Duration dependence, lagged duration dependence, and occurrence dependence in individual employment histories:

Evidence from German register data

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How does state dependence influence labor market policy:

- If the chance to find a new job decreases with unemployment duration, then policy measures that prevent unemployment at an early point should be put into operation
- If the occurrence of past employment experiences does not help to find employment, then short run policies, such as job-creation measures or settling-in allowances, do not have an effect on the unemployment rate

Goal:

- Disentangle the different forms of state dependence for the three labor market states employment, unemployment, and out of labor force

Data:

- Integrated Employment Biographies Sample (IEBS) provides daily-measured information and long labor market histories
- Sample selection: Men born 1950-1970

Method:

- An event history framework is used, where each transition is modeled as a mixed proportional hazard and observed and unobserved heterogeneity is accounted for

Results:

- Negative duration dependence is found for the transition from unemployment into employment but not vice versa
- Occurrence dependence is present for all transitions
- Lagged duration dependence only plays a minor role

Definition of state dependence:

- Heckman and Borjas (1980): Duration dependence, occurrence dependence, and lagged duration dependence

State dependence due to past unemployment experiences:

- Arulampalam et al. (2000), Gregg (2001): Scarring effects of past unemployment experiences
- Biewen and Steffes (2010): Scarring effects occur due to stigmatization of unemployed
- Winter-Ebmer and Zweimüller (1992): Occurrence and lagged duration dependence increase the propensity of repeat unemployment

State dependence in labor market histories:

- Doiron and Gorgens (2008):
  - Use the three states employment, unemployment, and out of the labor force
  - Duration and occurrence dependence are found, but no lagged duration dependence
- Magnac (2000):
  - Uses six transition states
  - State dependence is clearly present, especially duration dependence
- Cockx and Picchio (2010):
  - Only use employment and unemployment, but take into account job-to-job transitions
  - All forms of state dependence are present

German Integrated Employment Biographies Sample (IEBS):

- 2.2% random sample from a merged data file that integrates data from four different administrative registers
- The registers are:
  - BeH (*"Beschäftigten-Historie"*): data on individual employment histories
  - LeH (*"Leistungsempfänger-Historie"*): data on receipt of unemployment benefits, unemployment assistance and income maintenance during training measures
  - BewA (*"Arbeitssuchenden- und Bewerbungsangebotsdaten"*): data on the histories of registered unemployment
  - MTH (*"Maßnahmeteilnehmer-Historie"*): data on histories of participation in public sponsored training measures

Advantages of the data set:

- Spells are measured on daily basis
- Rich information of current labor market states
- Relatively long histories

Problems with the data set:

- Parallel and overlapping periods
  - Inadmissible parallel and overlapping periods are adjusted (Bernhard et al. (2006) and Jaenichen et al. (2005))
- Missing and unreliable information
  - Education variable is adjusted for, following an approach similar to Fitzenberger et al. (2005)
  - Missing variables are imputed forward if possible

How labor market states are identified:

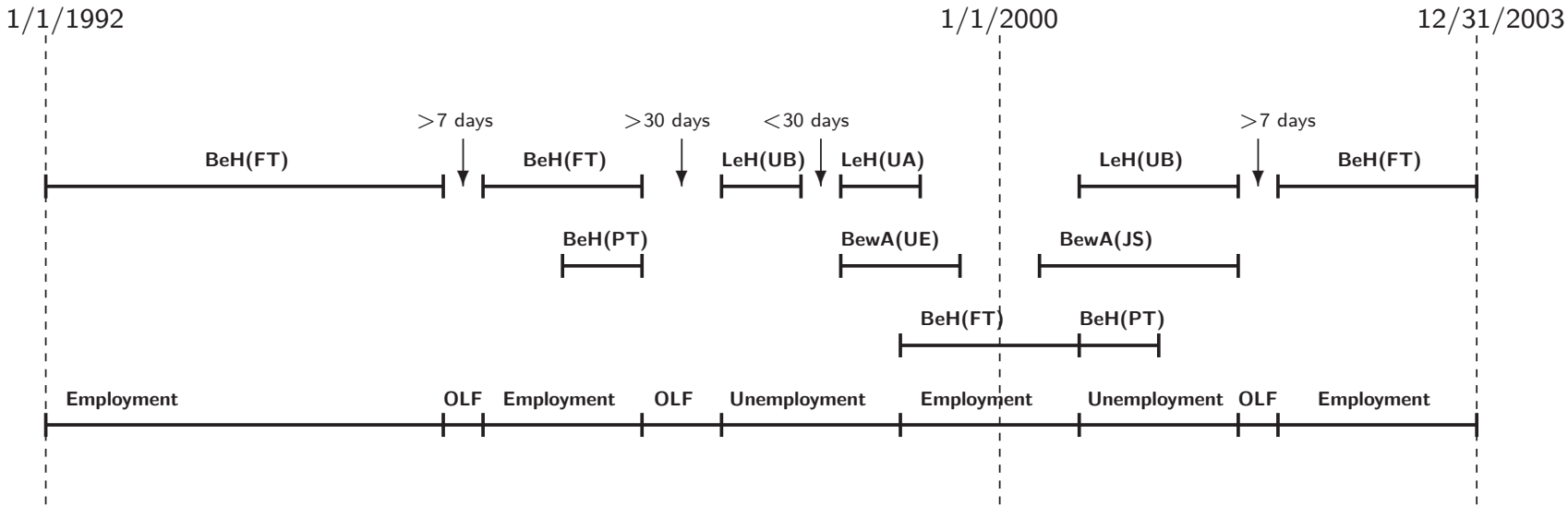

Figure (1): For the period 1992-1999 periods with no information that are longer than 7 days between two employment spells, 30 days between two unemployment spells or an employment and an unemployment spell are assumed to be spells out of the labor force. For the period 2000-2003 all minimum lengths are reduced to 7 days.

Who is in the sample:

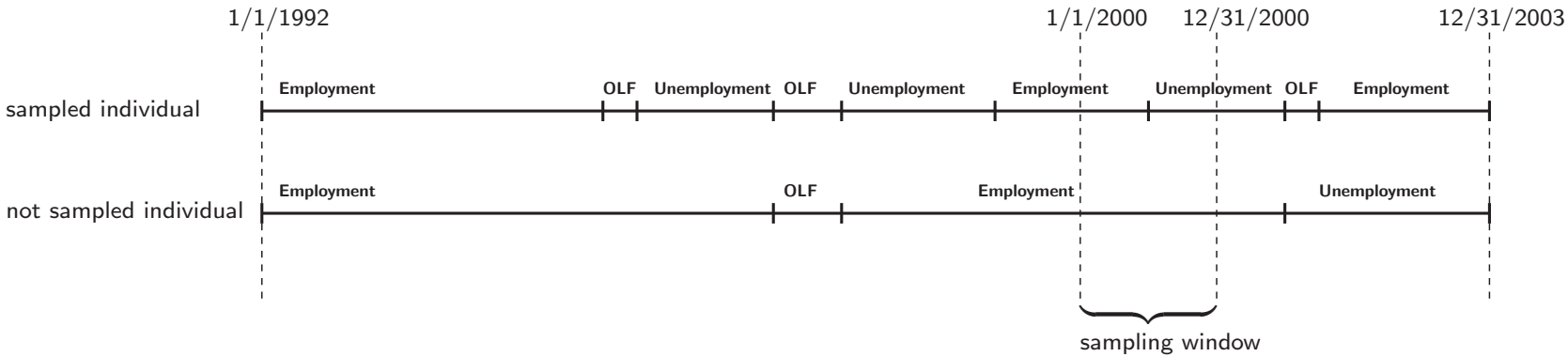

Figure (2): Only individuals, who transit between 1/1/2000 and 12/31/2000 enter the sample.

What information is used:

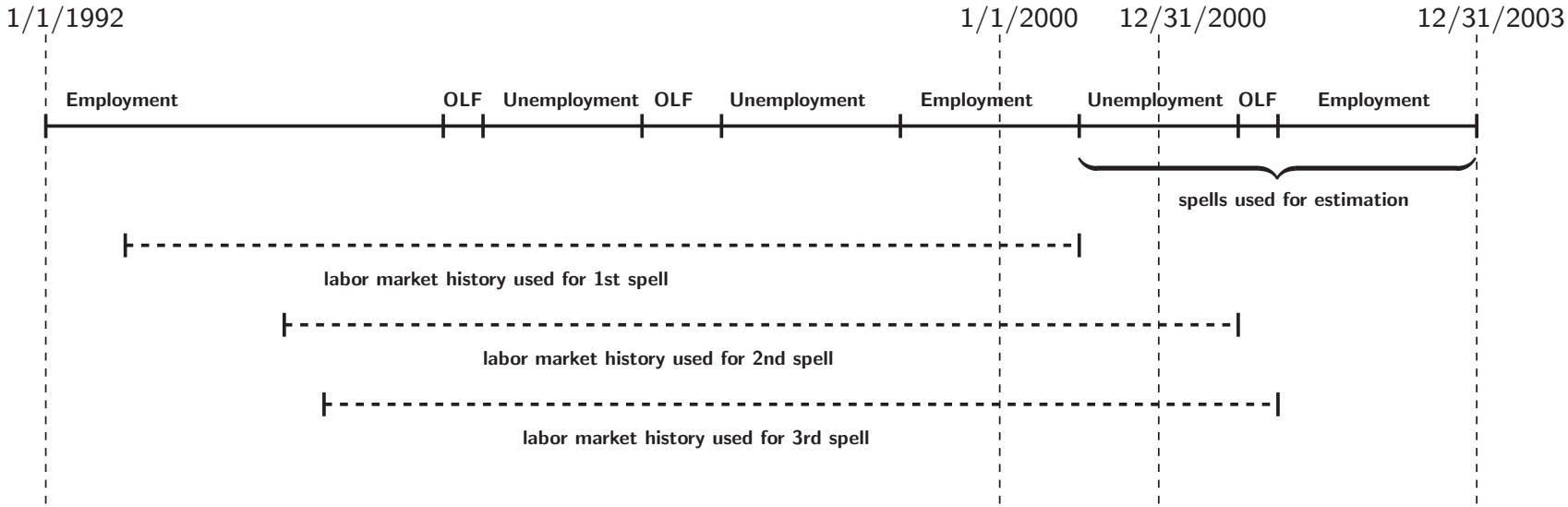

Figure (3): Only the spells that start after 1/1/2000 are used for estimation. Labor market information within the window of eight years before the beginning of a certain spell are used to construct labor market histories.

- The likelihood is the product of the likelihood contribution of each spell:

$$\mathscr{L}\left(\mathbf{y}_i(t_{i,n_i^+}, s_{i,n_i^+}), c_i | \mathbf{y}_i(t_{i,0}, s_{i,0}), \mathbf{x}_i(c_i), v_i\right) = \mathscr{L}\left(c_i | \mathbf{y}_i(t_{i,n_i^+}, s_{i,n_i^+}), \mathbf{x}_i(c_i), v_i\right) \times \left(\prod_{j=1}^{n_i^+} \mathscr{L}\left(t_{i,j}, s_{i,j} | \mathbf{y}_i(t_{i,j-1}, s_{i,j-1}), \mathbf{x}_i(t_i), v_i\right)\right) \tag{1}$$

- Likelihood contribution of person i's transition to state $s_{i,j}$ at time $t_{i,j}$:

$$\mathscr{L}\left(t_{i,j}, s_{i,j} | \mathbf{y}_i(t_{i,j-1}, s_{i,j-1}), \mathbf{x}_i(t_i), v_i\right) = h\left(t_{i,j}, s_{i,j} | \mathbf{y}_i(t_{i,j-1}, s_{i,j-1}), \mathbf{x}_i(t_{i,j}), v_i\right) \times \exp\left(-\sum_{\substack{k=E,U,O \\ k \neq s_{i,j-1}}} \int_{t_{i,j-1}}^{t_{i,j}} h(u, k | \mathbf{y}_i(t_{i,j-1}, s_{i,j-1}), \mathbf{x}_i(u), v_i)\, \mathrm{d}u\right) \tag{2}$$

- Unobserved heterogeneity V_i has discrete support $\{v_1, \ldots, v_M\}$ and $\mathrm{p}_m = \mathrm{P}(V_i = v_M)$ is the probability of V_i taking on the value v_m. With $M = 3$ the likelihood contribution of person i is therefore:

$$\mathscr{L}_i = \sum_{m=1}^{3} \mathscr{L}\left(\mathbf{y}_i(t_{i,n_i^+}, s_{i,n_i^+}), c_i | \mathbf{y}_i(t_{i,0}, s_{i,0}) \mathbf{x}_i(c_i), v_i\right) \mathrm{p}_m \tag{3}$$

- Each transition is modeled as a mixed proportional hazard:

$$h(t, s|\mathbf{y}(\tilde{t}, \tilde{s}), \mathbf{x}(t), v) = \lambda_{\tilde{s},s}(t - \tilde{t}; \alpha_{\tilde{s},s}) \exp\left(x(t)'\beta_{\tilde{s},s} + y(\tilde{t})'\gamma_{\tilde{s},s} + z(\nu)'v_{\tilde{s},s}\right), \tag{4}$$
$$t \geq \tilde{s}, s \neq \tilde{s}, \text{and} \quad \nu \in \{v_1, \ldots, v_M\}$$

- Baseline transition is parametrized as a Weibull-function

$$\lambda_{\tilde{s},s}(t - \tilde{t}; \alpha_{\tilde{s},s}) = \alpha_{\tilde{s},s}(t - \tilde{t})^{\alpha_{\tilde{s},s}-1}. \tag{5}$$

- Parameters are estimated by means of Maximum Likelihood using analytical derivatives and the Newton-Raphson method as optimization method

State dependence:

	Transitions					
	E → U	E → O	U → E	U → O	O → E	O → U
Elapsed Duration						
Weibull $\alpha_{\tilde{s},s}$	0.983***	0.829***	0.918***	0.974***	0.977***	0.864***
	(0.028)	(0.039)	(0.015)	(0.043)	(0.029)	(0.039)
Wald-Test (all $\alpha_{\tilde{s},s} = 1$)						
p-value	0.549	0.000	0.000	0.534	0.425	0.001
Wald-Test (jointly $\alpha_{\tilde{s},s} = 1$)						
p-value = 0.000						
Previous spell (base: person with other type of spell)						
Previous E spell			0.384***	-0.566***	1.069***	-0.343***
			(0.048)	(0.069)	(0.062)	(0.050)
Previous U spell	1.045***	-0.603***				
	(0.066)	(0.106)				
Cumulative number of previous spells						
Previous cum. E spells	0.036	-0.069***	0.121***	-0.070**	0.095***	0.035**
	(0.027)	(0.021)	(0.022)	(0.031)	(0.030)	(0.015)
Previous cum. U spells	0.093***	0.074**	0.031	0.079***	-0.083***	0.076***
	(0.017)	(0.033)	(0.020)	(0.016)	(0.016)	(0.018)
Previous cum. O spells	0.020	0.170	-0.101***	0.135***	-0.048*	-0.071***
	(0.038)	0.041)	(0.012)	(0.012)	(0.025)	(0.014)
Cumulative duration of previous spells (measured in months)						
Previous cum. E duration	0.006	-0.003	0.007	-0.006	-0.003	-0.004
	(0.009)	(0.009)	(0.005)	(0.008)	(0.011)	(0.008)
Previous cum. U duration	0.016*	0.003	-0.012**	-0.013	-0.011	0.004
	(0.009)	(0.009)	(0.005)	(0.008)	(0.012)	(0.008)
Previous cum. O duration	0.011	0.004	0.007	-0.002	-0.004	-0.002
	(0.009)	(0.009)	(0.005)	(0.008)	(0.010)	(0.007)

Table (1): **Standard deviation in parentheses. Significance on 10%, 5% and 1%-level is indicated by *, ** and ***.**

Duration dependence:

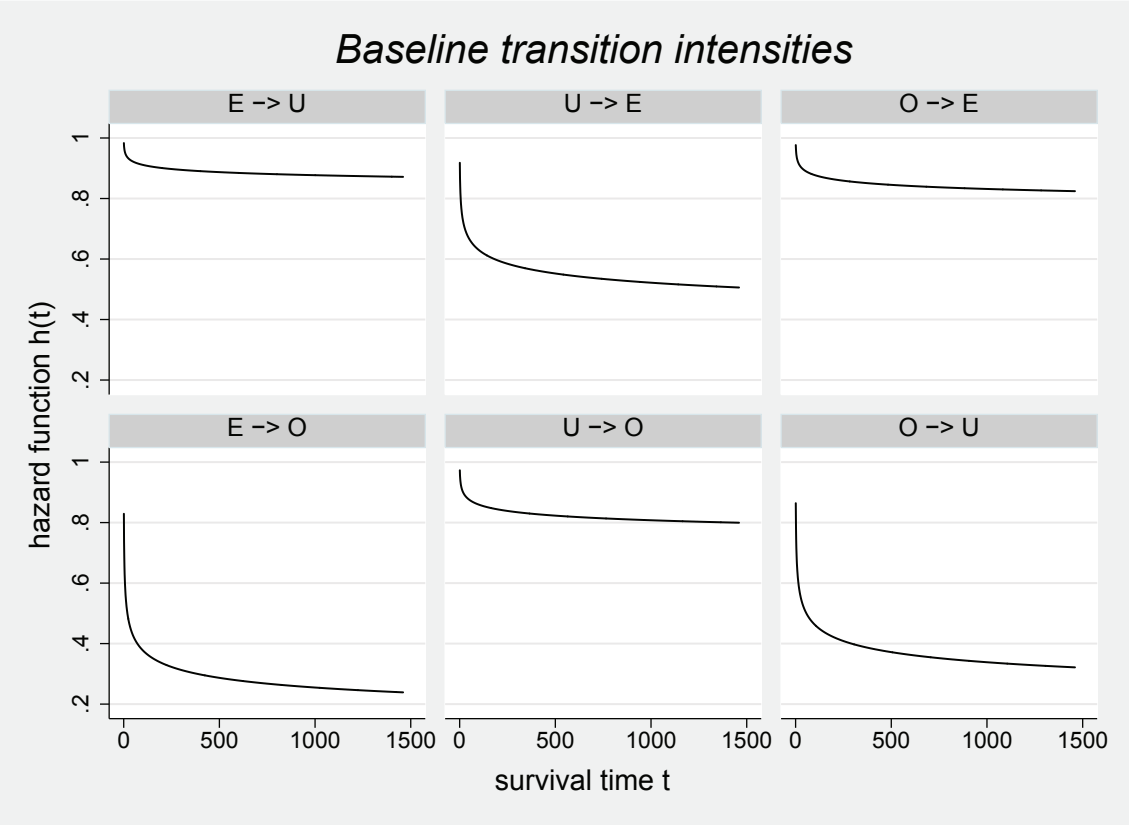

Figure (4): Fitted baseline transition intensities are plotted against time

Occurrence dependence:

- Type of the previous spell indicates a significant and huge impact on the type and timing of the possible transitions
- Past unemployment experiences significantly increase the transition intensity from employment into unemployment, while past employment experiences increase the intensity from unemployment into employment
- Occurrence of past employment spells reduce the risk to exit the labor force and increase the likelihood to reenter the labor force
- The opposite seems to be true for the occurrence of past unemployment and out of labor force spells

Lagged duration dependence:

- For most transitions no lagged duration dependence is found
- Lagged unemployment duration increases the risk to being dismissed and decreases the intensity of becoming employed when unemployed and the intensity to reenter the labor force

Comparison of survivor functions:

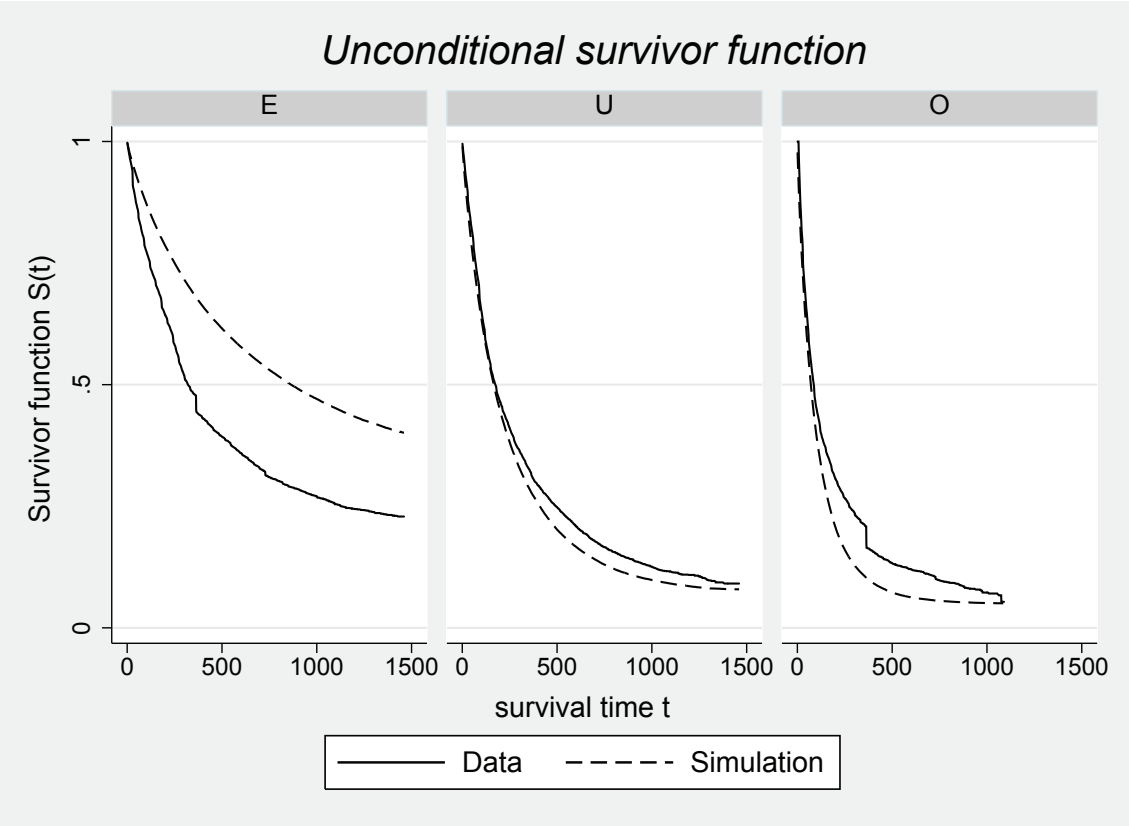

Figure (5): Survivor functions of simulated and raw data are compared for the three labor market states.

6. Conclusion

- State dependence is investigated for a sample of men born 1950 to 1970 extracted from the IEBS
- Labor market states are identified by means of data from four administrative registers
- Results suggest that especially duration and occurrence dependence are present for the estimating sample
- Lagged duration dependence arises only through past unemployment duration, which has an effect on the transitions from employment into unemployment and vice versa
- The model seems to overestimate employment durations but fits well the durations for the other two states

Thank you for your attention!

Unemployment:

- All spells from LeH, BewA and MTH except for job-creation measures and settling-in-allowances

Employment:

- All spells from the BeH except for part-time employment or marginal employment with parallel unemployment information
- Job-creation measures and settling-in-allowances

Out of labor force:

- All periods without information on the labor market state, if they are longer than some predefined levels
- The levels are based on the approach "Unemployment between Jobs" by Fitzenberger and Wilke (2010)

Minimum duration of gaps:

	Origin state			
	E	**U**	**E**	**U**
	1992-1999		*2000-2003*	
Destination state				
E	7	30	7	7
U	30	30	7	7

Table (2): Minimum duration (in days) for periods with no information

- Gaps between to E-spells are considered as *Employment* if shorter as the minimum length.
- Gaps between all other combinations of E-spells and U-spells are considered as *Unemployment* if shorter as the minimum length.
- All gaps that are longer than the minimum length are considered as out of employment.

Data overview:

	Origin state			Total
	E	U	O	
Number of histories beginning after 01/01/2000				
Total				33461
Time under observation (days)				
Average per person	747.83	400.47	151.55	
Per cent	57.53	30.81	11.66	
Maximum history length				1460
Number of spells				
Total	59008	53934	33976	
Right-censored	16627	12600	4234	33461
Uncensored	42381	41334	29742	113457
Destination state				
E	0	30791	14929	
U	27704	0	14813	
O	14677	10543	0	
Incidence rate (exits per year)				
Total	0.62	1.13	2.14	
Destination state				
E	0	0.84	1.07	
U	0.41	0	1.07	
O	0.21	0.29	0	
Duration quantiles (days)				
10%	31	25	13	
20%	81	52	22	
30%	146	81	32	
40%	215	109	49	
50%	286	153	71	
60%	368	225	104	
70%	670	349	165	
80%		576	284	
90%		1160	529	

Table (3): E: Employment, U: Unemployment, O: Out of labor force. *Notes:* Quantiles are based on the Kaplan-Meier product limit estimator. The 80th and 90th percentile are not identified due to right-censoring.

Overview about previous labor market histories:

Past labor market experience				
	E	U	O	Total
Previous spells				
Average number	3.16	2.35	1.71	7.23
Per cent	43.74	22.51	23.75	100.00
Previous duration (in months)				
Average duration	56.31	19.95	20.67	96.93
Per cent	58.09	20.58	21.33	100.00

Table (4): Occurrence and lagged duration for the first spell of the estimating sample

Explanatory variables:

Explanatory Variable	*Date*	*Mean*	*Standard Deviation*
Age	January 1, 2000	41.45	4.61
	last spell	44.07	4.71
Occupation	last spell		
Farming		0.051	0.219
Mining		0.036	0.060
Manufacturing		0.472	0.499
Engineering		0.499	0.218
Service		0.414	0.493
Miscellaneous		0.010	0.100
Education	last spell		
No degree		0.223	0.416
Vocational Training		0.648	0.477
High School		0.012	0.110
High School + Vocational Training		0.035	0.183
Technical College		0.026	0.159
University Degree		0.056	0.229

Table (5): Mean and and standard deviation of explanatory variables are given for the end of last spell of an individual's history.

Results for personal characteristics:

	Transitions					
	E → U	E → O	U → E	U → O	O → E	O → U
Personal characteristics						
Age structure						
Age	-0.058	-0.004	0.019	-0.052	-0.014	0.085
	(0.056)	(0.088)	(0.054)	(0.085)	(0.112)	(0.086)
Age^2	0.000	0.000	-0.001	0.000	-0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Nationality (base: German)						
Foreigner	-0.064	0.121**	-0.101**	0.033	0.022	-0.043
	(0.043)	(0.054)	(0.045)	(0.061)	(0.067)	(0.068)
Occupation (base: manufacturing)						
Farming	0.068	-0.167	-0.081	-0.048	-0.107	-0.205*
	(0.107)	(0.150)	(0.054)	(0.084)	(0.189)	(0.108)
Mining	0.008	-0.011	-0.312	-0.621*	0.303	0.022
	(0.301)	(0.353)	(0.299)	(0.324)	(0.328)	(0.453)
Engineering	-0.394***	-0.240**	-0.169**	-0.128	-0.082	-0.249**
	(0.091)	(0.108)	(0.079)	(0.113)	0.096	(0.115)
Service	-0.257***	0.007	-0.026	0.025	-0.056	-0.163**
	(0.035)	(0.066)	(0.031)	(0.043)	(0.114)	(0.070)
Miscellaneous	0.060	0.057	-0.166	-0.122	-0.511**	0.007
	(0.107)	(0.129)	(0.151)	(0.213)	(0.258)	(0.183)
Education (base: no degree)						
Voc. Train.	-0.365***	-0.164**	0.035	0.099	-0.222***	-0.348***
	(0.076)	(0.079)	(0.040)	(0.064)	(0.067)	(0.051)
HS degree	-0.087	0.345*	-0.313*	-0.174	0.096	-0.472***
	(0.130)	(0.195)	(0.161)	(0.194)	(0.176)	(0.154)
HS + VT	-0.516***	-0.481***	-0.093	0.082	-0.342*	-0.508***
	(0.115)	(0.174)	(0.113)	(0.154)	(0.177)	(0.152)
Tech. College	-0.888***	-1.199***	0.084	0.032	-0.684***	-0.805***
	(0.121)	(0.214)	(0.129)	(0.173)	(0.157)	(0.173)
Uni. degree	-0.751***	-0.691***	-0.041	-0.091	-0.505***	-0.769***
	(0.112)	(0.128)	(0.101)	(0.131)	(0.160)	(0.127)

Table (6): **Standard deviation in parentheses. Significance on 10%, 5% and 1%-level is indicated by *, ** and ***.**

Personal characteristics:

- Age does not seem to have an effect on any of the transitions
- Foreigners are more likely to move from employment into out of labor force and have a lower intensity to find employment when unemployed
- Individuals working in the sectors of engineering and service have a lower risk to become unemployed but also a lower intensity to find a job
- A higher level of education protects against unemployment, but does not seem to help in finding employment
- Interestingly, a higher level of education implies a lower risk to reenter the labor force

Results for environmental characteristics:

	Transitions					
	E → U	E → O	U → E	U → O	O → E	O → U
Environmental characteristics						
Business cycle						
L.GDP growth	-0.057**	-0.172***	0.296***	0.000	0.033	0.050
	(0.023)	(0.027)	(0.024)	(0.046)	(0.051)	(0.037)
Labor market situation in Germany (dynamic)						
Unemployment rate	0.078***	-0.115**	-0.124***	-0.123***	-0.293***	-0.121***
	(0.024)	(0.054)	(0.019)	(0.031)	(0.029)	(0.028)
Regional labor market situation in Germany (static, base: West, hi. dyn. regions + good LM-cond.)						
East, shortcoming in employment	0.433***	-0.156**	-0.333***	-0.484***	-0.203***	0.232***
	(0.068)	(0.079)	(0.041)	(0.088)	(0.067)	(0.066)
West, hi. urbanized + hi. U-rate	0.158*	0.040	-0.469***	-0.257***	-0.132	0.111
	(0.082)	(0.087)	(0.045)	(0.077)	(0.083)	(0.071)
West, more rural + avg. U-rate	0.041	-0.092	-0.201***	-0.212***	-0.108	0.002
	(0.081)	(0.070)	(0.042)	(0.061)	(0.073)	(0.079)
West, hi. dyn. centers + g. LMC	0.038	0.248***	-0.183***	-0.012	-0.182**	-0.028
	(0.084)	(0.084)	(0.064)	(0.077)	(0.074)	(0.080)

Table (7): **Standard deviation in parentheses. Significance on 10%, 5% and 1%-level is indicated by *, ** and ***.**

Environmental characteristics:

- A high unemployment rate indicates a higher risk to become unemployed and a lower intensity to find employment
- A high GDP growth in the last quarter decreases the risk of a dismissal and also increases the intensity to find employment
- Individuals living in regions with worse labor market situations face a higher risk to lose employment and a lower intensity to find employment

Results for unobserved heterogeneity:

	Transitions					
	E → U	E → O	U → E	U → O	O → E	O → U
Unobserved heterogeneity						
Type 1	-8.795***	-4.195	-4.543***	-3.765	-1.484	-4.303**
	(1.768)	(2.750)	(1.298)	(2.395)	(1.791)	(1.770)
Type 2	-8.976***	-3.972**	-5.721***	-3.715	-2.836	-5.642***
	(1.559)	(1.942)	(1.315)	(2.309)	(1.798)	(1.823)
Type 3	-9.958***	-6.080***	-4.535***	-3.417*	-2.344	-4.794**
	(2.141)	(2.008)	(1.280)	(1.883)	(2.878)	(2.117)
Probability of type 1	0.326					
	(-)					
Probability of type 2	0.372***					
	(0.103)					
Probability of type 3	0.302*					
	(0.165)					

Table (8): Standard deviation in parentheses. Significance on 10%, 5% and 1%-level is indicated by *, ** and ***.