German Apprenticeship Training, Earning Profiles and Labour Turnover: Theory and Evidence

Spiros Bougheas[1] and Yannis Georgellis[2]

May 2001

Abstract

We develop a simple labour turnover model of general training. Upon completion of their training, apprentices are equipped with general skills and they accumulate firm-specific skills by continuing working for their training firm. Job turnover is associated with a loss of accumulated firm-specific skills, not fully transferable to new employers. Our model predicts that: (i) post-apprenticeship wage profiles for those workers who stay with the apprenticeship firm are steeper than the corresponding profiles of those workers who find new jobs, and (ii) labour turnover decreases with tenure. Based on data from the German Socio-Economic Panel (GSOEP), turnover patterns and estimated wage profiles of German apprentices support the predictions of the model.

***JEL Classification*:** J24, J31, J41, J62
***Key Words*:** Apprenticeship Training, German Labour Market

[1] School of Economics, University of Nottingham, University Park, Nottingham, NG7 2RD, United Kingdom
Tel: 0115-8466108; e-mail: spiros.bougheas@nottingham.ac.uk
[2] Department of Economics and Finance, Brunel University, Uxbridge, Middlesex, UB8 3PH, United Kingdom
tel: 01895-203174; e-mail: yannis.georgellis@brunel.ac.uk

I. Introduction

The German apprenticeship system has often being quoted as a virtuous example of youth training that has been the cornerstone of the "high skill, high wages" equilibrium in the German labour market. A main feature of the system is that it offers a substantial component of general training by allowing apprentices to attend occupational schools offering theoretical education based on a detailed and well-specified curriculum. State governments, employers' associations and industrial chambers regulate the content and time structure of training, the successful completion of which is certified by central examinations that establish national standards.[1] The success of the apprenticeship system has been attributed to a unique institutional framework that removes many of the obstacles, such as poaching externalities, for firms to sponsor general training. As Culpepper (1999) highlights, a weakening of institutions imposes one of the main, if not the most important, threats for the high skill equilibrium in Germany.

Challenging Becker's (1964) view that in competitive labour markets firms should not pay for general training, recent work focuses on sources of wage compression to explain why firms sponsor such training in non-competitive labour markets, thus offering valuable insight regarding German apprenticeships and their effect on workers' subsequent wage and labour turnover patterns.[2] However, in the context of the unique institutional framework under which the apprenticeship system operates, some of these explanations may be less relevant. For example, certification of skills, sorting of apprentices based on ability, and information exchange between employers, chambers of commerce and state agencies, cast doubt on asymmetric information as a potential source of wage compression.[3] In this paper, we offer an alternative explanation for the observed post-apprenticeship wage and turnover patterns, assuming that although apprenticeship training may be general training, workers

accumulate firm-specific skills by working for their training firm after the completion of training. Workers who change jobs incur a cost associated with the loss of accumulated firm-specific skills. The interaction of such a cost with an exogenous variability in wages and mobility costs is sufficient to explain the observed post-apprenticeship earnings profiles in the German labour market.

The model predicts that when apprenticeship training is general, post-apprenticeship earnings profiles for stayers, those continuing working for their training firm, will be steeper than earnings profiles of movers, those who change employers. Therefore, in large firms, we expect that although upon completion of training stayers may initially earn less than movers, the wage gap between the two groups should decrease with post-apprenticeship tenure. In small firms, where apprenticeship training is more likely to be firm-specific and of lower quality, post-apprenticeship earnings profiles for both stayers and movers are expected to be relatively flat.[4] Our model also predicts that job turnover decreases with tenure because of the loss of firm-specific accumulated skills.

Evidence based on data from the German Socio-Economic Panel (GSOEP) support these predictions. Specifically, we find that in large firms (> 200 employees) although movers earn initially higher wages than stayers, the situation is reversed in about two years after the completion of apprenticeship training. When focusing only on very large firms (with more than 2000 employees) it takes about six years after the completion of training for stayers' wages to overtake the wages of movers. In contrast, estimated earnings profiles of movers and stayers in small firms are relatively flat, with stayers earning higher wages than movers. In addition, we find that the job turnover rate of German apprentices declines with tenure.

In section II, we present the model. In section III, we present empirical evidence on labour turnover and earnings profiles by apprenticeship firm size. In section IV, we conclude.

II. The Model

Consider a multi-period discrete finite model of the labour market; (t = -1, 0, 1, …T). Young, risk-neutral workers start their apprenticeship training, which lasts for one period, at t = -1. We normalise their pre-training level of skills at zero. At t = 0, upon completion of apprenticeship training, workers enter the labour market and decide whether to stay with the apprenticeship firm or to seek employment elsewhere. Assuming that apprenticeship training is predominantly general training, then all workers entering the labour market at t = 0, are endowed with the same level of skill z(0). However, their skill level at later periods depends on whether or not they change employers.[5] By remaining with the same firm, workers improve their skills through the acquisition of firm-specific skills, not fully portable/useful to potential new employers. If the accumulation of firm-specific skills increases with tenure, but at a decreasing rate, then the level of skills accumulated by a worker who stayed with her current employer (stayer) for t periods will be:

$$z_{st} = z(0) + bz_{s(t-1)} = z(0)\sum_{i=o}^{t} b^{i}, \qquad (1)$$

where $0 < b < 1$ captures the rate of accumulation of skills.

For a worker who changed jobs at time t (mover), her level of transferable skills is:

$$g_t = z(0) + \gamma g_{t-1} = z(0)\sum_{i=0}^{t} \gamma^i , \qquad (2)$$

where $0 < \gamma < \beta < 1$. Therefore, the loss in skills associated with changing jobs is equal to ($z_{st} - g_t$), representing the part of accumulated skills that can not be used to increase productivity with the new employer. We naturally assume that this loss increases with tenure. We further assume that while working at the new employer, a worker will continue accumulating firm-specific skills at a rate β. Under these assumptions, the skills profile of a worker who changed employers at $t = \tau$ can be summarised as follows:[6]

For

$t < \tau$: $z_t(t) = z_{st}$,

$t = \tau$: $z_t(t) = g_t$,

and for

$t > \tau$: $z_t(t) = z_{st} - [z_{st} - g_t]$

$$= z(0)\left[\sum_{i=0}^{t} \beta^i - \sum_{i=0}^{t}\left(\beta^i - \gamma^i\right)\right]$$

$$= z(0)\left[\sum_{i=0}^{t} \gamma^i + \sum_{i=\tau+1}^{t} \beta^i\right]. \qquad (3)$$

Expression (3) implies that at any time $t > \tau$, the skill level of a worker who changed job at $t = \tau$ will be equal to: (i) the skills accumulated in her prior employer, only a part of which she can use in the new employer; plus (ii) skills accumulated during her work in the new employer.

Figure 1 illustrates the skills profiles of stayers and movers and the associated loss of skills for movers. At time $t = \tau$, movers are not able to transfer firm-specific skills

accumulated with the previous employer, equal to the vertical distance between the line indicating the accumulated skills of stayers (b) and the transferable skills of movers (g). Notice that this vertical distance becomes larger the later the job change occurs, that is, it increases with tenure. For those who change jobs immediately upon completion of their apprenticeship training (direct movers), the loss of firm-specific skills is zero, as shown also in equation (2) for $t = 0$. At the new employer, movers continue accumulating skills at a rate b. Thus, the skills profile of movers can be summarised by the line (0AB).

Job Changes and Tenure

While wages are related to productivity (skills), there is some variability in cross-firm wages due to local effects or other exogenous reasons. We assume that the wage that a worker receives at firm j is proportional to productivity, with the factor of proportionality k_{tj} following a random walk.[7] Job mobility is associated with mobility costs, m, which are randomly drawn from a distribution with density f on the interval $[\underline{m}, \bar{m}]$.

A worker's decision to change employers at $t = 0$ (upon completion of apprenticeship training) is based on a comparison between the expected earnings by remaining with the current employer and the expected earnings by changing employer. If the worker stays with the apprenticeship firm, her expected lifetime income, V_s, will be:

$$V_s = k_{0s} z(0) \sum_{n=0}^{T} \sum_{t=0}^{n} b^t , \qquad (4)$$

while a mover's expected income V_q is:

$$V_q = k_{0q} z(0) \sum_{n=0}^{T} \sum_{t=0}^{n} b^t - m \,, \tag{5}$$

where k_{0s} and k_{0q} denote the factors of proportionality for stayers and movers respectively. Taken together, equations (4) and (5) imply that a worker will leave the apprenticeship firm when

$$\left(k_{0q} - k_{0s}\right) z(0) \sum_{n=0}^{T} \sum_{t=0}^{n} b^t > m \,, \tag{6}$$

that is, when the earnings differential between the new and the current employer is sufficiently large to compensate for mobility costs.

Next, we consider the more general case where the worker considers a job change after she has remained for t periods with the training firm. The worker's expected income from remaining with the training firm is:

$$V_{st} = k_{ts} z(0) \sum_{n=t}^{T} \sum_{t=0}^{n} b^t \,. \tag{7}$$

If the worker changes employers at $t = t$, her expected income will be:

$$V_{qt} = k_{tq} z(0) \left[\sum_{n=t}^{T} \sum_{t=0}^{n} b^t - \left(T - \left(t - 1\right)\right) \sum_{t=0}^{t} \left(b^t - g^t\right) \right] - m \,, \tag{8}$$

where the first term in the brackets captures the gains from accumulating firm-specific skills at the new employer, while the second term captures the loss of firm-specific skills

associated with the employer change for a worker who is expected to be in the new employer for $T-(t-1)$ periods. Therefore, if

$$z(0)\left[\left(k_{tq}-k_{ts}\right)\sum_{n=t}^{T}\sum_{t=0}^{n}b^{t}-k_{tq}\left(T-\left(t-1\right)\right)\sum_{t=0}^{t}\left(b^{t}-g^{t}\right)\right]>m\,, \tag{9}$$

then the worker will change jobs. Wages at the new employer must be sufficiently high to cover not only the mobility costs but also the loss of firm-specific skills accumulated with the previous employer. For our purposes, we would like to know how the left-hand side of equation (9) varies with t, the time of a potential job change. In other words, given similar distributions across periods of both wages and mobility costs, we are interested in making predictions about the relationship between variations in the likelihood of changing jobs and variations in job tenure. Equation (9) implies, that there are three effects. The first two effects arise from the fact that working life (T) is finite. Therefore, when the job change takes place relatively late (high t), there are few periods of both expected income gains due to the wage difference and losses due to the reduction in firm-specific skills. These effects are captured by the first term and by the (T-(t-1)) part of the second term in the brackets. The third effect arises from the fact that later job changes imply higher losses in firm-specific human capital, captured by the summation part of the second term in the brackets. Because $b<1$, this last effect is likely to dominate when t is low, as it increases at a decreasing rate while the other two effects are linear in t. In the context of German apprenticeships t is small relatively to T because we focus on the behaviour of workers early in their careers, implying that the probability of job changes decreases with tenure.

Tenure and Post-apprenticeship Wages

How do post-apprenticeship wages of stayers and movers vary with tenure? It is natural to assume that each period, among all workers who change jobs, a proportion q does so for exogenous reasons. These workers are randomly distributed among high-wage and low-wage firms. The remaining proportion (1 - q) changes jobs because they have found higher wages in other jobs that compensate for mobility costs and the loss of firm-specific skills accumulated at the previous job. However, workers with higher tenure at their old job are going to experience a larger loss in firm-specific human capital. Inequality (9) defines a cut-off value of mobility costs, $m^*(t)$, which depends on tenure such that workers with lower mobility costs change jobs. Then, for a given tenure, the proportion of workers changing jobs because they have found higher paying jobs is equal to:

$$(1-q)\int_{\underline{m}}^{m^*(t)} f(m)dm\,, \tag{10}$$

which, as demonstrated above, is decreasing in tenure. Workers who change jobs for exogenous reasons, on average, experience a pay cut, because of the loss in firm-specific skills, a loss that increases with tenure. Although workers who quit because of higher wage offers are receiving higher wages than the stayers, their proportion declines with tenure. Therefore, the difference between the wages earned by movers and those earned by stayers decreases with tenure. This implies that post-apprenticeship earnings profiles for stayers will be steeper than the earnings profiles of movers.

III. Empirical Evidence

In this section, we examine whether the observed post-apprenticeship wages and turnover patterns in the German labour market are broadly consistent with the predictions of the model. In order to put the analysis into context, we first summarise descriptive evidence on the effect of apprenticeship training on workers' subsequent employment status. Then, turning our attention to the two main predictions of the model, we provide evidence showing that the probability of a job change decreases with post-apprenticeship tenure. By estimating standard Mincer-type earnings functions, we also examine whether, as the model predicts, the earnings profiles of stayers are indeed steeper than the earnings profiles of movers. Given firm size differences in the quality and nature of training, we pay particular attention at the comparison of post-apprenticeship earnings profiles and turnover patterns between small and large apprenticeship firms.

Our empirical evidence is based on data from fourteen waves of the GSOEP covering the period 1984-1997.[8] Restricting the sample to males, German nationals, we observe 401 workers who completed apprenticeship training between 1984 and 1997.[9] In the last year of their apprenticeship training, these apprentices were on average 22 years of age and they were earning an average hourly wage of about DM4, roughly 30 per cent of the average wage of an unskilled worker. Prior to starting training, apprentices had on average 11 years of education. Specifically, 41 per cent of apprentices had a secondary school degree, 33 per cent had non-class secondary degree, about 11 per cent had completed high school and 7.5 per cent had other secondary degrees. About 7.5 per cent had no degree.

Post-apprenticeship employment status

Table 1 summarises the employment status of apprentices for a period up six years after the completion of apprenticeship training. As Table 1 shows, immediately upon completion of their training, 65.2 per cent of apprentices (262 out of 401 workers who completed apprenticeship training during the sample period) were in full-time employment. About 11.5 per cent were unemployed and 7 per cent were out-of-the labour force. The remaining were either drafted for military service (11.5 per cent) or in part-time employment (about 2 per cent) and a small proportion (2.5 per cent) continued vocational training.[10]

Two years after the completion of training, about 72 per cent of respondents were in full-time work, about 5 per cent were unemployed and 11 per cent reported as being out-of-the labour force. Similarly, five years after the completion of apprenticeship, about 74 per cent of those completed were in full-time employment, only about 5 per cent were unemployed, whilst 17 per cent were out-of-the labour force.[11] In general, the percentage of apprentices in full-time work increases with time after apprenticeship, while the percentage unemployed stabilises at about 5 per cent after an initial increase at about 11 per cent.[12] The percentage of workers reporting of being out-of-the labour force increases with post-apprenticeship time, reaching a peak of about 17 per cent five years after the apprenticeship and then declining.

The size of apprenticeship firm is an important factor for apprentices' employment status, at least for the initial period after the completion of training. As shown in Table 1, the unemployment rate among apprentices in small firms is substantially higher, at least in the first two years after the completion of training, than apprentices in large firms. Such differences by apprenticeship firm size are also highlighted in Winkelmann (1996) who provides evidence showing that apprentices who were trained in large firms had a smoother transition to employment than other apprentices. However, it is also noticeable that the

proportion of individuals who report as being out-of-the labour force is generally higher among those who were trained in larger firms. This is partly explained by the higher proportion among workers who did their apprenticeship in large firms, compared to those who did their apprenticeship in small firms, and pursue higher degrees and participate in further training schemes.[13] There is also evidence that apprentices in large firms are generally of higher ability than the average apprentice, as large firms select the best candidates.

Post-apprenticeship labour turnover

Table 2 shows the proportion of stayers by apprenticeship firm size. As shown in the last column of Table 2, among those who got full-time jobs immediately upon completion of their apprenticeship training, about 62 per cent stayed with the training firm, while 38 per cent got jobs with new firms. However, the proportion of stayers (and movers) differs according to the size of apprenticeship firm. Of those who got full-time jobs after completing their training in small firms (< 200 employees), 64.6 per cent stayed with their training firm. The corresponding percentage of stayers among those who did their apprenticeship in large firms (> 200 employees) is about 58 per cent. A similar percentage (59 per cent) of apprentices who were trained in very large firms (> 2000 employees) stayed with their training firm. It is apparent from Table 2 that most apprentices change jobs immediately upon completion of their training. The proportion of those who change jobs declines with post-apprenticeship tenure and stabilises around five to six years after the completion of apprenticeship training. Five years after the completion of training, about 62 per cent of those who completed apprenticeships in small firms were working for another firm. The corresponding percentage for those who did apprenticeships in large firms (>200 employees) and very large firms (>2000 employees) is about 53 and 58 per cent

correspondingly. These numbers are broadly consistent with Winkelmann's (1996) and Harhoff and Kane's (1997) findings suggesting that about 70 per cent of apprentices left their training firm within a five-year period. In particular, Harhoff and Kane (1997) find that departure rates are higher in the crafts sector (mostly concentrated in small firms) than the industrial sector (mostly large firms). The above evidence does not only support the prediction of the model that the likelihood of a job change decreases with tenure, but it also highlights the importance of firm size as a factor determining the post-apprenticeship turnover.

Post-apprenticeship earnings profiles

Shifting focus to post-apprenticeship wages, we estimate earnings equations in order to compare the wage profiles of movers and stayers. We are particularly interested in examining whether these earnings profiles differ by apprenticeship firm size. For the purpose at hand, stayers are defined as those who remain with their training firm as full-time, salaried employees at time $0 < t < T$, where $t = 0$ is the time of completion of training. The maximum number of years a worker is observed after the completion of apprenticeship is T. A mover is someone who at time t during the post-apprenticeship period is a full-time salaried employee in a firm other than the training firm. Those who were drafted for military service immediately upon completion of their training and who did not return to their training firm are classified as military quitters.

We estimate earnings equations of the general form:

$$w_{it} = b_o + b_1\,(\text{TIME}) + b_2\,(\text{TIME})^2 + b_3\,(\text{STAYER}) + b_4\,(\text{STAYER} \times \text{TIME}) + X_{it}\,g + Z_i\,d + e_{it} + u_i, \qquad (11)$$

where TIME represents the number of years after the completion of apprenticeship and STAYER is a dummy variable with value 1 for stayers (as defined above) and value 0 for movers. The dependent variable (w_{it}) is the log of real hourly wage of a full-time worker *i* at time *t*, X_{it} is a vector of covariates including firm and individual characteristics during the post-apprenticeship period. The vector Z_i includes time invariant covariates such as: dummy variables for the schooling degree of apprentices; the hourly wage during the last year of apprenticeship, W_{APPR}; dummy variables for the calendar year the apprenticeship training was completed; the age of a worker when he completed his training; a dummy variable whether an individual is a military quitter; and a dummy variable whether a full-time worker at time *t* had experienced unemployment between $t = 0$ and $t = t\text{-}1$. The term e_{it} is a random error, and u_i represents unobserved individual specific effects. To be able to estimate the effects of the time invariant variables in Z_i on subsequent wages, we reject a fixed effects specification on a priori grounds in favour of a random effects specification.

Excluding civil servants, the estimation of equation (11) is based on an unbalanced panel of 1630 person-year observations. The results are shown in Table 3. Specifically, column 1 shows the results for those who completed their apprenticeship training in small firms (< 200 employees) while column 2 shows the results for those who completed training in large firms (>200 employees). While the results in column 2 are based on all firms of any size more than 200 employees, in column 3, we restrict the sample to include only the very large firms, that is, firms with more than 2000 employees. We do so in order to focus attention on a more homogeneous group of firms in which training is even more likely to be general and of higher quality than training in smaller firms. However, a drawback of restricting the sample in column 3 to very large firms is the small sample size and therefore the results in column 3 are to be interpreted with some caution.

The results suggest that higher wages during apprenticeship training are positively associated with post-apprenticeship wages. As Winkelmann (1996) argues, apprenticeship wages proxy the quality of training not accounted by firm size. Therefore, the higher quality of an apprenticeship is reflected to a certain extent in the apprenticeship wage and the higher subsequent wages of those who successfully complete such apprenticeships. Education of apprentices is also positively correlated with wages, that is, those with higher educational qualifications tend to earn more after the completion of apprenticeship compared to those with no qualifications. For large firms in particular (column 2), the impact of educational qualifications on post-apprenticeship wages is stronger for those with a high school degree or other equivalent qualification. The post-apprenticeship firm size makes a difference in terms of wages, ceteris paribus, for those who completed apprenticeships in small firms. There is no evidence, at least in terms of conventional levels of significance, that post-apprenticeship earnings of military quitters are higher than the earnings of non-military quitters. The age of apprentices and intervening unemployment spells after completion of training has no significant effect on earnings.

Turning to the main variables of interest, the results show (estimated coefficients b_1 and b_2) that post-apprenticeship earnings for those who did apprenticeships in large firms increase with time after apprenticeship but at a decreasing rate. In contrast, post-apprenticeship earnings for those who completed apprenticeship training in small firms are relatively flat and stayers tend to earn more than movers do. When limiting our attention to very large apprenticeship firms (column 3), we find that there is a statistically significant difference between the earnings of stayers compared to movers – stayers earn less than movers.

Figures 2(a)-2(c) illustrate the post-apprenticeship earnings profiles for stayers and movers in small and large firms. As Figure 2(a) shows, in the case of small firms, earnings

profiles of both stayers and movers are relatively flat, with stayers earning more than movers throughout the post-apprenticeship period. Figure 2(b) shows that for those who completed apprenticeship training in large firms, the earnings profiles of stayers are steeper than those of movers. Although movers earn more than stayers immediately upon completion of apprenticeship training, after about two years those who stayed with their training firm do better than the movers. Similarly, when limiting attention to very large apprenticeship firms, movers earn on average more than stayers in the early years after the completion of training but after about six years, stayers do better. The findings are consistent with Harhoff and Kane (1997) who find that those who completed apprenticeship training in industry and left the training firm immediately upon completion of training earned 8.3 per cent higher wages than stayers. Those who did not leave immediately, but left in the first year after graduation earned 6.6 per cent more than the stayers. It seems that the wage gap between stayers and movers closes as the move occurs at later years after graduation. Interestingly, Harhoff and Kane's (1997) results suggest that stayers start earning more than movers in about five years after the completion of training. As Figure 2(c) shows, in very large firms stayers will start earning more than movers at about 6 years after apprenticeship training was completed.

In general, the above evidence supports the prediction of the model that post-apprenticeship earnings profiles of stayers are steeper than the profiles of movers. It is clear, however, that this is only true in the case of large firms where training is most likely to be general and of high quality. This suggests that controlling for apprenticeship firm size when estimating earnings profiles could offer an indirect test of the extent at which training is general or specific.

IV. Conclusion

In this paper, we have argued that a simple labour turnover model of general training could explain observed post-apprenticeship wages and labour turnover patterns in the German labour market. In our model, workers acquire general skills during apprenticeship and firm-specific skills after the completion of training as they continue working for the training firm. The loss of accumulated firm-specific skills associated with job changes offers a simple explanation for the observed post-apprenticeship labour turnover patterns and wages. We argue that this simple explanation becomes particularly relevant in the context of the German industrial relations system, which has removed many of the obstacles for firms to subsidise general training.

NOTES

1. See Steedman (1993) and Soskice (1994) for a description of the German apprenticeship system.
2. Sources of wage compression include asymmetric information about the quality of training and/or the ability of workers, the interaction between general and specific skills, mobility costs, and various institutional factors such as unions, minimum wages, and firing costs. For a review of recent theoretical work on why firms pay for general training see Acemoglou and Pischke (1999).
3. Using GSOEP data, Clark (2000) provides evidence against the asymmetric information hypothesis and in favour of the mobility costs hypothesis as explanations of why German firms sponsor apprenticeship training.
4. Harhoff and Kane (1997) provide evidence, highlighting differences in the net costs of apprenticeship training between firms in the crafts sector - usually small firms, and firms in the industrial sector - mostly large firms. Such differences in the net cost per apprentice reflect differences in the quality and the extent at which training is general or specific.
5. Throughout the paper, we use the terms “employer change” and “job change” interchangeably.
6. Here we assume only one job change. The model could be easily extended to account for multiple job changes.
7. This simplifies the derivation of expected lifetime income because today’s wages are the best predictors of future wages; i.e. observed wage differentials are expected to be permanent.
8. For a description of the GSOEP data see Wagner *et al*. (1993).
9. The GSOEP data allows us to track individuals for a number of years prior and after the year of completion of their apprenticeship. Therefore, we are able to obtain information on the size of the apprenticeship firm, apprentices’ wages, and post-apprenticeship employment status and wages. As also noted by Winkelmann (1996), one of the main limitations of the GSOEP is that wages are reported annually and not monthly. Thus, wages used in our analysis refer to the average wage during the first and each subsequent year after completing the apprenticeship training.
10. To preserve space, these percentages are not shown in Table 1.
11. Notice that five years after the apprenticeship training was completed, we are able to track only 52 per cent of apprentices. For those who completed their apprenticeships after 1993 or had been in the sample for less than five years, we naturally can not observe five years of post-apprenticeship history.
12. Part of this initial unemployment rate among apprentices could be attributed to institutional factors characterising the German labour market. Specifically, upon completion of their apprenticeship, German workers are entitled to unemployment assistance equal to their apprenticeship wage.
13. As Winkelmann (1996) points out, among those who intent to do an apprenticeship, 39 per cent intent to acquire a university degree.

References

ACEMOGLOU, D. and PISCHKE, J. S. (1999), "The structure of wages and investment in general training", *Journal of Political Economy*, 107(3), 539-72.

BECKER, G. (1964), *Human Capital*, Chicago: The University of Chicago Press.

CLARK, D. (2000), "Why do German firms subsidise apprenticeship training? Tests of the asymmetric information and mobility cost explanations", Paper presented at the Fourth Annual GSOEP Users Conference, Berlin.

CULPEPPER, P. (1999), "The future of the high-skill equilibrium in Germany", *Oxford Review of Economic Policy*, 15(1), 43-59.

HARHOFF, D. and KANE T.J. (1997), "Is the German apprenticeship system a panacea for the U.S. labor market?", *Journal of Population Economics*, 10, 171-96.

SOSKICE, D. (1994), "Reconciling markets and institutions: The German apprenticeship system", in L. Lynch (ed.), *Training and the private sector*, Chicago: The University of Chicago Press.

STEEDMAN, H. (1993), "The economics of youth training in Germany", *Economic Journal*, 103, 1279-91.

WINKELMANN, R. (1996), "Employment prospects and skill acquisition of apprenticeship-trained workers in Germany", *Industrial and Labor Relations Review*, 49(4), 658-72.

WAGNER, G.G., BURKHAUSER, R.V. and BEHRINGER, F. (1993), "The English language public use file of the German socio-economic panel", *Journal of Human Resources*, 28, 429-33.

Table 1: Post-apprenticeship employment status

Year after apprenticeship (t=0 year appr. completed)	Size of Apprenticeship Firm						All Apprentices		
	Small (<200 employees)			Large (>200 employees)					
	FT %	UN %	OLF %	FT %	UN %	OLF %	FT %	UN %	OLF %
0	65.0	12.7	6.3	65.6	9.6	8.3	65.2	11.5	7.0
1	65.0	8.3	7.8	58.0	2.9	13.8	62.5	6.3	10.0
2	75.0	4.8	6.9	66.1	4.7	17.3	71.6	4.7	11.3
3	74.7	3.5	11.2	67.3	6.2	20.4	71.5	4.5	14.9
4	76.7	2.7	4.8	65.7	3.0	21.2	72.3	2.8	13.3
5	79.7	4.1	11.4	65.4	4.9	25.9	73.7	4.8	17.2
6	80.0	5.0	12.0	73.0	1.6	17.5	77.1	4.2	13.9

Table 2: The proportion of stayers after completion of apprenticeship

Year after apprenticeship (t=0 year appr. completed)	Size of Apprenticeship Firm			All Apprentices
	Small (<200 employees)	Large (>200 employees)	Very Large (>2000 employees)	
0	64.6	57.3	58.7	61.8
1	58.8	56.3	56.0	57.9
2	47.8	47.6	43.1	47.7
3	43.8	44.7	44.2	44.1
4	42.3	47.7	43.2	44.0
5	38.3	47.2	42.4	41.1
6	37.7	45.7	38.5	40.2

Table 3: Wage Regressions (Random Effects Model)

Variables	Small Apprenticeship Firm (<200 employees) (1)	Large Apprenticeship Firm (>200 employees) (2)	Very Large Apprenticeship Firm (>2000 employees) (3)
Constant	1.112 (3.28)	2.036 (5.44)	2.423 (5.57)
TIME	-0.016 (0.79)	0.057 (4.62)	0.033 (1.87)
$(\text{TIME})^2$	0.0047 (3.23)	-0.0035 (3.55)	-0.0016 (1.11)
STAYER	0.182 (2.66)	-0.054 (1.08)	-0.201 (2.79)
(STAYER) × (TIME)	-0.0059 (0.53)	0.028 (3.91)	0.033 (3.18)
Military quitter	-0.120 (1.22)	0.070 (0.76)	-0.011 (0.08)
Age	0.018 (1.21)	-0.0079 (0.46)	0.0033 (0.15)
$\text{Log}(W_{APPR})$	0.160 (1.75)	0.229 (2.12)	0.090 (0.53)
Unemployment	-0.054 (0.63)	-0.060 (0.74)	-0.056 (0.55)
Educational qualifications of apprentices			
Secondary school	0.331 (2.29)	0.280 (2.33)	0.105 (0.67)
Non-class second. school	0.334 (2.23)	0.223 (1.91)	0.037 (0.25)
High school	0.317 (1.69)	0.364 (2.40)	0.202 (0.97)
Other school degree	0.370 (1.97)	0.357 (2.11)	0.150 (0.69)
Size of current firm			
Small	0.155 (3.38)	-0.0067 (0.12)	-0.031 (0.42)
Large	0.249 (4.80)	-0.047 (0.91)	-0.008 (0.11)
Dummies for year completed apprenticeship	Yes	Yes	Yes
R^2	0.125	0.122	0.159
LM-statistic	280.05	7.51	2.14
Sample size (person-year observations)	1031	599	362

Notes: Reference categories: No school degree, Very small firm; Absolute t-ratios in parentheses.

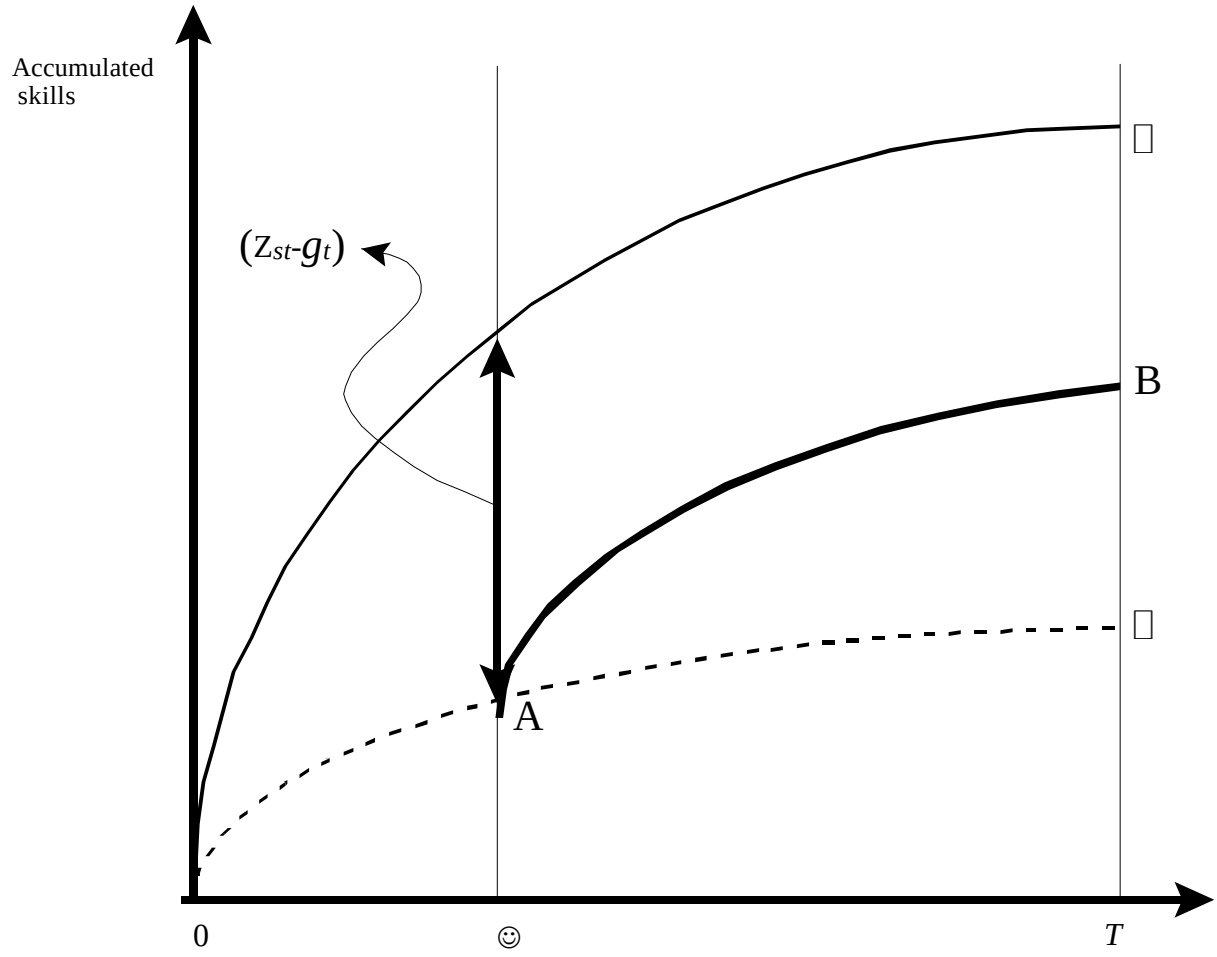

Figure 1

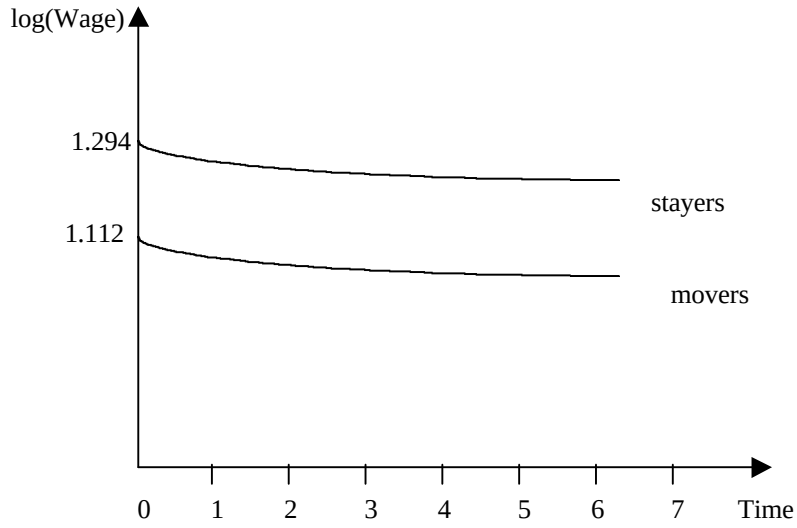

Figure 2(a): Small apprenticeship firms

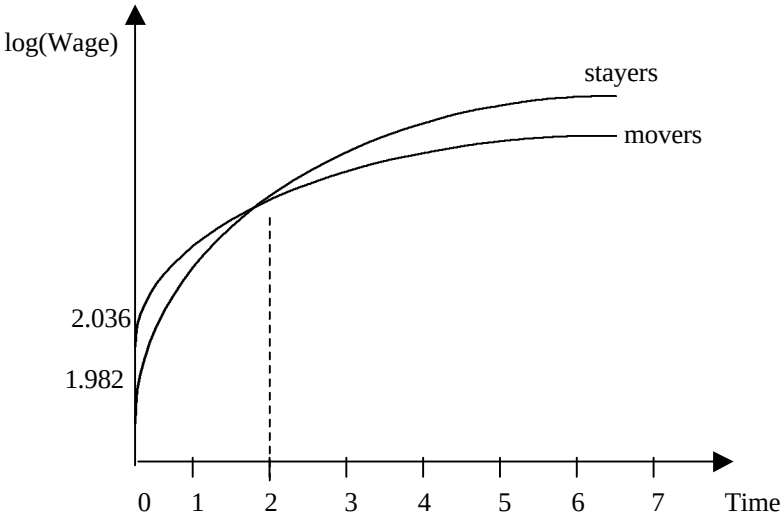

Figure 2(b): Large apprenticeship firms

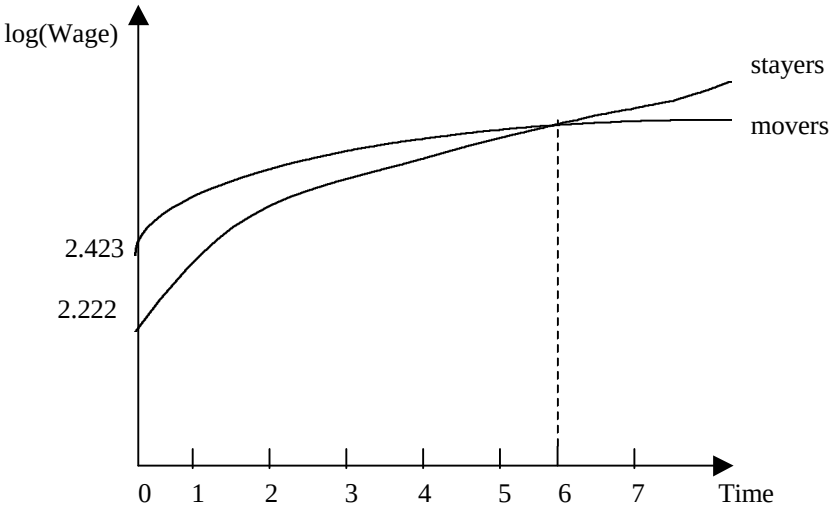

Figure 2(c): Very large apprenticeship firms