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Vierteljahrshefte zur Wirtschaftsforschung

**Provided in Cooperation with:**

German Institute for Economic Research (DIW Berlin)

*Suggested Citation:* Vilhuber, Lars (1999) : Continuous Training and Sectoral Mobility in Germany, Evidence from the 1990s, Vierteljahrshefte zur Wirtschaftsforschung, ISSN 0340-1707, Duncker & Humblot, Berlin, Vol. 68, Iss. 2, pp. 209-214

This Version is available at:

<http://hdl.handle.net/10419/141240>

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# Continuous Training and Sectoral Mobility in Germany, Evidence from the 1990s\*

By Lars Vilhuber\*\*

## Summary

*This article studies mobility patterns of German workers in light of a model of sector-specific human capital. Furthermore, I employ and describe little-used data on continuous on-the-job training occurring after apprenticeships. Continuous training is quite common, despite the high incidence of apprenticeships that precede this part of a worker's career, but it may act as a substitute for apprenticeships in jobs with high training requirements. Most previous studies have assumed that training was general. In this paper, I show that German men are more likely to find a job within the same sector if they have received continuous training in that sector, a finding that is inconsistent with models of firm-specific and general human capital. These results are similar to results obtained for young workers from the United States, and suggest that sector-specific capital is an important feature of very different labor markets.*

## 1. Introduction

The dual model of German apprenticeship training is widely admired and often cited as a model of on-the-job training (Hilton 1991; Muszynski and Wolfe 1989). Less attention has been paid to subsequent continuous on-the-job training. Post-apprenticeship training is quite common in Germany. In cross-sectional analysis, 2.05 percent of all full-time workers are in some sort of nonapprenticeship training. This compares to 2.14 percent of workers in all types of on-the-job training in the United States.<sup>1</sup>

One of the most common conclusions found in the literature on German apprenticeships is that the training received is quite general (Winkelmann 1996; Werwatz 1997), and that firms incur substantial costs to provide apprenticeship training (Harhoff and Kane 1993). It is argued that firms are willing to provide costly training if general human capital facilitates future company-specific training (Soskice 1994). However, there has been little or no work to verify this latter implication.

Although some authors have looked at mobility after apprenticeship training (Winkelmann 1996; Werwatz 1997), none have done so in the context of continuous training. Pischke (1996) Pannenberg (1996), and Georgellis and Lange (1997) have looked at wage growth associated with continuous training in Germany using earlier versions of the German Socio-Economic Panel (GSOEP), but did not consider mobility.

In Vilhuber (1997), I used data from the National Longitudinal Survey of Youth (NLSY) to show that the mobility patterns associated with the stock of on-the-job

training are consistent with the presence of industry-specific, but not firm-specific, human capital. However, since apprenticeships are less prevalent in the United States, this conclusion may not carry over to Germany. Having acquired a higher initial stock of human capital through apprenticeships, the mobility decisions of German workers may be less affected by subsequent human capital acquisition.

In this article, I focus on sectoral mobility after continuous training to determine to what degree such training is firm-specific. I exploit the longitudinal nature of the GSOEP to study the transition patterns related to incidence and duration of on-the-job training. These patterns allow inference as to the specificity of the human capital thus formed.

## 2. A Model of Sectoral Capital and Mobility

Human capital theory, though primarily interested in the wage and its remuneration of human capital, has implications as to the mobility of workers. This obviously depends on the degree of specificity of the human capital acquired, either through formal or informal training. Most work based on human capital theory has used a dichotomy between firm-specific and completely general capital formation. Recent empirical work on the wage effects of industry tenure (Neal 1995; Parent forthcoming) has shown that this start dichotomy may be too imprecise. Work on on-the-job training has been inconclusive as to the specificity of training.<sup>2</sup>

To fix ideas, consider the following model. It is a model of jobs as inspection goods (Jovanovic 1979), coupled with the usual assumption of an increase in marginal product due to human capital formation (Becker 1993). There is no active job search, but job offers arrive at constant rates, which may differ across sectors.

There are two sectors. The worker is initially employed in sector 1, receiving a wage  $\omega_0 = \gamma(k) = \gamma k$ . The firm pays for the training irrespective of its specificity, and the

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<sup>1</sup> Author's computations based on 1984-1995 waves of German Socio-Economic Panel (GSOEP) for Germany and on the 1979-1992 sample of the National Longitudinal Survey of Youth for the United States.

<sup>2</sup> For a more extensive overview of United States findings, see Vilhuber (1997).

worker's wage is increasing in  $k$ . Offers arrive at a constant rate  $r$ . With probability  $q$ , offers come from sector 2. Both sectors are competitive. In each sector  $i$ , wage offers  $\omega_i(k)$  (the value of worker-firm matches) are normally distributed with mean  $\gamma k \alpha_i$  and variance  $\sigma = 1$ .<sup>3</sup>  $\alpha_i$  is the degree of transferability to the firm making the offer.

The worker will switch firms and/or sectors if  $\omega_i(k) > \omega_0(k)$ , which occurs with probability  $1 - \Phi_1(\omega_0(k) - \omega_i(k)) = F_i(\omega_0)$ . Abstracting from ties, the probability of a sectoral move per period, the inter-sectoral transition intensity, is  $\theta_2(k) = \tau \cdot q \cdot F_2(\omega_0)$ . The hazard function  $\lambda(k)$  is simply the sum of transition intensities. The probability of a sectoral move conditional on leaving the current job is  $M_2(k) = \theta_2 / (\theta_1 + \theta_2) = q F_2 / [(1 - q) F_1 + q F_2]$ .

If training, the process of human capital acquisition, is firm-specific, then  $\alpha_1 = \alpha_2 = 0$ . Industry-specific capital is the case where  $\alpha_1 = 1$  and  $\alpha_2 = 0$ : training is perfectly portable within the same sector, but not across sectors. Finally, general training is portable across sectors, hence  $\alpha_1 = \alpha_2 = 1$ .

Suppose that initially  $k = 0$ , such that all distributions have the same mean. Now consider the acquisition of  $dk$  units of human capital through training. If training is firm-specific, then  $\delta F_i(\omega_0) / \delta k < 0 = i = 2$ . Both transition intensities decline, and so does the hazard. This is so because the firm will share part of the return on human capital with the worker and match most outside wage offers.<sup>4</sup> The conditional probability of a sectoral move  $M_2(k)$ , however, is unchanged, since the desirability of wage offers from both sectors relative to the current wage declines in the same manner. If training is general, then both transitions intensities remain unchanged, and so does the overall hazard. Furthermore, as in the firm-specific case,  $\delta M_2(k) / \delta k = 0$ , since the desirability of wage offers from both sectors increases in the same manner. However, if training is industry-specific, the transition intensity to sector 2 decreases,  $\delta \theta_2(k) / \delta k < 0$ , but the transition intensity to the same sector remains unchanged,  $\delta \theta_1(k) / \delta k = 0$ , since the mean productivity for other firms in the same sector increases by the same amount as for the present firm. Hence, the conditional probability of a sectoral move  $M_2(k)$  decreases, since  $\text{sign}(\delta M_2(k) / \delta k) = \text{sign}(\theta_1 \delta \theta_2 / k - \theta_2 \delta \theta_1 / \delta k) < 0$ . Note that the hazard  $\lambda$  also declines, although by less than in the firm-specific case.

Thus, it is possible to distinguish the three cases by estimating the conditional probability of a sectoral move. A reduction in this probability following the acquisition of human capital is inconsistent with both firm-specific and general human capital.

The model can easily be extended to include nonemployment by defining it as a third sector. It then obtains that (conditional) labor force attachment increases with training if training is not firm-specific, but remains unchanged in the case of more general training.  $M_2$  is now reinterpreted as the probability of a sectoral change, conditional on being

employed in the next period, and I denote by  $M_{job}$  the probability of being employed, conditional on separation.<sup>5</sup>

### 3. Data and Estimation Strategy

In this paper, I use data from the German Socio-Economic Panel (GSOEP) for the years 1992 to 1994. In 1993 (and 1989), the GSOEP asked a series of questions on *Fortbildung* (further, or continuous training) of its respondents. Here, I use information on training incidence, duration (in six increasingly broad categories), and training intensity (hours per week). I merge this information with, on one hand, job market data relating to the period between January 1, 1992, and the 1993 interview and, on the other hand, labor market activity at the time of the 1994 interview. The GSOEP questionnaire methodology puts a number of restrictions on the data. First, of those training spells having occurred within the last three years, only the three most recent spells are recorded. About 50 percent of respondents who say they received some training in the last three years received more than three spells during that period. Thus, the observed quantity of training spells is heavily censored. Second, information on financing and the organizing entity are only available for one of the reported training spells, about two-thirds of all training spells. Since I am interested in identifying on-the-job training for all training spells, I circumvent this problem by assuming that training was on-the-job if it occurred concurrently with a job spell. Less than 1 percent of all training spells in the sample (eight spells) cannot be associated with a specific employer, and thus all training spells are considered to be on-the-job.

In light of the data constraints, the following sample selection and estimation strategy is adopted in this paper. The first period is defined as starting on January 1, 1992, and ending with the interviewee's date of interview in 1993. Any individual having worked within this time frame is chosen for the present sample. For these workers, I consider only training having occurred within the same time frame to alleviate the problem of incompleteness. This reduces the censoring problem to, at most, 4.5 percent of the trained subsample.

The second period is defined as the time elapsed between the 1993 and 1994 interviews. Information from the 1994 interview is merged with the sample, allowing identification of four possible states an individual can be observed in and three possible transitions. The four states are: employment with the same employer, employment with a different employer in the same industry (industry stayers), employment in a different industry with a different employer

<sup>3</sup> I assume that the variance is equal across sectors. This is a sufficient condition, but not necessary for our results to hold.

<sup>4</sup> This was suggested by Becker (1993) and formalized by Hashimoto (1981).

<sup>5</sup> See Vilhuber (1999) for more details.

(industry switchers), and nonemployment. This data structure allows us to estimate the probability of an industry change in period 2, conditional on employment in period 1.

In this paper, I will only look at West Germans, due in part to the particularities and differences in the former East German training system, and to the oversampling of the foreign born population. The final sample comprises male blue- and white-collar workers aged 18 to 65 having worked during period 1 and still present in the data in period 2. Workers are excluded if working in either agriculture, fishing, or unclassified service industries, primarily because of small cell sizes. The resultant sample comprises about 1,400 individuals, of which about a quarter have received some type of training in period 1. However, nearly 80 percent never change employers, and only 6 percent are with a different employer in period 2. The small sample sizes involved may thus prohibit generalizations at this point, and the results here are preliminary.

The choice of destination state as outlined in Section 2 can be modeled as a multinomial logit, equivalent to a proportional intensity specification of a duration model with multiple destinations.

The multinomial model posits that the different feasible states are independent. An alternative model is a sequential choice model, where the first decision is about employment after separation, the second, conditional on employment, about sectoral allocation. For the present data, I cannot reject the hypothesis that the sequential logit model is appropriate, and thus Section 4 reports results for the sequential logits. Complete results for the multinomial logit models and the pertaining tests are reported in Vilhuber (1999).

#### 4. Some Basic Results

Industry mobility conditional on changing jobs is high. More than 60 percent of those changing jobs between the first and second period also change industry. When cross-tabulating industry change with training incidence, a strong pattern appears: only 53 percent of those having received some training in the first period change industry when changing jobs, compared to 64 percent for those without training (Table 1).

It is of interest for the present analysis to ask what determines the incidence of training. If training is dispensed in a nonrandom manner by the employer, then inclusion of a dummy for training incidence in the mobility model may be proxying for unobserved characteristics of the trained worker rather than human capital. The employer will certainly offer training to more able workers. However, there seems to be no *a priori* reason why more able workers should be intrinsically less mobile.<sup>6</sup> The employer may choose workers who are less likely to leave the firm, but again it is unclear why workers should show less industry mobility once they have actually left the firm.

Table 1

#### Training and Mobility: Frequencies

|             | On-the-Job Training |       |        |
|-------------|---------------------|-------|--------|
|             | No                  | Yes   | Total  |
| Nonemployed | 71.60               | 65.49 | 69.66  |
| Stayers     | 10.29               | 15.93 | 12.08  |
| Switchers   | 18.11               | 18.58 | 18.26  |
| Total       | 68.26               | 31.74 | 100.00 |

Source: Author's calculations.

Logit models of incidence, not reported here, show that indicators of unobserved ability, such as income and tenure on the last job held, have a strong (positive) impact on incidence. Potential experience is negatively related with incidence. A worker in a job usually requiring an apprenticeship is more likely to receive training, but if this worker actually completed an apprenticeship in this profession then he is no more likely to receive training than a worker in a job where no apprenticeship is required. Blue-collar workers are less likely to receive training than white-collar workers. Marital status, possibly an indicator of reduced mobility, is not significant.

Can these results be taken as evidence that sorting or selection, apart from occupational sorting, plays no role in the incidence of continuous training? To the extent that a higher salary proxies for higher ability, sorting by ability would seem to play a role. But the sorting criterion of interest in the case of training that is not firm-specific is sorting by inherent mobility. Note that even if training is general, employers are willing to pay for it if either the worker can be subsequently tied to the firm (though higher wages, promotion prospects, or other methods), or the worker is otherwise inherently less mobile. It is far from clear that a high salary must be correlated with an inherently lower mobility. A far better indicator of mobility would seem to be marital status, but here it does not seem to play a role.

#### 5. Mobility of Trained Workers

Table 1 reports frequency counts for the proportion of job separations by workers who are either not employed, employed in the same sector, or employed in a different sector at the end of the second period, by incidence of training. Workers having received training are less likely to be nonemployed, and, conditional on being employed, are more likely to be employed in the same sector.

However, logit models of employment attachment fail to confirm the first observation. Employment attachment is convex in experience, positively related to marital status,

<sup>6</sup> See Neal (1998) for a more elaborate argument.

and slightly more likely for workers with higher weekly hours on their last job. Neither continuous training nor the presence of an apprenticeship affects the probability that the respondent is working at the time of the period 2 interview, once other individual characteristics have been controlled for.

One explanation may lie with the German unemployment benefit system. It encourages industry stayers, and, given the long duration of unemployment benefits of up to two years, the sample used here may not be capturing the employment effect of training.

The absence of employment effects may also be attributable to the state of the German economy after 1993. Unemployment was increasing, and Germany was entering a downturn. Preliminary results using both 1989 and 1993 data show an overall employment effect once year effects have been controlled, which lends support to this explanation.

Table 2 reports logit coefficients for the probability of changing sectors conditional on having a different employer at the end of the second period. The first specification includes only variables that describe training requirements and training achievements on the job prior to the switch. As other authors have pointed out, row (1) shows that a worker in his apprenticed profession is less likely to switch to a different industry after a separation, indicating

strong industry attachment through apprenticeship training. The effect of continuous training, reported in row (2), reflects the observation from the raw data, though only on the margin of significance.

In columns (b) to (d), I control for individual characteristics and characteristics pertaining to the last job held, in several permutations. The data seem to favor model (c), which includes industry dummies. The effect of continuous training has the expected negative sign and is significant.

Row (3) reports coefficients on an interaction term, which is set to unity for workers in their apprenticed profession who received continuous training. This term captures any supplementary effect of continuous training on workers who have accumulated a significant amount of industry- or occupation-specific human capital. Throughout, this term is positive and significant, and row (6) reports p-values for a test of the hypothesis that the mobility of former apprentices still in their profession is not substantially changed by continuous training. This hypothesis cannot be rejected in all specifications. Note that this result is obtained even when I control for a quadratic in (potential) labor market experience (included in the individual controls). On the other hand, the hypothesis that an apprenticeship and continuous training have the same effect on mobility (row (1) = row (2), test results not reported here) can never be

Table 2

**Mobility Conditional on Subsequent Employment**

|   | (a)               | (b)               | (c)               | (d)               | (e)               |
|---|-------------------|-------------------|-------------------|-------------------|-------------------|
| 1. Currently in apprenticed profession        | -1.403<br>(0.064) | -1.706<br>(0.069) | -2.470<br>(0.071) | -2.032<br>(0.059) | -2.350<br>(0.090) |
| 2. Receipt of continuous training             | -1.681<br>(0.101) | -1.911<br>(0.123) | -4.040<br>(0.023) | -1.930<br>(0.128) | -                 |
| 3. Interaction of (1) with (2)                | 2.466<br>(0.056)  | 3.382<br>(0.034)  | 5.079<br>(0.022)  | 3.551<br>(0.032)  | 4.817<br>(0.036)  |
| 4. Short training spell ( $\leq$ one month)   | -                 | -                 | -                 | -                 | -4.079<br>(0.023) |
| 5. Long training spell ( $\geq$ three months) | -                 | -                 | -                 | -                 | -3.440<br>(0.139) |
| 6. Test <sup>a)</sup>                         | 0.287             | 0.114             | 0.422             | 0.102             | 0.619             |
| Individual controls                           | No                | Yes               | Yes               | Yes               | Yes               |
| Industry controls                             | No                | No                | Yes               | No                | Yes               |
| Occupation controls                           | No                | No                | No                | Yes               | No                |
| Observations                                  | 87                | 81                | 81                | 81                | 81                |
| Log-Likelihood                                | -54.81            | -46.89            | -33.32            | -46.38            | -33.24            |

a) p-values for  $\chi^2$  test of hypothesis that rows (2) + (3) = 0 resp. (4) + (3) = 0. P-values in parentheses. Individual controls: 1992 net monthly income, hours worked, tenure, experience, and its square, years of education, indicators for part-time status, absence of a degree, marital status. Common controls: time elapsed between January 1, 1992, and 1993 interview, and between 1993 and 1994 interviews.  
Source: Author's calculations.

rejected. Thus, continuous training only affects workers who either have never completed an apprenticeship or who have changed sector since completion. I take this to suggest that continuous training may serve as a substitute (from the worker's perspective) for apprenticeship training as an acquisition mechanism for human capital.

In column (e), I separate the incidence of training into short (up to one month) and long training spells. The results show that most of the action comes from short training spells. Long training spells have a smaller effect on sectoral mobility. The latter effect is only marginally significant (p-value of 0.139), which may be due to very small sample sizes in some of the cells.

Shorter spells are more time-intensive. However, the longer spell categories are very broad. Whereas the shortest category comprises just one day, the largest category includes any training spell longer than one year. It is thus difficult to compute consistently the total time spent on training for all spells. When included in the regressions, hours per week spent training had no significant influence on and did not affect other parameters, and thus it was not retained for the present analysis.

## 6. Conclusion

This paper has presented preliminary evidence from German data that on-the-job (continuous) training, defined as employer-provided formal training while holding a job, is sector-specific, rather than firm-specific or completely general. A simple model of human capital investment with random job offers allows the distinction between the three degrees of specificity by looking at the sectoral mobility patterns of workers after separation. I find that, conditional on finding a job, workers are more likely to remain in the sector

if they were trained there, consistent with sector-specific human capital.

Some caveats apply. First, the data used in this paper only use transitions between jobs held in 1993 and 1994. Thus, year effects may unduly influence the results. The results would only generalize if this were a typical two-year period, which seems unlikely. This may explain in part why I do not find any evidence that training increases employment attachment. Here, I suggest that the absence of an employment effect may be due to some as yet unexplained macroeconomic effect. An alternative would be to view the absence of an employment effect as evidence for firm-specific human capital, and to attribute the results on mobility to some unexplained business-cycle effect. A third caveat lies in the small sample sizes. Vilhuber (1999) addresses these issues in more detail.

Using more detailed data on young United States workers, Vilhuber (1997) obtains results that generally support the model of sector-specific human capital. Employment attachment increases with the quantity of training irrespective of sector, and sectoral mobility is reduced by the quantity of training (total hours) acquired with the present employer or other employers in the same sector.

On-the-job training would thus appear to confer industry-specific human capital, of use to a larger number of firms producing similar outputs as the training firm, in both Germany and the United States. Though not answering the still open question of why firms would finance training that could be of use to other firms, it is a result of interest from both workers and a policymaker's perspective. However, the coinciding results for the United States and Germany may be due to two quite different mechanisms, and further research is required to unveil the precise economic model behind these phenomena.

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