perform the work of an apprentice and the wage of skilled workers at the firm. The value of apprentice production was estimated as the product of these three.

Table 2 reports the estimated costs of such training by sector and category of cost for both 1970 and 1980.[9] In both years, the net cost of training apprentices is estimated to be positive in all sectors. However, the net costs were highest in the industrial sector: In 1980, the estimated net cost of training an apprentice was roughly $5991 and $9381 in the craft and industrial sectors respectively (1990 U.S. dollars). The difference between in gross costs was largely due to apprenticeship wages and the costs of training personnel. A more detailed decomposition of gross training costs is given in Table A.1 in the appendix.

However, as Soskice (1993) conjectures, these estimates probably overstate training costs in craft firms. The simple reason is that master craftsmen have considerable flexibility in the scheduling of the training sessions. It would certainly be reasonable to expect that

[9]Both have been converted to 1990 U.S. dollars by first accounting for inflation with the German consumer price index through 1990 and then applying the average exchange rate of the respective year.

much of the training occurs during slack periods of the day when the opportunity costs of the trainers' time is lowest. For instance, a master plumber might be expected to instruct his/her apprentices on days when there are few calls to be made, on the way to a job or at the end of the day. Therefore, the *average* cost of a master craftsman's time probably overstates the actual costs of the periods of training. In contrast, industrial firms usually employ full-time training personnel, who often train apprentices in classroom settings away from the production line. The reported costs for these firms are more likely to approximate the true costs of the resources required for training.

Though analysts in the U.S. have recently discovered the issue, the size of the net cost of apprenticeship training has been a matter of considerable debate in Germany for decades. For example, in the face of rising cohort sizes during the Seventies, the issues of financing and employer incentives were hotly debated. For instance, in a recent Federal Report on Vocational Training (Berufbildungsbericht 1993, p. 27) published by the Ministry of Education and Science, state governments were concerned about a rising number of firms which have cut apprenticeship positions in some fields due to cost considerations. For their part, labor representatives have sought to understate the costs in an attempt to pressure employers to provide more training slots for potential members. On the other side of the debate, employers have overstated costs to promote a public image of social consciousness, to bargain for greater public subsidies for vocational schools and to obtain more flexibility in the type of training they provide to apprentices. It is of some importance, therefore, that both panels charged by the government with evaluating the net costs of employer training have concluded that the net costs are substantial.

Soskice (1993) and Steedman (1993) both distinguish between apprenticeships at large, industrial firms where, they believe, the net costs are large and positive. and smaller craft firms, where master craftsmen are presumably reimbursed for their efforts by the relatively inexpensive labor of apprentices. One way to test for the importance of this distinction is to observe how the number of apprentices in each sector varies with the business cycle. If smaller craft firms are merely selling their training services and if firms in the industrial sector are making large positive investments, we might expect the two to have very different trends over the business cycle.

In the two panels of Figure 1, we plot the following series: the number of apprentices in the craft and industrial/trade sectors relative to 1965 and the unemployment rate in the Federal Republic of Germany.[10] During each recession over this period, 1967-68, 1973-1975 and 1981-1983, the number of apprentices in each sector slumped. However, following the recession of 1967-68, after which unemployment in Germany began to climb, the number of apprentices in the industrial/trade sector declined until 1974. We take this as being consistent with the story that craft apprenticeships and apprenticeships at large industrial firms may have different underlying incentive structures which have been affected differentially by the rise in German unemployment.

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[10]The source for these figures is the Statisches Bundesamt, Bildung and Kultur Fachserie 11, Reihe 3, Berufliche Bildung, 1986, p. 11.

IV. Evaluating Reasons Why German Firms Might Invest in General Human Capital

In the classic Becker formulation, firms and workers are predicted to share the costs and benefits of firm-specific investment, with worker turnover being endogenous.[11] We have little direct evidence with which to test this proposition. However, we have reason to believe that much of the training is general, gue to the regulatory pressure to standardize apprenticeships. Industrial chambers, which license firms seeking to hire apprentices, regulate the type of training which occurs in two ways. First, they develop the tests which apprentices must pass to receive their skilled worker certificate. These tests focus upon general skills. Firms with consistently low pass rates have their licenses revoked. Second, the chambers not only regulate the output of apprenticeship training programs, but often regulate the content as well. For instance, they may list the skills which the training program must cover as well as, in some cases, the amount of time they are to receive in the curriculum.

However, though there are reasons to believe that much of the training is general in nature, we do not pretend to have the data to determine the specificity of the skills imparted during an apprenticeship. Rather, we first describe and evaluate 3 different characteristics of the German labor market institutions which may lead firms to provide general human capital skills which are not contemporaneously financed by worker productivity:

- o Union Collusion, Works Councils and Restricted Mobility
- o Firing Costs, Uncertainty and Option Value
- o Unobserved heterogeneity in Worker's Costs of Mobility

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[11]For a discussion of the use of deferred benefits packages in employment relationships, see Lazear (1981).

A. *Union Collusion, Works Councils and Restricted Mobility*

Soskice (1993) has offered a provocative hypothesis regarding the role of unions in financing apprenticeship training. As a result of German labor law, wage floors are set by region and industry through negotiations between industrial unions and employers' associations. However, individual employers and works councils negotiate supplements to these minima at the firm level. The works councils in each of the plants are elected by employees and typically have strong informal ties to local unions. Although employers maintain control of hiring decisions, Soskice argues that works councils effectively limit the "poaching" of skilled workers trained elsewhere through their influence over these wage agreements. A union as a decision-making unit would have the incentive to foster this investment to increase the size of the stock of human capital it controls. In other words, according to Soskice, unions help to solve the borrowing constraint problem by limiting non-training firms' ability to attract workers and, thereby, allowing employers to make "loans" to apprentices for general human capital investments.

However, the data are not fully consistent with this explanation. First, turnover rates are much higher than popularly believed, even within the industrial sector. Figure 2 portrays the proportion of apprentices leaving the firm where they were trained by year of apprenticeship completion and timing of departure. For instance, roughly 30% of all apprentices leave the firm where they were trained immediately upon completion of their training. At the end of the first year, 40% will have left. Further, within 5 years of the end of training, 70% of the typical firms' apprentices have left. As evident in Figure 2,

departure rates vary by sector, being highest within the craft sector and lowest in industry. This is consistent with the notion that craft apprenticships may have zero net costs for employers. However, even in industrial firms with more than 1000 employees, 50% of those completing apprenticeships leave the firm where they were trained within 5 years.

Two other facts are evident in Figure 2. Because retrospective data are available for workers of various ages, it is possible to study the trend in exit rates over time with a cross-section. Note that despite understandably high departure rates in the years immediately following WWII, the leaving rates were stable for decades. Further, at least in industry, exit rates seem to have begun falling during the Seventies. This may be related to the decline in apprenticeships in the industry/trade sector mentioned above, if the firms with the largest retention problems cut their programs.

Though the exit rates reported here suggest that apprenticeships clearly are not the beginning of a life-long relationship between an apprentice and a firm, it is difficult to know how high they would have to be to rule out the Soskice hypothesis. For instance, 5 years may be long enough for firms to recoup their investments, and works councils need only limit mobility within this time. However, given the average monthly earnings of a young skilled workers aged 20-24 of only 2000 DM in 1985 and a net investment of 15000 DM per apprentice in the industrial sector, young skilled workers would need to produce 75% more than their own salary to pay off the investment within 1 year, 23% more to pay off within 3 years and 15% more to do so within 5 years.[12] However, though this last figure falls within the bounds of credibility, it is important to recognize that only 50% of these workers

[12]All of these calculations were made using an interest rate of .06.

last 5 years even in the larger firms.

Tables 3 and 4 report the proportion of those leaving by the size and sector of the training firm and the size and sector of the employing firm. Consistent with conventional wisdom in Germany, small craft firms are the biggest "exporters" of skilled labor and large, industrial firms are the largest "importers." Although firms with more than 1000 employers generated only 6% of the apprentices that left their training firms, they hired 11.2%. Firms with 5-9 employs produced 24% of the apprentices who left their training firm, but hired only 12.2% of them. Only a third (36.8%) of those who left craft firms remained in the craft sector, while 60% of apprentices who left industrial firms remained in the trade or industrial sectors.

Below, we provide evidence on wage differentials enjoyed by those leaving the training firm. Unfortunately, our wage data are only cross-sectional, so it is not possible to identify wage changes for any individual. Rather, one is forced to compare the *current* earnings of the leavers and stayers. Despite the possible interventions of works councils, it seems that those workers who leave within the first year after the end of their apprenticeships earn roughly 11% more on average than the workers who remain with their employers for a lifetime.

We estimated wage differentials for those departing the training firm at different points in their careers.[13] These are reported in Table 5. (In all cases, the monthly earnings

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[13]For each sector (subscripted by j), we estimated the following equation:

$$\ln W_{ij} = \alpha_{kj} + \delta_{1j} Leav_{ij} + \gamma_{1j} School_{ij} + \gamma_{2j} Exp_{ij} + \gamma_{3j} Exp_{ij}^2 + \gamma_{4j} Exp_{ij}^3 + \gamma_{5j} Firm\,Size_{ij} + \epsilon_{ij}$$

where k indexes the field of the apprenticeship. We included dummies for 325 fields of apprenticeship. We also used 7 different dummies for training firm size and 5 dummies for

of those who have remained with the firm where they were trained is the reference category.) In the industrial sector, those leaving the firm within the first year earned roughly 17% more than those who remained with their employer. Those leaving immediately enjoyed smaller differentials, but since many of these were not offered contracts by their employers, they would have been expected to have been the inferior workers given the wage minima. Quite interestingly, the differentials decline for those leaving industrial firms at later points. This is not true in the public sector, for instance, where the wage differentials do not vary by time of departure, possibly reflecting a persistent public-private wage difference. The differentials were also much smaller for those leaving craft firms. Again, this is consistent with the notion that there is little net investment in craft workers. When workers bear the costs of general training, they are paid their productivity whether they stay or leave.

Unfortunately, we cannot identify whether the skilled workers are joining "free-riding" firms which do no training. However, it seems that a number of firms, particularly medium-sized firms, provide little or no apprenticeship training.[14] Using preliminary results from a survey of two thousand German manufacturing firms, we find that about 20% of the firms with more than 100 and fewer than 500 employees provide no training at all.[15] For larger firms, the proportion doing no apprenticeship training at all is virtually zero.

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those leaving at different points in their careers.

[14]Soskice (1993) reports data from a survey of employers regarding apprenticeship training programs. However, response rates were quite low in that survey. Since the survey was explicitly focused upon training issues, one might have expected training firms to be more likely to respond.

[15]These results are based upon an innovation survey commissioned by the Federal Ministry of Research and Technology and administered by the Zentrum fur Europaische Wirtschaftsforschung.

However, the *extent* to which firms train varies considerably. For example, while the average number of apprentices per 100 employees is 4.2 in this sample, about 40% of the medium-sized firms have fewer than 2 apprentices per 100 employees. Exploring the sources of variability in these data may provide additional clues.

B. *Firing Costs, Uncertainty and Option Value*

In the German labor market, the combination of high firing costs and binding wage minima confers value upon any information employers can gather regarding a particular employee's productivity before hiring them. Since an employer can decide not to hire an apprentice, but faces considerable costs when firing a regular employee, the firm may be willing to subsidize apprenticeship training. Therefore, regardless of any human capital which may be developed along the way, such apprenticeship programs may serve as an expensive employment test for which employers are willing to pay. However, unlike a simple employment test, observing an apprentice provides more information than just their *current* productivity. It also allows an employer to observe one's capacity for *learning* new skills (i.e. one's human capital production function). Since wage bargaining in Germany often regulates not only the level of earnings, but the returns to tenure as well, this information on an employees ability to learn and adapt could prove quite valuable.

As Abraham and Houseman (1993) suggest, high firing costs make apprenticeship programs valuable for a second reason. A German firm may more flexibly adjust apprentice employment than the regular workforce. Apprentices, then, become a buffer for adjusting employment levels with short-term demand fluctuations. Therefore, even if there were no

information gathered during the course of the training, having a reserve pool of apprentices may be valuable, again due to the high firing costs in Germany.

Firms' ability to layoff groups of workers has been heavily regulated under German law, although such regulations were loosened in 1986. From 1972 to 1986, employers laying off more than 10% of their workforce or more than 30 workers were required to negotiate a severance package for the employees.[16] (Firms unable to reach such agreements were required to submit to arbitration.) Hemmer (1988) estimated from a sample of 145 such compensation plans, the median settlement was equal to 15 to 25 weeks of pay for the average blue collar worker.[17] As part of the "Employment Promotion Act of 1985", these limits were loosened somewhat, to apply only to layoffs involving 20% of the workforce or 60 workers. Employers are also required to provide minimum amounts of advance notice depending upon the tenure of the employee.

The extent of regulation is less clear for individual dismissals. The works council must be consulted before any dismissal of a regular employee. Although the employer need not receive the approval of the works council to fire an employee, the works council's finding may be used by the former employee in any subsequent legal challenge.

Initial entry into apprenticeship programs at larger firms is competitive. In the *Qualifikation und Berufsverlauf* survey in 1979, respondents were questioned regarding their school performance in mathematics and german. In Table 7, we report the proportion of apprentices in different sectors reporting that they were one of the best in the class in math

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[16]See Abraham and Houseman (1993a) for a more detailed description.
[17]We found this cite in Abraham and Houseman (1993).

or German by sector and by size of training firm. There seem to be important differences, particularly in math performance. For instance, 17% of those entering apprenticeships at firms with over 1000 employees reported being in the top of their class as opposed to 10% of those completing apprenticeships at firms with less than 4 employees. Further, 14-15% of apprentices in the industrial/trade sectors reported high math grades as compared to 10% of craft apprentices. Further, these figures probably understate the differences, since apprentices in the industrial sectors are likely to have attended more competitive middle schools.

As Soskice(1993) describes, in the presence of wage minima and high firing costs, firms have an incentive to attract and identify the most productive workers. However, as we saw above, the rigidity of the German labor laws can be overstated. First, with the employer supplements, the wage minima are often not binding. Therefore, there is often room for adjusting the wages of a particular worker downward if they prove to be less productive than expected. Second, employers may have alternatives to apprenticeship training programs to evaluate skilled workers. Until 1985, employers could hire workers on fixed term contracts of 6 months. During this period, such employees are not covered by the laws requiring prior notification or the negotiation of severance packages. In 1986, this limit was raised to 18 months. The use of such contracts has increased in recent years. Therefore, while we find the option value explanation intriguing, an apprenticeship program is not the only chance employers have to learn about the productivity of specific workers before incurring substantial firing costs. Further, to the extent that this is the explanation for employer participation in apprenticeship training, much of that incentive may have been

weakened by the legal reforms of the Eighties.

C. *Unobserved Heterogeneity in Worker Tastes for Mobility*

The combined evidence of leaver wage differentials, particularly in industrial firms, and high departure rates provide a puzzle to be understood, since they would be consistent with evidence of poaching by other employers. However, a remarkable proportion of German workers report that they have never moved to take another job. In 1986, for instance, 80% of the German workforce reported that they had never done so. This fact may indeed have some significance for the current debate. In a simple model sketched below, firms may be willing to invest when there are initially unobserved differences in worker tastes for mobility. As long as there are "enough" workers with high costs of mobility willing to work for the local employer, one might observe firms continuing to provide training in the presence of considerable turnover and poaching by other employers. In expectation, there must simply be enough "trapped" employees from whom the employer can extract payment.

Suppose that apprentices have quite different tastes for moving, δ_i, which are unobserved by firms or workers at age 16, when apprentices join the training firms. Suppose that W_u,W and W_l represent the present value of the lifetime wages of unskilled workers, skilled stayers and skilled leavers respectively. Further, suppose that C represents the (constant) net costs of training incurred by employers and F() is the distribution function for worker mobility costs (δ_i). A worker would decide to remain with the training firm after the training as long as the payoff to leaving did not exceed the costs of mobility ($\delta_i \geq W_l$-W).

Then the proportion of apprentices choosing to leave the training firm could be described as below:

$$P=F(W_l-W)$$

Youth would be willing to undergo the training as long as the expected wage of the apprentice exceeded the wage of the unskilled worker ($PW_l+(1-P)W \geq W_u$) and that the stayers wages exceed the wages of local unskilled workers during all periods after the training is complete. Employers would be willing to continue to train workers as long as the following condition remained true (W_l presumably measures a worker's actual productivity):

$$(1-P)(W_l-W) \geq C$$

For such an equilibrium to exist, workers and firms must be ignorant of any particular workers training costs. Otherwise, youth with high known mobility costs may avoid apprenticeship training and attend university instead.

This could not be long-term equilibrium, since firms would be tempted to enter local markets to take advantage of wage differentials. Note also that this is only a partial solution to the lack of a capital market for worker investment. There will still be underinvestment in worker training, since firms would stop providing training at the point where $C=(1-P)(W_l-W)$, rather than at the social optimum, where $C=(W_l-W)$.

Using a discount rate of 6%, we calculated the present value of the earnings differentials of those leaving within the first year after the training (but not immediately) and

those remaining with the training firm.[18] We estimate that those who leave the firm within the first year earned roughly 73,000 DM (1986 DM) more over 40 years of work experience than those who remained with the firm that trained them. If 70% of apprentices leave the firm where they were trained, then $(1-P)(W_I-W)$ in this case would be 22,000 DM. As we saw in Table 2 above, this is of comparable magnitude to the 24,000 DM net cost over two years as repored in Table 2 above.

The existence of such an equilibrium obviously depends upon the distribution of δ_i. More specifically, 30% of apprentices must have mobility costs exceeding 73,000 DM. Even though this refers to the discounted value of such costs over a lifetime, such an estimate may seem ludicrously high for an American reader. Indeed, this could be one reason why we see few American firms seeming to make training decisions which are not financed contemporaneously. However, the desire to remain near family and home may be stronger in Germany and, hence, allow for more such investment by firms.

[18]The lifetime earnings differentials were calculated by estimating a quartic in experience for leavers and stayers, controlling for firm size and field of apprenticeship effects.

V. Why Are German Firms More Willing to Invest in Firm-Specific Human Capital?

In the above section, we outlined several possible explanations for German firms' potential willingness to share the costs of general training. However, the question remains open whether the portion of the training financed by German employers is general or firm-specific. To the extent that the training is specific, the puzzle is no longer *why* German firms provide this training at all, but why German firms are *so much more willing* to do so than employers in the U.S.. Although we do not have the data to provide a careful test, we offer in this section a hypothesis which is consistent with what we observe.

Clearly, not all of the skills imparted during an apprenticship are general in nature. One imperfect test of the specificity of the training is to compare the proportion of leavers and stayers who report that the training received during their apprenticeship was useful in their current jobs. In Table 8 we report the proportion of apprentices reporting that they utilize "very much" or "quite a lot" of their training in their current jobs. These are reported by sector and timing of departure from the training firm. In each sector, 75-85% of those who remained with the training firm report that their apprenticeship training was useful in their current job. On the other hand, 45-55% of those who left the training firm report that the training they received was helpful in their current job. This difference was similarly large in each sector, including crafts. Therefore, at least from this subjective measure, much of the training would appear to be specific in nature.

We find it intriguing that, given the differences in human capital investment in the U.S. and Germany, we do not observe differences in wage growth over the life-cycle of

German and American workers.[19] In Figure 3, we plot the average weekly earnings of male HS graduates and former German apprentices by age. Given the vagaries of exchange rates and purchasing power, one should not take the similarity in intercepts too seriously.[20] Rather, it is the shape of the age-earnings profile which is quite striking. Earnings seem to follow similar patterns over the life-cycle, at least among those working. This is quite provocative, given the apparent differences in human capital investment in the two countries.

One potential reason for the similarity in the age-earnings profiles despite apparent differences in human capital investment is the difference in the return to job search in the U.S. and Germany created by the relative inflexibility of the German wage structure. Figure 4 reports the cumulative distribution functions of log weekly earnings for male U.S. high school graduates age 25-40 and similarly aged apprentices in Germany.[21] (To avoid the issue of comparability of U.S. dollars and German marks, both are reported as deviations from the median log weekly earnings.) As is evident, the distribution of earnings has wider tails in the U.S. than in Germany, particularly in the lower half of the distribution.

Figure 5 reports the average job tenure and proportion with less than 3 years of experience with the current employer for employed male high school graduates (with no

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[19]Under the Lazear story, wage profiles may be even steeper in Germany if firms are deferring payments to protect firm-specific investments.

[20]These figures were calculated using non-self-employed males, age 21-60. The U.S. figures represent reported weekly earnings in the outgoing rotation files from the *Current Population Survey*. The German figures were calculated using monthly income divided by 4. To convert them into 1990 dollars we first used the German CPI between 1986 and 1990 and then the exchange rate of 1.64.

[21]The data for the U.S. are drawn from the outgoing rotation groups of the CPS in 1986. Self-employed workers have been excluded. The data from Germany are categorical reports of monthly earnings. Because the underlying data are categorical, the observed c.d.f is not smooth as reported in Figure 4.

college) in the U.S. and apprentices in Germany.[22] The gap in average tenure expands throughout the life-cycle and U.S. males are consistently more likely to have been in their jobs for less than 3 years. U.S. workers are much more likely to switch jobs throughout the life-cycle.

As the job search and job-matching literature suggests, the returns to job search will increase with the variance in wage offers one can expect to receive. It is impossible to say how much of the difference in wage variability is due to greater heterogeneity in ability in the population or in the variation in job matches. However, to the extent that the residual variation is due to greater variability in job matches, American workers may simply invest heavily in job search at young ages because it pays to do so.

Indeed, Topel and Ward (1992) estimate that at least a third of the wage growth achieved by U.S. workers between the ages of 18 and 34 occurs at job transitions rather than within jobs. Consistent with Jovanovic (1979), there may be a trade-off between job search and firm-specific human capital investments. Firms and workers will be less likely to invest in firm-specific human capital when the probability that a worker will find a better match with another firm is high. Therefore, German workers and firms may be more willing to invest in firm-specific human capital *because of* the compressed wage structure generated by centralized wage bargaining. Observers such as Kochan and Osterman (1991) have pointed to job turnover as being an obstacle to firm-specific investment. Since turnover itself might be expected to be endogenously determined, it is important to be able to point to the particular institutional structures in the two countries which might lead to such differences.

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[22]The U.S. figures were calculated using the January, 1987 *Current Population Survey.*

The answer may lie in the wage structure.

IV. Discussion

In this paper, we first surveyed three possible reasons for the apparent net investments by employers in worker training observed in Germany. Several hypotheses stand out:

> *Union Collusion and Restricted Mobility:* Soskice (1993) has suggested that, through their presence on works councils, unions may allow firms to make loans to workers by restricting worker mobility and preventing firms from poaching workers trained elsewhere.

While this is an intriguing hypothesis, departure rates are actually quite high even for large, industrial firms. Given their short tenures, if workers are reimbursing firms, they would need to have productivity considerably higher than their wages in the first few years after their apprenticeships. Further, workers leaving training firm seem to earn more than those who remain with the firm that trained them.

> *Uncertainty, Firing Costs and Option Value:* In the presence of rigid wage structures and high firing costs, firms may place a high value on information regarding a particular worker's productivity. Apprenticeships may serve as an extended employment test for firms to identify the most productive workers.

This may have been an important part of the reason firms established apprenticeship programs in the past. However, beginning in 1986, firms were allowed to hire workers on contingent contracts for up to 18 months before being subject to the regulations covering worker dismissals. This may be a much less expensive way to collect information and, to the extent that high firing costs have provided the incentive to invest in apprenticeship training in the past, may lead some firms to dismantle their training programs.

Heterogeneous Costs of Mobility: If there are enough workers with very high costs of mobility, the economy may reach a short-term equilibrium in which firms geographically isolated from other firms in the industry are willing to invest in training in the face of high worker turnover, extracting the costs of such training from the workers who remain.

Given the magnitude of the costs involved, this hypothesis could not explain the investment decisions of all firms, particularly those in large cities located near similar firms. Further, such differentials could not persist in the face of firms entering local markets to hire away loyal skilled workers. However, for those firms geographically more isolated from firms in the same industry, worker immobility could provide a convenient financing mechanism in the short-term.

Relevance to the Debate in the U.S.

Any policy to develop school-to-work programs in the U.S., must be based upon a clear understanding of employer incentives. Above we outlined 3 different reasons why German firms might accept part of the costs of general training. Unfortunately, none of these forces would be expected to dominate in the U.S.. With unions representing only 15% of the workforce and enjoying much weaker legal standing, they could hardly be counted upon to limit employer poaching. Further, as the experience of the Eighties has demonstrated, wages are relatively flexible in the U.S.. This fact, along with low firing costs, would grant low option values to firms interested in recruiting apprentices for the sole purpose of finding the most productive. Finally, there may be many too few workers with high mobility costs to sustain an equilibrium such as the one sketched above.

Why might German firms also be more willing to invest in specific human capital? We hypothesized above that one reason for the relative lack of firm-specific training in the U.S. may lie in the wage structure: the higher the variance in wage offers, the higher the payoff to job search; the higher the payoff to job search, the lower the incentive for firms and workers to invest in specific skills. However, wage flexibility has advantages too. It is important to note that, from the point of view of economic efficiency, the high-search/low-investment equilibrium may even be preferrable to the low-search/high-firm-specific-investment equilibrium. Unconsummated job matches represent missed opportunities, just as the failure to make worthwhile firm-specific investments is a loss to the economy.

As we argued above, it may not be an historical accident which has U.S. firms to invest less in general or specific skills. Simply extolling the virtues of the German model, as has occured in the current debate, is not likely to persuade firms to make such investments. One method for artificially creating training incentives for employers would be to establish a payroll tax against which training expenses can be deducted. In fact, the Commission on the Skills of the American Workforce (1990) has given voice to such a proposal. In the face of mushrooming cohorts of 16-19 year-olds in the late Seventies, the Social Democratic Party proposed a similar measure in Germany. Though the proposal had considerable support within the SPD, it was never enacted due to employer opposition. Such a tax would overcome the borrowing constraint on human capital investment by workers, but at the price of encouraging a number of potentially offsetting inefficiencies. Presumably, not

any kind of training expense is socially worthwhile.[23]

As we proceed in the debate over policies to promote human capital investment in the U.S., it will be useful to keep in mind that the underlying market failure is the inability of workers to provide collateral to banks or to the training firms in seeking to finance general training. After all, workers themselves have always had an incentive to invest in general skills which are valued on the job market. However, they may simply not be able to secure a loan to finance the training. Guaranteed student loans were designed to fill this void. However, such funds can be used only at universities, community colleges or proprietary schools-- not to finance on-the-job training. Yet it is currently widely believed that on-site training with an employer has greater pedagogic value. This is the primary source of the current momentum behind school-to-work initiatives rather than policies to promote postsecondary education. However, without understanding the incentives, there is a real danger that we may invest heavily in isolated firm-based apprenticeship programs which may rely upon public subsidy to survive. There may be ways to build ties between *schools* and employers which are more consistent with our institutions and current funding mechanisms.

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[23]Under such a plan, employers will still have an incentive to provide the type of training that workers desire, rather than simply being wasteful. However, since such costs would be subsidized, the firms would have an incentive to invest beyond the point where they were worthwhile.

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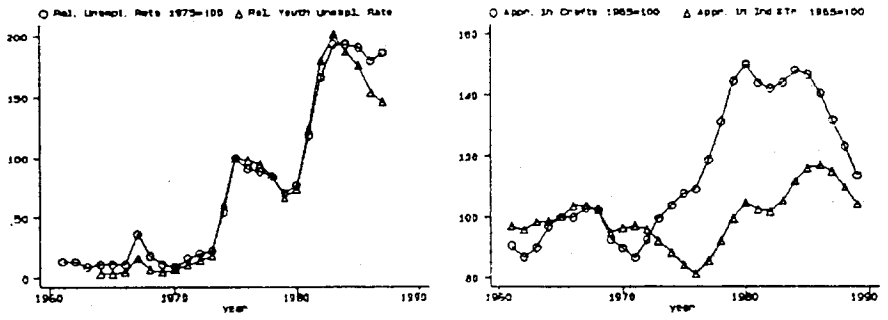


Figure 1. Unemployment in FRG and Number of Apprentices by Sector

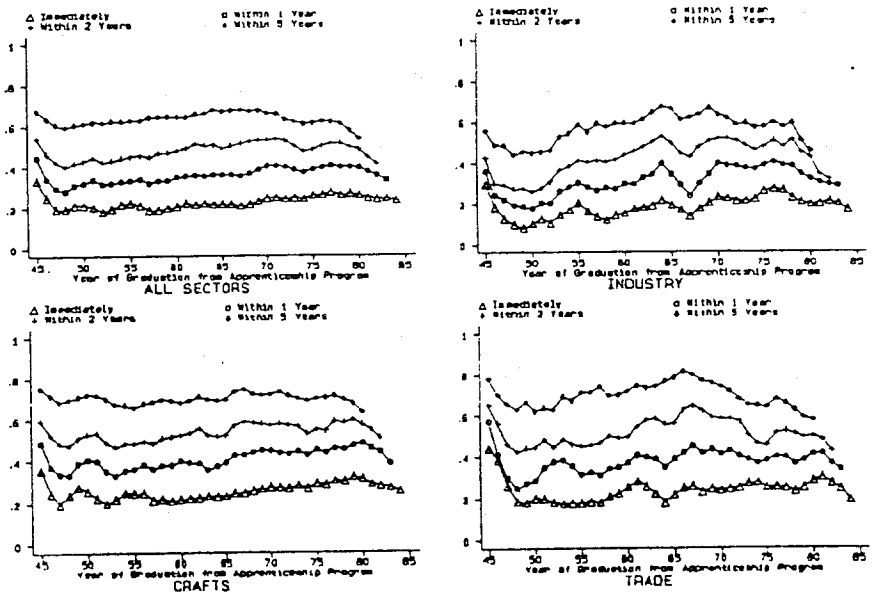
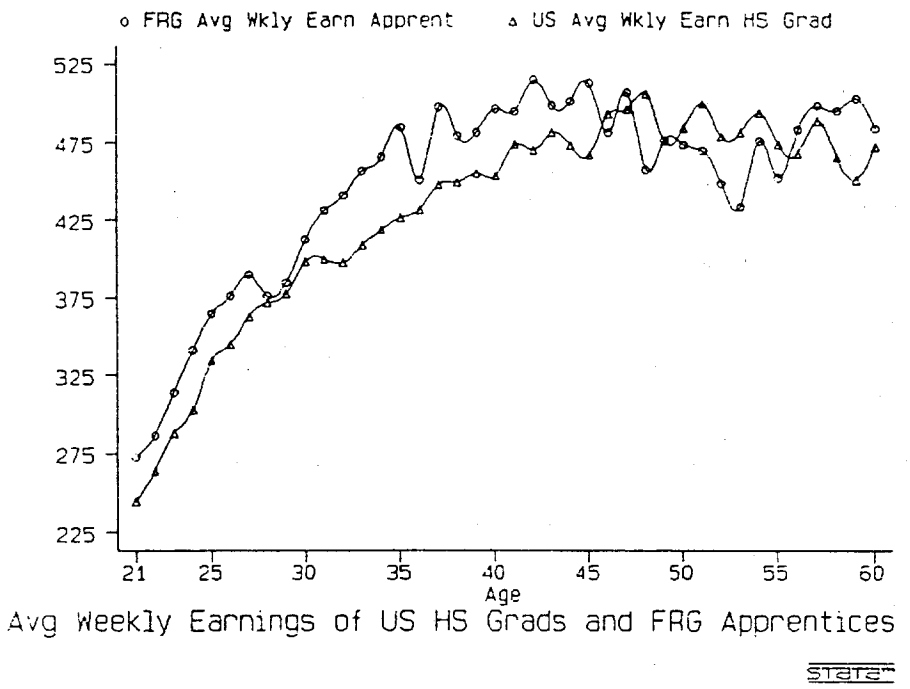

ALL SECTORS
INDUSTRY
CRAFTS
TRADE
Apprentices Leaving Firms by Cohort and Sector

Figure 2.


o FRG Avg Wkly Earn Apprent
Δ US Avg Wkly Earn HS Grad
525
475
425
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Age
Avg Weekly Earnings of US HS Grads and FRG Apprentices

Figure 3.

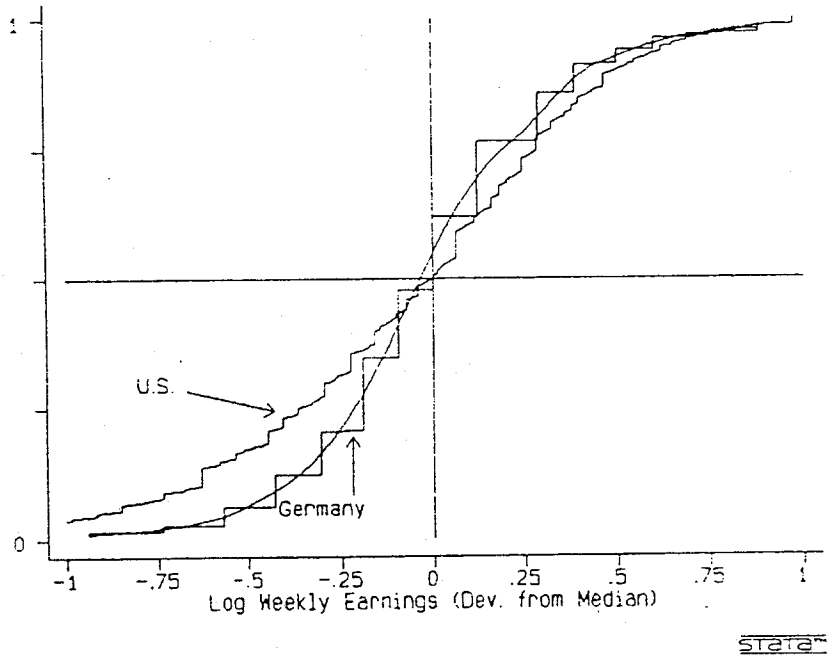
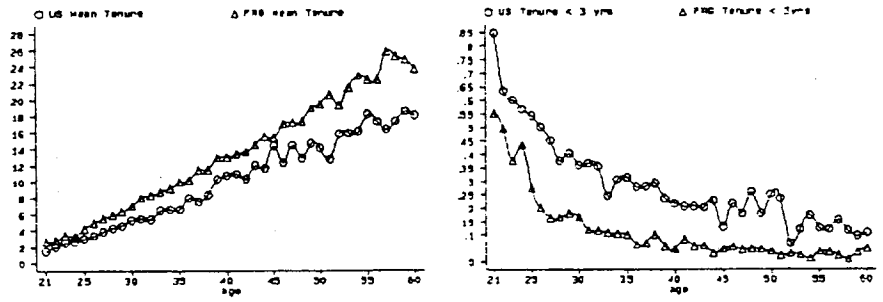


Figure 4. Distribution of Log Weekly Earnings for Male U.S. High School Graduates and German Apprentices Age 25-40



Job Tenure of Male US HS Grads and German Apprentices

Figure 5.

Table 1
Educational Background and
Average Monthly Wages of Male German Workers

Educational Background by Age Cohort

	Year Turned 18:		
Educational Attainment:	1955-1962	1963-1970	1971-1978
10 Years of Schooling or less	17.0%	12.8%	9.4%
11-13 Years of Schooling	1.0%	1.3%	2.2%
Dual System:			
Apprenticeship Only	61.9%	63.0%	66.3%
Apprenticeship + Master Certificate	8.3%	7.4%	5.1%
Technical University (3-year program)	4.6%	3.8%	5.4%
University (4-year program)	5.8%	9.6%	8.5%
Other Postsecondary	1.4%	2.1%	3.3%
	100.0%	100.0%	100.0%
N:	2952	3144	3387

Note: Derived from authors' tabulations of the *Qualifikation und Berufsverlauf Survey* 1985/86. The data do not include guest workers.

Average Monthly Wages by Age Cohort

	Year Turned 18:		
Educational Attainment:	1955-1962	1963-1970	1971-1978
10 Years of Schooling or less	$1792	$1765	$1769
11-13 Years of Schooling	2649	2500	2213
Dual System:			
Apprenticeship Only	2193	2148	1841
Apprenticeship + Master Certificate	2923	2632	2256
Technical University (3-year program)	3524	3037	2169
University (4-year program)	3952	3168	2448
Other Postsecondary	2310	2149	1808
N:	2952	3144	3387

Note: Wage figures in 1990$. These estimates were derived from authors' tabulations of the *Qualifikation und Berufsverlauf Survey* 1985/86. The wage figures were deflated and then converted to US$ at a rate of 1.62 DM/$. The data do not include guest and part-time workers.

Table 2

Costs of Apprenticeship Training By Training Sector

1971/72 and 1980 Estimates

1971/72 Estimates: (Per apprentice and year.)

Training Sector	Gross Costs	Apprentice's Productivity	Net Costs	Net Costs as % of Gross Costs
All Sectors*	$7774	$3518	$4255	55%
Industry and Trade*	9171	3046	6123	67%
> = 1000 employees	10600	2640	7959	75%
< 1000 employees	9080	3072	6006	66%
Crafts	6233	3163	3071	49%
Consultancy Professions	7869	5979	1890	24%
Public Service	n.a.	n.a.	n.a.	n.a.
Agriculture	6360	5906	453	7%
Health sector	6299	6197	102	2%

Source: Sachverständigenkommission (1974). * Weighted averages computed by the authors.
Note: All cost figures in 1990$. The 1971/72 figures were deflated and then converted to US$ at a rate of $1.62/DM.

1980 Estimates: (Per apprentice and year.)

Training Sector	Gross Costs	Apprentice's Productivity	Net Costs	Net Costs as % of Gross Costs
All Sectors	$12845	$5091	$7755	60%
Industry and Trade	14654	5272	9381	64%
> = 1000 employees	n.a.	n.a.	n.a.	n.a.
< 1000 employees	n.a.	n.a.	n.a.	n.a.
Crafts	10939	4947	5991	55%
Consultancy Professions	13199	4700	8499	64%
Public Service	17855	2814	15041	84%
Agriculture	10420	7673	2746	26%
Health Sector	n.a.	n.a.	n.a.	n.a.

Source: Noll et al. (1983), Tables 1 and 2
Note: All cost figures in 1990$. The 1980 figures were deflated and then converted to US$ at a rate of $1.62/DM.

Table 3
Apprentices by Size of Training and Employing Firm
(Leavers Only)

Training Firm - Number of Employees	Employing Firm - Number of Employees							
	1-4	5-9	10-49	50-99	100-499	500-999	1000+	Total
1-4	*27.3* 29.9	*13.3* 18.2	*21.6* 14.4	*10.3* 14.3	*15.0* 13.4	*4.4* 13.3	*8.1* 12.1	*100.0* 16.7
5-9	*17.4* 27.4	*18.1* 35.5	*25.2* 24.2	*11.1* 22.1	*14.3* 18.5	*5.5* 23.9	*8.5* 18.1	*100.0* 24.0
10-49	*11.7* 21.9	*11.3* 26.4	*33.6* 38.2	*12.2* 28.9	*18.3* 27.9	*3.9* 20.3	*9.0* 22.7	*100.0* 28.5
50-99	*12.5* 7.8	*7.5* 5.8	*24.0* 9.1	*18.6* 14.7	*22.8* 11.6	*6.1* 10.7	*8.5* 7.2	*100.0* 9.5
100-499	*9.3* 7.5	*8.6* 8.6	*17.9* 8.7	*13.5* 13.7	*28.4* 18.6	*7.0* 15.7	*15.2* 16.6	*100.0* 12.2
500-999	*9.1* 1.8	*7.9* 2.0	*20.8* 2.5	*7.9* 2.0	*22.0* 3.6	*11.4* 6.4	*20.8* 5.7	*100.0* 3.1
1000+	*9.7* 3.8	*6.8* 3.3	*12.4* 2.9	*8.9* 4.4	*19.6* 6.2	*8.9* 9.7	*33.5* 17.7	*100.0* 5.9
Total	*15.3* 100.0	*12.2* 100.0	*25.1* 100.0	*12.1* 100.0	*18.7* 100.0	*5.5* 100.0	*11.2* 100.0	n= 10624

Note: Row proportion in italics. Column proportion in regular type face.
Only apprentices between age 25 and 65 are included in the tabulation.

Table 4
Apprentices by Sector of Training and Employing Firm
(Leavers Only)

	Sector of Employing Firm:					
Sector of Training Firm:	Industry	Crafts	Trade	Public Adm.	Other	Total
Industry	*50.9* 43.2	*7.3* 8.7	*9.9* 12.3	*19.3* 21.7	*12.6* 15.2	*100.0* 22.0
Craft	*24.5* 38.3	*36.8* 80.9	*9.9* 22.4	*17.5* 36.1	*11.4* 25.3	*100.0* 40.5
Trade	*13.1* 10.3	*5.7* 6.3	*49.9* 56.8	*15.9* 16.4	*15.3* 17.1	*100.0* 20.3
Public Adm.	*12.1* 2.0	*4.2* 1.0	*6.7* 1.6	*63.0* 13.9	*14.0* 3.3	*100.0* 4.3
Other	*12.6* 6.2	*4.5* 3.1	*9.5* 6.9	*18.1* 11.9	*55.3* 39.1	*100.0* 12.9
Total	*25.9* 100.0	*18.4* 100.0	*17.8* 100.0	*19.6* 100.0	*18.2* 100.0	n= 10624

Note: Row proportion in italics. Column proportion in regular type face.
Only apprentices between age 25 and 65 are included in the tabulation.

Table 5
Log Monthly Earnings Differentials for Male Skilled Workers by Length of Time with Training Firm

Time of Departure From Training Firm:	Sector:					
	Total	Industry	Crafts	Trade	Pub. Adm.	Other
Immediately	.080 (.013)	.069 (.023)	.062 (.020)	.077 (.051)	.046 (.041)	.117 (.044)
Within 1 year	.111 (.014)	.179 (.025)	.063 (.022)	.039 (.055)	.148 (.050)	.162 (.057)
1-2 Years	.056 (.015)	.080 (.026)	.036 (.023)	.048 (.058)	.134 (.053)	-.016 (.061)
2-5 Years	.030 (.015)	.027 (.026)	.017 (.022)	-.000 (.060)	.101 (.043)	.053 (.060)
5 + Years	.031 (.015)	-.003 (.026)	.030 (.023)	.008 (.060)	.129 (.043)	.054 (.060)
N:	8488	2302	3711	829	700	946

Note: All differentials are log monthly earnings differentials relative to workers who have remained with the firm where they were trained. The differentials were estimated in a linear model also conditioning upon firm size of training firm, a fixed effect for the field of apprenticeship, master certification, quartic in experience.

Table 6
Proportion of Apprentices Leaving the Training Firm

Within 1 Year:

	Number of Employees:							
Sector:	< =4	5-9	10-49	50-99	100-499	500-999	³1000	Total
Industry	.61	.53	.39	.35	.31	.29	.26	.33
	(35)	(99)	(494)	(475)	(1017)	(369)	(886)	(3375)
Crafts	.50	.40	.40	.35	.39	.42	.39	.42
	(1045)	(1717)	(1708)	(355)	(210)	(42)	(41)	(5118)
Trade	.42	.37	.36	.35	.29	.32	.39	.36
	(326)	(586)	(850)	(250)	(238)	(34)	(32)	(2316)
Public Adm.	.43	.33	.21	.18	.15	.13	.19	.19
	(36)	(62)	(264)	(180)	(379)	(101)	(186)	(1208)
Other	.44	.44	.38	.36	.36	.24	.16	.39
	(520)	(469)	(520)	(182)	(188)	(42)	(77)	(1998)
Total	.47	.40	.37	.33	.30	.27	.25	.37
	(1962)	(2933)	(3836)	(1442)	(2032)	(588)	(1222)	(14015)

Within 5 years:

	Number of Employees:							
Sector:	< =4	5-9	10-49	50-99	100-499	500-999	³1000	Total
Industry	.79	.84	.70	.64	.56	.54	.48	.59
	(35)	(99)	(494)	(475)	(1017)	(369)	(886)	(3375)
Crafts	.78	.71	.69	.65	.65	.53	.60	.71
	(1045)	(1717)	(1708)	(355)	(210)	(42)	(41)	(5118)
Trade	.70	.74	.69	.67	.60	.67	.66	.69
	(326)	(586)	(850)	(250)	(238)	(34)	(32)	(2316)
Public Adm.	.60	.39	.34	.36	.32	.30	.30	.34
	(36)	(62)	(264)	(180)	(379)	(101)	(186)	(1208)
Other	.66	.70	.60	.54	.58	.40	.29	.62
	(520)	(469)	(520)	(182)	(188)	(42)	(77)	(1998)
Total	.73	.71	.66	.60	.54	.50	.45	.64
	(1962)	(2933)	(3836)	(1442)	(2032)	(588)	(1222)	(14015)

Note: Sample size of cell in parentheses. Only apprentices between age 25 and 65 are included in the tabulation.

Table 7

Apprentices' Self-Reported Performance in Secondary School by Sector and Size of Training Firm

		Proportion Reporting:			
Size of Train. Firm:	Sample Size:	Good Math:	Good German:	Poor Math:	Poor German:
1-4	2972	.110	.065	.101	.121
5-9	4016	.107	.071	.094	.110
10-49	4806	.136	.078	.092	.122
50-99	1579	.136	.085	.091	.096
100-499	2526	.154	.089	.093	.093
500-999	830	.160	.093	.086	.122
1000+	1819	.172	.079	.073	.110
Total:	18548	.132	.077	.092	.112
Sector of Train. Firm:	Sample Size:	Good Math:	Good German:	Poor Math:	Poor German:
Industry	4393	.152	.083	.085	.105
Craft	7290	.106	.051	.092	.142
Trade	2989	.143	.099	.094	.087
Public Adm	955	.199	.116	.077	.071
Other	2921	.137	.101	.104	.085
Total:	18548	.133	.077	.092	.112

Note: The above were derived from authors' tabulations of the *Qualifikation und Berufsverlauf Survey 1979*. These figures do not include guest workers.

Table 8
Proportion Responding that Apprenticeship Training Was Useful in Current Job by Sector and Length of Time with Training Firm

Time of Departure From Training Firm:	Sector:					
	Total	Industry	Crafts	Trade	Publ. Serv	Other
Immediately	.444	.523	.469	.429	.523	.332
Within 1 year	.416	.478	.457	.441	.397	.279
1-2 Years	.442	.514	.449	.514	.596	.382
2-5 Years	.484	.508	.537	.498	.464	.479
5 + Years	.482	.552	.498	.676	.560	.238
Never Left	.735	.779	.815	.786	.751	.591
N:	9713	2612	4238	974	771	1120

Note: The question read "How much of the knowledge and capabilities that you acquired during your apprenticeship are you able to utilize in your current job?... Very much, quite a lot, some, a little, very little or nothing." Respondents were coded with 1 if the response was "very much" or "quite a lot." These estimates have been adjusted for years of experience, field of apprenticeship and size of training firm.

Appendix

Table A.1
Composition of Gross Costs of Apprenticeship Training

1980 Estimates: (Per apprentice and year.)

Training Sector	Cost of Training Personnel	Plant and Equipment, Materials	Apprenticeship Wages and Social Security	Other Costs	Gross Costs
All Sectors	$5223	$834	$6177	$611	$12845
Industry and Trade	5896	1020	7034	704	14654
>= 1000 employees	n.a.	n.a.	n.a.	n.a.	n.a.
< 1000 employees	n.a.	n.a.	n.a.	n.a.	n.a.
Crafts	4515	623	5300	502	10939
Consultancy Professions	5893	659	6034	612	13199
Public Service	7208	1804	7760	1082	17855
Agriculture	2703	1021	6154	542	10420
Health Sector	n.a.	n.a.	n.a.	n.a.	n.a.

Source: Noll et al. (1983), Tables 1 and 2

Note: All cost figures in 1990$. The 1980 figures were deflated and then converted to US$ at a rate of $1.62/DM.