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Interfirm Job Mobility of Two Cohorts of Young German Men 1979 - 1990:

An analysis of the (West-)German Employment Statistic Register Sample concerning multivariate failure times and unobserved heterogeneity

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1 Introduction

The OECD (1993) has documented that the majority of workers in industrialised countries can look forward to finding a stable employment relationship. However new entrants into the labor force experience high turnover. Promoting institutions which support longer tenures and worker participation (or „voice“ in the firm) utilize strategies to encourage enterprise and employee efforts in skill formation and training. The results of the OECD (1993) study show that attachments between employee and employer are more likely to endure for Japanese, French and German workers. Furthermore Germany has the highest share of young new recruits who received any formal training from their employer. In Germany, 71.5 % of young new recruits were trained at any job within 7 years after leaving school, whereas in the U.S. only 10.2 % of young new recruits were similarly trained (cf. OECD 1993, 137).

It is sometimes assumed that employment protection policies have been exogenously imposed and thus probably impair efficiency. However, research on the micro-economics of labor markets has shown that employers may be interested in long-term employment relationships (cf. Levine 1991). Here, the job training model focusing on the importance of human capital investment, specifically the job shopping and matching model stressing the process of information gathering through employment experience should be mentioned. In such models employment protection legislation has not only desirable distributional effects but also help to ensure efficient outcomes. Therefore, it is important to assess the relevance of micro-economic theories empirically.

This paper provides an empirical analysis of job durations in Western Germany using information from two cohorts of new entrants to the labor force documented in the (West-)German employment statistic register sample (cf. Bender and Hilzendegen 1996). The appropriate empirical technique to study job length is event history or survival analysis. In labor market research, survival analysis has primarily focused on explaining the length of unemployment spells. Application of this technique to employment is less common[1], because huge longitudinal data sets are needed. Apart from testing hypotheses about the effect of personal characteristics and labor demand variables (e.g. firm size and industry affiliation), we will assess the influence of heterogeneity of the members of the two cohorts on their duration profile. The applied model and estimation method allow for unobserved

1 An exception is Farber (1994).

heterogeneity and correlation between the clustered failure times of one employee as well as for right-censored spells. Our analysis is not restricted to the beginning of the working life of the employees. The individual retirement decision is affected by employment protection and early retirement regulations which differ widely between the firms. The respective data are missing in the employment statistic register, so that the retirement decision cannot be modelled explicitly.

The paper is organized as follows. In section 2 we survey the job training and the job matching model. In section 3 we present the statistical methods and the data set. The results are discussed in section 4. Finally, in section 5, a summary is given.

2 Hypotheses

In this section theoretical arguments from the specific human capital model, job search, job shopping and job matching theory are presented in order to derive the testable hypotheses about the determinants of the duration of job spells.

In contrast to the other theories mentioned, the specific human capital model emphasizes the returns of long lasting jobs. Apart from the firms' human capital investments in their employees, hiring costs (advertising, interviewing, etc.) and screening costs will arise. The larger the employee's human capital endowment, the higher the potential earnings stream to be expected (even at investment levels which are relatively low for some time). Insofar both the employer and the employee have contributed to the costs to finance the employee's human capital stock, a long-term employment relationship should be optimal for both sides. However, the potentially distorting effect of contract enforceability and asymmetric information of efficient employment relationships (cf. Parsons 1986) require more complicated compensation packages and complex theoretical considerations.

Furthermore, the relationship between general (transferable) and specific human capital is not clear (cf. Parsons 1972, Hashimoto 1979). There are cases where firms undertake job specific training only for those employees with a certain level of general human capital endowment. They argue that already trained employees are easier and cheaper to be trained further, because those persons have learned to learn. This view contrasts with the argument that the financial resources of each individual employee are limited so that she has the choice

between general and specific human capital formation. Under the assumption that more job specific human capital increases the job duration, a positive correlation of job duration and proxies for general human capital is expected in the first case, whereas in the second case a negative correlation should arise.

Search theory models the worker's problem of finding employment in a decentralized labor market. Information regarding the location of vacant jobs and the compensation that they offer is recognized as imperfect. Therefore, the search process is costly for workers. The existing literature examines whether or not the search costs are higher for those specialising in search activities, i.e. people unemployed or out of work, and employees who continue the search for a better employment opportunity. In a model developed by Mortensen (1986), the search effort is endogenously determined. The propensity to separate from a job is positively correlated with the search effort on the job which is itself negatively associated with the wage earned on the job.

In the original search model and the search on the job extension, information is regarded as imperfect concerning the location of vacant jobs, but the relevant characteristics for a located job are known. Job shopping (cf. Johnson 1978, Javanovic 1979, Viscusi 1980) and job matching models (cf. Hartog 1981) relax this assumption. The worker must spend some time on the job in order to find out whether the job characteristics and his abilities match one another. Conversely the employers need some period during which they employ and test the match between the employee's abilities and the job characteristics.

Whereas in Viscusi's model the employee acts as a Bayesian forecaster, the employer may try to use personal characteristics of the job applicants like qualification, social background and gender to improve the match. In the framework of Bayesian decision making, observations available for employees (not for searchers) are used to make predictions concerning the job's true but unknown characteristics. As new information arrives, the forecast is revised and a quit decision is made. Therefore it is expected that separation rates decline with length of current job tenure. Since the acquisition of experience about the characteristics of different jobs requires some time, a positive effect of age on job tenure may be interpreted according to the job shopping and matching argument too.

Idson and Feaster (1990) investigate wage differentials for employees working in firms of different size. According to their model, employees in larger firms receive a greater return to

on-the-job-training (assuming complementarity between human and physical capital, cf. Griliches 1969). Therefore, a higher level of on-the-job-training is expected in larger firms. Differential production functions facing larger employers will then lead them to hire workers with greater general human capital endowments, if they believe that those employees who have proved that they are able to learn are easier to be trained. Furthermore, large employers are inclined to put a premium on a willingness to conform to the relatively rigid requirements of large-team production found in larger firms, and thereby will tend to select employees who exhibit some desirable combination of these attributes.

Then, Idson and Feaster (1990) assume that workers with a strong preference for independence will tend to be sorted to relatively smaller firms and conversely. Workers' heterogeneity with regard to a willingness to conform to group norms, and employer heterogeneity with regard to a need to have „conform" workers, would therefore be mutually consistent, yielding a market outcome of more „independent" workers matching to smaller firms and more „conform" workers matching to larger firms. This argument provides also an explanation for the differential impact of industry dummies on job duration, because conformity to group norm has different relevance in industries like banking and catering.

Heckman (1981) emphasizes the importance of the distinction between „true state dependence" and „spurious state dependence". In the „true" case once a person experiences an event, her behaviour or opportunities change compared with an otherwise identical person who has not experienced this event. In the „spurious" case, past experience has no effect on the probability of experiencing the event in the future. However, in general one cannot properly control for all the variables that distinguish one individual's decision from another's. Past experience may be a good proxy for these omitted variables. However, the effect of past experience is overstated if it is not controlled adequately for heterogeneity caused by the influence of unmeasured variables. Heckman (1981) himself argued that it is also plausible to conjecture that „lagged employment" might serve as a good „proxy" for the effect of heterogeneity. Recently, Farber (1994) has used the term „heterogeneity" to refer to differences among workers in their probability of leaving a particular job conditional on worker characteristics and past labor force history up to the start of the job. Thus, heterogeneity in workers' propensities to change jobs is not necessarily fixed over time or unaffected by labor force history on earlier jobs. With our data and our method of analysis, it is possible to follow this line. We distinguish for the lagged state dependence between occurrence dependence and lagged occurrence dependence by using variables for both the

number of employment and unemployment spells. A special advantage of the method used for the estimation of the parameters is the provision of a measure for the amount of „unobserved heterogeneity“.

3 Model and Estimation Method

3.1 Modeling the failure times

The aim of the empirical analysis is to detect dependences of the lengths of the employment spells on the explanatory variables. As in general a man experiences more than one spell in the observation period, we are in the statistical context of multivariate failure time analysis. The analysed employment spells are all of the same kind and we do not distinguish various destination states such as another job or enemployment. The successive spells of one employee are separated by recurrent events (job changes) or by intervening spells (e.g. periods of unemployment).

One common way of modeling failure times is the class of accelerated failure time models where the logarithm of the duration depends on a linear predictor (of covariates and regression parameters) and on an error term (see standard textbooks such as Kalbfleisch and Prentice 1980, 33f, Lancaster 1990, 40f). We consider the following extension of an accelerated failure time model allowing for unobserved heterogeneity.

The data consist of N employees $(n = 1,\ldots,N)$ with a varying number K_n of employment spells $(k = 1,\ldots,K_n)$, each of which is at least partially observed during the observation period. The lengths of the spells T_{nk} are influenced by a vector x_{nk} of covariates (which may vary from spell to spell) according to

$$y_{nk} := \ln(T_{nk}) = \beta_0 + x'_{nk}\beta + \sigma_\alpha \alpha_n + \sigma_\varepsilon \varepsilon_{nk}.$$

The stochastic component consists of an individual effect α_n which absorbs non-observed covariates and an error term ε_{nk}. The α_n are assumed to be independent and identically distributed. The ε_{nk} can but need not be independent; their distribution is assumed to be one of the usual distributions in accelerated failure time models. The normal distribution leads to

the Log-normal model, the logistic distribution to the Log-logistic model, and the extreme value distribution to the Weibull model. But note that in the analysis we use a nonparametric estimation method so that the kind of distribution need not be specified. For simplicity, α_n and ε_{nk} are standardized to mean zero and standard deviation one.

Thus, in the special case of independent ε_{nk} we have an equicorrelation structure with

$$Cov(y_{nk}, y_{ml}) = 0 \quad if \;\; n \neq m,$$

$$Cov(y_{nk}, y_{nl}) = \sigma_\alpha^2 \quad if \;\; k \neq l,$$

and

$$Var(y_{nk}) = \sigma_\alpha^2 + \sigma_\varepsilon^2 \quad \forall \;\; n = 1,\ldots,N \quad \forall \;\; n = 1,\ldots,K_n.$$

The observation of the employment histories breaks off with the end of 1990. Employment spells which continue beyond this time are included as censored spells. Instead of T_{nk} we observe

$$z_{nk} = \min(T_{nk}, c_{nk})$$

together with an indicator variable

$$\delta_{nk} = \begin{cases} 1 \;\; if \;\; T_{nk} \leq c_{nk} \\ \\ 0 \;\; if \;\; T_{nk} > c_{nk} \end{cases}$$

where the time span c_{nk} from the beginning of the spell to the end of the observation period is independent of T_{nk}.

3.2 Distribution-free estimation of the effects

As no one can be sure of the correlation structure and the distribution of the failure times, we use a distribution-free method for the estimation of the regression parameters which accounts for unobserved heterogeneity and censored spells. For a more detailed description and simulation studies, see Hornsteiner and Hamerle (1996).

This method combines the generalized estimating equations (GEE) approach for longitudinal data (Liang and Zeger, 1986) with the replacement of censored times with values imputed along lines used by Buckley and James (1979). The estimating equations are

$$\sum_{n=1}^{N} X_n' V_n^{-1} (y_n^* - X_n \hat{\beta}) = 0,$$

where X_n is the matrix containing the lines x_{nk}', $k = 1,\ldots,K_n$, and $y_n^* = (y_{n1}^*,\ldots,y_{nK_n}^*)'$ is a vector consisting of the observed non-censored values and, in the cases of censored spells, of their conditional expectations, thus

$$y_{nk}^* = \delta_{nk} \ln z_{nk} + (1-\delta_{nk}) \hat{E}(y_{nk} | y_{nk} > \ln z_{nk}).$$

These expectations are estimated by the nonparametric product limit estimator (Kaplan and Meier 1958). Further on, the covariance matrix V_n depends on an assumption about the correlation structure within the clustered failure times. One feature of the GEE approach is that it works well also when the „working correlation“ is not specified correctly. On the other hand, a working correlation which is similar to the real one improves the efficiency of the estimator. In this analysis we use the equicorrelation assumption.

The iterative algorithm for solving the estimating equations consists of three steps in each iteration. We get an initial estimation simply by $\hat{\beta}^{(0)} = (\tilde{X}' \tilde{X})^{-1} \tilde{X}' \tilde{y}$ where $\tilde{X}$ and $\tilde{y}$ only include the uncensored spells. The first step of the u^{th} iteration $(u = 1,2,\ldots)$ is the imputation part in which $\hat{\beta}^{(u-1)}$ is used for computing residuals and the (renewed) $y_{nk}^{*(u)}$. Both $\hat{\beta}^{(u-1)}$ and $y_{nk}^{*(u)}$ enter into the second step, the moment estimations of

$$v = Var(y_{nk}^*)$$

and

$$c = Cov(y_{nk}^*, y_{nl}^*).$$

All these are the basis for the third part, the modified Fisher scoring

$$\hat{\beta}^{(u)} = \hat{\beta}^{(u-1)} + \left(\sum_{n=1}^{N} X_n' \tilde{V}_n^{-1} (\hat{\beta}^{(u-1)}) \frac{\partial y_n^*}{\partial \beta} \right)^{-1} \left(\sum_{n=1}^{N} X_n' \tilde{V}_n^{-1} (\hat{\beta}^{(u-1)}) (y_n^* - X_n' \hat{\beta}^{(u-1)}) \right),$$

$u = 1,2,\ldots$ These three steps are repeated until either convergence criteria are fulfilled or a cycle of Buckley-James typical oscillating values is detected (see Miller 1981, 152 and Currie 1996).

An estimator of the asymptotic covariance matrix of the parameter estimations is

$$\hat{Cov}(\hat{\beta}) = \left(\sum_{n=1}^{N} X_n' \tilde{V}_n^{-1} \frac{\partial y_n^*}{\partial \beta} \right)^{-1} \left(\sum_{n=1}^{N} X_n' \tilde{V}_n^{-1} \hat{Cov}(y_n^*) \tilde{V}_n^{-1} X_n \right) \left(\sum_{n=1}^{N} X_n' \tilde{V}_n^{-1} \frac{\partial y_n^*}{\partial \beta} \right)^{-1},$$

where $\hat{Cov}(y_n^*) = (y_n^* - x_n'\beta)(y_n^* - x_n'\beta)'$. To test the significance of the estimated effects, simple t-tests can be performed using

$$\hat{\sigma}(\hat{\beta}_p) = \sqrt{\left(diag\left(\hat{Cov}(\hat{\beta}) \right) \right)_p}, \quad p = 1, \ldots, P,$$

as estimated standard error of the p^{th} covariate where P is the number of covariates.

A measure for the extent of the remaining unobserved heterogeneity is $\hat{c} / \hat{v}$ - the estimated correlation of the transformed failure times within one employee. Also in the case of unobserved heterogeneity the applied methods promise unbiased estimators of the included variable effects.

3.3 Data and Variables

At the Federal Employment Office (Bundesanstalt für Arbeit), a file is constructed as an insurance account for each employee covered by the social security system in Germany. It contains the information about notices of the beginning or the end of an employment or yearly notices or notices in case of change regarding the insurance (the so called historic file of the Employment Statistic). Thus, this procedure guarantees a continuous employment history for employees covered by social security and it is justified to regard the employment statistic as one of the datasets in Germany „ (...) that constitute the backbone of German social statistics (...) “ (Alba et al. 1994, 66)

The following analysis is based on a 1% random sample from the historical file of the Institute for Employment Research (IAB-Subsample) ensuring representativity of the analysis for all employees covered by the social security system. For the scientific community there is

an anonymized version available (cf. Bender and Hilzendegen 1995, Bender et al. 1996). Since the main advantage of the IAB-Subsample is that the problems of attrition (panel mortality) and errors-in-variables (memory errors of retrospectively collected data) are minimal, the IAB-Subsample is especially suited for longitudinal analysis.

The IAB-Subsample covers an observation period between 01.01.1975 and 31.12.1990. It comprises the possible censored work history of more than 460,000 persons. Cross-section analyses can be carried out for 200,000 persons in each year.

The variables comprised in the historic file (as well as in the IAB-Subsample) are based on the notices of the employers to the relevant social security institutions, which transmit them to the Federal Employment Office. Due to the fact that only employment spells of persons covered by the social security system are registered, self-employed, civil servants, family workers as well as employees, who are only irregularly employed or earn less than a certain small amount per month are not covered in this file, so that information exists for about 80% of all employed persons (cf. Herberger and Becker 1983).

The variables in the notices are legally prescribed. Variables at the individual level are age, sex, personal status, nationality as well as professional qualification, occupational status as well as the gross earnings (up to the limit of the compulsary insurance), and at the establishment level the company code, industry affiliation, establishment size, as well as the site of the company. Additionally, the IAB-Subsample contains information about the periods when persons are in receipt of unemployment benefit and assistance as well as subsistance allowance during training courses. Especially these variables are of great accuracy as they form the basis for individual claims for pensions and unemployment insurance. So the gross earnings and the dates of the beginning and ending of jobs are highly precise. „Much of the important information about state dependence in mobility unfolds very early on the job, and data on the job durations that can be calibrated only annually or even quarterly are not likely to be informative.“ (Farber 1994, 555).

The model is estimated on the basis of employment spells, defined as a notice in the employment statistics register which refers to the starting and ending date of an employment spell and its corresponding wage received for that time period.
The change in the youth labor market affect the career opportunities at the point of entry into the labor market. Thus, the structural context at the point in time people start their careers has a substantial impact upon people’s subsequent careers. This kind of influence is generally

called cohort effect which is controlled by the comparison of two cohorts of young men, entering the labor market during a boom (1979) and during a slump of the business cycle (1985).

These years were also selected because the number of years after 1985 is large enough to allow a sufficient number of transitions during the time span covered in the sample. In fact, in the year 1979, the capacity utilized was 99.9 which is the highest value for the years since 1961 (Council of Economic Advisors 1996, 26*). The three years preceeding 1985 had lower (1982,1983) or the same (1984) rates of capacity utilization than 1985 and the years 1986-1988 experienced even lower rates than 1985. However, the unemployment rate was both lower in the years before 1985 and lower until 1994 (Council of Economic Advisors 1996, Table 21*).

Therefore, members of the 1979 and 1985 cohorts had to fulfill the condition that their first notice in the employment statistic register must be in these respective years. Additionally, the birth year of different occupational groups was controlled by the time, which is on average necesssary to receive secondary school leaving certificate (13 years), to complete an apprenticeship or graduate from a full-time vocational school (3 years), to graduate from a university (18 years) or a specialized college of higher education (Fachhochschule, 15 years). For employees who combined higher education and apprenticeship training, different assumptions are used (cf. Bellmann et al. 1994, 49f). For persons with a lower schooling level and no occupational qualification, 10 years were assumed to be the schooling time.

The selection of cases was carried out according to the following rules:

1. Women are excluded from the present study, since they show very different occupational structures and mobility patterns.
2. Employments in more than one job for each time are excluded.
3. Employees working in agriculture are excluded because their earnings are not comparable with those of other employees and also with earnings of these individuals outside agriculture,

The numbers of employees who enter the analysis are shown in Table 1.

Table 1: *Numbers of employees and transitions*

	1979	1985
Total number of employees	4134	4312
Total number of transitions	15143	9490
Right censored number of transitions	3804	3940
In % of total number of transitions	25.12	41.52

The duration of a job is defined as actual employment within the same establishment. For an intervening spell, the job duration does not continue, even if the employees have a right to return to their jobs (something that cannot be observed in the sample). A transition from one job to another is defined by a change of the establishment code.

The variables used are (descriptive statistics are given in Table 2)

- tenure with the same establishment (possibly interrupted).
- age in natural logs.
- qualification: (1) lower secondary school (Hauptschule) and intermediate secondary school (Realschule) graduates who did not complete an apprenticeship or graduate from a full-time vocational school, (2) persons with the same schooling level but with completion of an apprenticeship or graduation from a vocational school, (3) secondary school leaving certificate with/without any other qualification, (4) graduates with a university-type education (Hochschulabschluß).
- a dummy indicating whether the establishment switch was directly from apprenticeship training
- dummy variables concerning industry
- dummy variables concerning establishment size
- the past labor force history is captured by the number of former employment transitions until a job transition is done, the number of former gap transitions and the number of former unemployment transitions
- if a person is recalled after leaving a firm, job duration is prolonged after the out-of-labor-force spell. A dummy variable is constructed to distinguish employment tenure with and without intervening unemployment and/or out-of-labor-force spells (recall).

Table 2: *Description of the variables for the transitions of the two cohorts (1979 and 1985)*

frequency (%)	**1979**	**1985**
establishment size		
unknown	2.29	2.23
1	2.51	2.14
2-9	20.13	18.96
10-19	12.77	10.84
20-49	14.85	13.30
50-99	9.45	9.96
100-499	18.44	20.59
500-999	6.19	7.67
>= 1000	13.37	14.31
ln age (mean)	3.1517	3.0767
industry		
production	42.57	44.92
construction	17.84	12.83
business services	18.33	18.60
personal services	21.26	23.65
recall	29.27	28.26
# former unemployment transitions		
no	53.65	77.47
one time	21.37	15.89
two times	11.15	4.58
more than two times	13.83	2.06
# former gap transitions		
no	41.79	64.43
one time	33.80	24.82
two times	12.88	6.23
more than two times	11.53	4.52
# former employment transitions		
no	29.41	45.87
one time	23.65	26.65
two times	16.56	13.73
more than two times	30.38	13.75
qualification		
unknown	5.73	5.87
lower secondary school without completed apprenticeship	27.55	35.35
lower secondary school with completed apprenticeship	55.74	47.20
secondary school leaving certificate without or with completed apprenticeship	4.30	6.54
graduates	6.68	5.04
apprenticeship	13.76	22.74

Table 3: *Estimation Results*

	1979	**1985**
$\hat{\beta}_0$	-18.9	-19.2
	[0.46]	[1.03]
establishment size (1 employee)		
unknown	-0.235 *	-0.394 *
	[0.114]	[0.170]
2-9	0.182 *	0.194
	[0.088]	[0.127]
10-19	0.170	0.202
	[0.091]	[0.138]
20-49	0.180 *	0.247
	[0.090]	[0.132]
50-99	0.158	0.210
	[0.093]	[0.141]
100-499	0.159	0.310 *
	[0.090]	[0.132]
500-999	0.339 **	0.430 **
	[0.104]	[0.152]
>= 1000	0.490 **	0.598 **
	[0.098]	[0.147]
ln age	8.363 **	8.351 **
	[0.152]	[0.343]
industry (production)		
construction	-0.100 *	0.004
	[0.039]	[0.075]
business services	-0.201 **	-0.174 *
	[0.042]	[0.076]
personal services	-0.352 **	-0.336 **
	[0.044]	[0.071]
recall	-0.413 **	-0.564 **
	[0.029]	[0.047]

Table 3 (continued)

	1979	**1985**
# former unemployment transitions (0)		
one time	-0.702 **	-0.791 **
	[0.045]	[0.083]
two times	-0.931 **	-0.804 **
	[0.063]	[0.165]
more than two times	-1.277 **	-0.481
	[0.072]	[0.294]
# former gap transitions (0)		
one time	-0.165 **	0.180 *
	[0.039]	[0.079]
two times	-0.273 **	0.103
	[0.063]	[0.140]
more than two times	-0.675 **	-0.252
	[0.080]	[0.196]
# former employment transitions (0)		
one time	-0.976 **	-0.688 **
	[0.039]	[0.061]
two times	-1.132 **	-0.634 **
	[0.051]	[0.094]
more than two times	-1.254 **	-0.371 *
	[0.064]	[0.148]
qualification (lower secondary school without completed apprenticeship)		
unknown	-0.212 **	-0.357 **
	[0.073]	[0.104]
lower secondary school with completed apprenticeship	0.302 **	0.777 **
	[0.041]	[0.073]
secondary school leaving certificate without or with completed apprenticeship	-1.149 **	-0.734 **
	[0.085]	[0.130]
graduates	-0.821 **	-0.831 **
	[0.105]	[0.244]
apprenticeship	0.620 **	0.908 **
	[0.044]	[0.066]
$\hat{v}$	1.55	1.83
$\hat{c}$	0.34	0.95

Remark:

The reference group is given in parentheses behind the variable name and the standard errors under the estimated coefficients. *(**) means significance at the 5% (1%) level of a two-sided test.

4 Results

The interpretation of the parameters of the estimated model is that positive coefficients prolong the employment spells whereas negative ones decrease their length.[2] Table 3 presents the results obtained for the two cohorts with members starting their working career during the boom of 1979 and the economic slump of 1985. The differences between the two cohorts are rather small - only in three cases (of 28) do the estimated coefficients have different signs: The effect of construction was negative and significant in 1979 and positive but insignificant in 1985. The effects of one and two former gap transitions were negative and significant in 1979, positive and significant in the one time case and positive and insignificant in the two time case in 1985. The effect of military service could theoretically differ between the two cohorts. Restricting the potential gap caused by military service in the cohort starting in 1979 to the same time span as in the cohort starting in 1985 reveals no significant changes in the results obtained. Therefore, we can interpret the estimates for both cohorts together.

Although the influence is not monotone, the employees in larger establishments have significantly longer job durations in comparison to employees in establishments with only one employee. Employees in the business and personal services experience shorter job attachments than those in the production industries. The results corroborate the hypothesis derived from Idson and Feaster (1990) that employees in larger firms have higher levels of on-the-job training and thus their employees are inclined to stay longer with their jobs. Aside from establishment size effect, the employees in service industries seem to have less specific human capital accumulated than those in the production industries. Furthermore, the services attract those employees who have a desire for independence.

The highly significant age effect can be interpreted as indication that „good“ matches endure and employees with accumulated human capital through work experience keep their jobs. The relationship between general (transferable) and specific human capital is not along the qualification level. The most relevant simple effect stems from the apprenticeship. Lower secondary school leavers with a completed apprenticeship stay longer than employees with other qualifications on their jobs. The positive and significant effect of the dummy indicating a switch from apprenticeship training points into the same direction.

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[2] A value of .620 for the apprenticeship dummy means that the individuals coming from an apprenticeship training have a duration of the subsequent employment spells which is exp(.620) = 1.86 times longer than those of the otherwise identical individuals coming from elsewhere.

The relevance of heterogeneity controls is demonstrated by the significant influence of the variables for the number of employment and unemployment spells. The more often employees experience unemployment spells and the higher the number of employment spells prior to the job under study, the shorter is the expected employment duration. Additionally, following the arguments given in Heckman (1981) and Farber (1994), the inclusion of these heterogeneity controls serves to avoid spurious regression results.

The estimation results show that the included variables do not suffice for a total disappearance of unobserved heterogeneity. A measure for the extent of the remaining unobserved heterogeneity is $\hat{c} / \hat{v}$ - the estimated correlation of the transformed failure times within one employee - which is 0.217 for the 1979 cohort but 0.521 for the 1985 cohort, which means that in the latter case the included variables cannot explain the failure times as well as in the former case. Nevertheless, the applied methods promise unbiased estimators of the included variable effects on both cases.

5 Conclusion

Microeconomic theories provide some interesting arguments about the determinants of the duration of employment spells. We tested some of them on the basis of a large micro data set using information from the German employment statistic register. The data contain personal characteristics and labor demand variables (establishment size and industry affiliation) and proxy variables for the heterogeneity within the two cohorts we consider. The effects are estimated by a distribution-free method which combines the generalized estimating equations approach for longitutional data with the replacement of censored cases by imputed values.

The most important results are that employees stay longer in larger establishments and in production industries. Older individuals, those with completed apprenticeship training and those coming directly from apprenticeship training have longer job durations. In contrast, the larger the number of unemployment and employment spells, the shorter is the job attachment expected.

References

Alba, R. D., Müller, W. and Schimpl-Neimanns, B. (1994): Secondary Analysis of Official Statistics, in: I. Borg and P. Ph. Mohler (eds.): Trends and Perspectives in Empirical Social Research. Berlin, New York, 57-78.

Bellmann, L., Reinberg, A. and Tessaring, M. (1994): Bildungsexpansion, Qualifikationsstruktur und Einkommensverteilung - Eine Analyse mit Daten des Mikrozensus und der Beschäftigtenstatistik. In: Lüdeke, R. (ed.): Bildung, Bildungsfinanzierung und Einkommensverteilung, Berlin: 13-70.

Bender, S. and Hilzendegen, J. (1995): Die IAB-Beschäftigtenstichprobe als scientific use file, Mitteilungen aus der Arbeitsmarkt- und Berufsforschung 28, 76-95.

Bender, S., Hilzendegen, J., Rohwer, G. and Rudolph, H. (1996): Die IAB-Beschäftigtenstichprobe 1975-1990. Beiträge zur Arbeitsmarkt- und Berufsforschung 197, Nürnberg.

Blossfeld, H. P. and Rohwer, G. (1995): Techniques of Event History Modeling - New Approaches to Causal Analysis. Hillsdale.

Buckley, J. and James, I. (1979): Linear regression with censored data. Biometrika 66, 429-436.

Council of Economic Advisors (1996): Jahresgutachten 1996/97.

Currie, I. D. (1996): A note on Buckley-James estimators for censored data. Biometrika 83, 912-915.

Farber, H. S. (1994): The Analysis of Inter-Firm Worker Mobility, Journal of Labor Economics 12, 554-593.

Griliches, Z. (1969): Capital-Skill Complementarity, Review of Economics and Statistics 51, 465-468.

Hartog, J. (1981): Wages and allocation under imperfect information, De Economist 129, 311-323.

Hashimoto, M. (1979): Bonus Payment, On-the-Job Training and Life Time Employment in Japan, Journal of Political Economy 87, 1086-1104.

Heckman, J. J. (1981): Heterogeneity and state dependence, in: S. Rosen (ed.): Studies in Labor Markets. Chicago, 91-139.

Herberger, L. and Becker, B. (1983): Sozialversicherungspflichtig Beschäftigte in der Beschäftigtenstatistik und im Mikrozensus, Wirtschaft und Statistik, 290-304.

Hornsteiner, U. and Hamerle, A. (1996): A combined GEE/Buckley-James method for estimating an Accelerated Failure Time Model of multivariate failure times. Discussion Paper 47, Sonderforschungsbereich 386, Ludwig-Maximilians-Universität München.

Idson, T. L. and Feaster, D. J. (1990): A Selectivity Model of employer size wage differentials, Journal of Labor Economics 8, 99-122.

Javanovic, B. (1979): Job Matching and the Theory of Turnover, Journal of Political Economy 87, 972-990.

Johnson, W. R. (1978): A theory of job shopping, Quarterly Journal of Economics 92, 261-277.

Kalbfleisch, J. D. and Prentice, R. L. (1980): The Statistical Analysis of Failure Time Data. New York.

Kaplan, E. L. and Meier, P. (1958): Nonparametric estimation from incomplete observations, Journal of the American Statistical Association 53, 457-481.

Lancaster, T. (1990): The Econometric Analysis of Transition Data. Cambridge.

Levine, D. I. (1991): Just-Cause Employment Policies in the Presence of Worker Adverse Selection, Journal of Labor Economics 9, 294-305.

Liang, K.-Y. and Zeger, S. L. (1986): Longitudinal data analysis using generalized linear models. Biometrika 73, 13-22.

Miller, R. G. jr. (1981): Survival Analysis. New York.

Mortensen, D. T. (1986): Job Search and Labor Market Analysis, in: O. Ashenfelter and R. Layard (eds.): Handbook of Labor Economics. Amsterdam, 849-919.

OECD (1993): Employment Outlook. Paris.

Parsons, D. O. (1972): Specific Human Capital: An Application to Quit Rates and Layoff Rates, Journal of Political Economy 80, 1120-1143.

Parsons, D. O. (1986): The Employment Relationship: Job Attachment, Work Effort, and the Nature of Contracts, in: O. Ashenfelter and R. Layard (eds.): Handbook of Labor Economics, Amsterdam, 789-849.

Spilerman, S. (1977): Careers, Labor Market Structure, and Socioeconomic Achievement, American Journal of Sociology 83, 551-593.

Viscusi, W. (1980): A theory of job shopping: A Bayesian perspective, Quarterly Journal of Economics 94, 609-614.