Institute for Employment Research
The Research Institute of the Federal Employment Agency

The Scars of Youth –
Effects of Early-Career Unemployment on Future Unemployment Experiences

Achim Schmillen
Institute for Employment Research; IOS
Matthias Umkehrer
Institute for Employment Research

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Background

- rising unemployment rates for 15- to 24-year-olds over the past five years
- in 2011 the OECD-wide unemployment rate for 15- to 24-year-olds was at one of the highest levels within the last 25 years

	OECD	US	France	Italy	Greece	Spain
Unempl. rate	16.2%	17.3%	22.1%	29.1%	44.4%	46.4%

Source: OECD Labor Force Statistics.

These worryingly high rates have stoked fears that the harm today's youth unemployment is doing will be felt for decades, both by those affected and by society at large.

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Two Notions of Early-career Unemployment

1. early-career unemployment as a temporary side-effect of matching processes: observed persistence due to individual differences in the probability to experience unempl. (cf. Topel and Ward, 1992)
2. early-career unemployment alters preferences, prices or constraints that determine in part future unemployment: observed persistence due to *true state dependence* (cf. Heckman and Borjas, 1980)

Research Question and Preview of Main Results

Specific research question:

- Is there a causal link between early-career and prime-age unemployment in Germany, *ceteris paribus*?

We find...

- ... that unemployment is highly persistent amongst a group of individuals
- ... strong evidence for the existence of true state dependence
- ... a downward bias of OLS estimates

Cf. Heckman and Borjas, 1980; Corcoran and Hill, 1985; Mühleisen and Zimmermann, 1994; Gregg, 2001; Gregg and Tominey, 2005; Mroz and Savage, 2006; Nordström Skans, 2011

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Data (1)

Integrated Employment Biographies (IEB) of the Institute for Employment Research (IAB):

- an administrative micro data set
- 1975–2008
- contains detailed longitudinal information exact to the day
- covers periods of employment and unemployment and training
- includes e.g. wages and socio-economic characteristics
- not included are employees not covered by social security (e.g. civil servants or family workers)

Combined with the Establishment History Panel (BHP):

- also an administrative data set,
- contains information on all German establishments with at least one worker employed subject to social security contributions on June 30th (sector, location, wage-level, size etc.)

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Data selection:

- individuals graduating from Germany's dual education system
- three labor market entry cohorts (1978, 1979, 1980)
- only West Germany
- only German citizens
- only men
- ...

Final sample:

- 739,432 individuals
- tracked for 24 years after the end of their first apprenticeship
- where the exact time and place of labor market entry is identified

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Main Variables

Dependent variable:

- m_{t2}: prime-age unemployment (total length in days of all unemployment spells of an individual within a 16 year period)

Main regressor of interest:

- m_{t1}: early-career unemployment (overall length of unemployment spells within the eight years after labor market entry)

An Econometric Model of Prime-age Unemployment (1)

$$m_{i,c,t2} = \alpha m_{i,c,t1} + \mathbf{x}'_{i,c,t0}\beta + \mu_i + \rho_i + \eta_r + u_{i,c,t2}, \quad (1)$$

- $i = \{1, ..., N\}$: individual
  $c = \{1978, 1979, 1980\}$: labor market entry cohort
  $t = \{t0, t1, t2\}$: pre-entry, early-career or prime-age
  $r = \{1, ..., R\}$: district of training firm
- μ_i: individual "ability", ρ_i: individual returns to search, η_r: district-specific effects
- Control variables $\mathbf{x}_{t0}$,

  measured right before graduation:
  - cohort dummies
  - graduation age
  - daily remuneration
  - industrial sector
  - occupation
  - number of employees and median daily wage of training firm

  measured eight years after graduation:
  - local unemployment rate at the transition from youth to prime-age

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An Econometric Model of Prime-age Unemployment (2)

If neither μ_i, ρ_i nor η_r are directly observed, the probability limit of an OLS estimate of α is:

$$plim\alpha_{ols} = \alpha + \frac{cov(\mu, m_{t1})}{var(m_{t1})} + \frac{cov(\rho_i, m_{t1})}{var(m_{t1})} + \frac{cov(\eta, m_{t1})}{var(m_{t1})}. \quad (2)$$

If $m_{i,c,t1}$ is measured with error $e_{i,c,t1}$, $\tilde{m}_{i,c,t1} = m_{i,c,t1} + e_{i,c,t1}$ and (2) becomes

$$plim\alpha_{ols} = \alpha(1 - \frac{cov(e_{t1}, \tilde{m}_{t1})}{var(\tilde{m}_{t1})}) + \frac{cov(\mu, \tilde{m}_{t1})}{var(\tilde{m}_{t1})} + \frac{cov(\rho_i, \tilde{m}_{i,c,t1})}{var(\tilde{m}_{i,c,t1})} + \frac{cov(\eta_r, \tilde{m}_{t1})}{var(\tilde{m}_{t1})}. \quad (3)$$

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Methodological Challenges (1)

OLS estimates might be biased due to unobserved heterogeneity:

- Instrument early-career unemployment with district unemployment rate right before graduation:
- Cf. Gregg (2001); Gregg and Tominey (2005) (and, similarly, Neumark, 2002)

The instrument is...

- ...relevant because it influences the quality of initial matching of apprentices to firms
- ...exogenous because the choice of location at age 17 is exogenous (given district fixed effects)
- ...excluded because time-varying patterns of economic conditions, accumulation of skills and early matching processes prevent a direct impact on prime-age unemployment (we also control for later unemployment rates, cf. Gregg, 2001)

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Methodological Challenges (2)

Corner solution of prime-age unemployment at zero:

- Use Tobit/TobitIV estimator (cf. Wooldridge, 2002)

Effects on the upper tail of the distribution of prime-age unemployment might be more interesting than on the mean:

- Use 4-step Censored Quantile Instrumental Variable estimator (CQIV)
  - introduced by Chernozhukov, Fernandez-Val and Kowalski (2011)
  - based on Hausman (1978), Powell (1986), Chernozhukov and Hong (2002)

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Descriptive Evidence

Table: Summary statistics on unemployment durations (days)

	lifetime	early-career	prime-age
mean	497	188	308
s.d.	900	334	701
min	0	0	0
max	8,754	2,922	5,844
p35	0	0	0
p45	70	0	0
p50	118	15	0
p55	178	44	0
p60	251	78	28
p65	338	121	84
p75	588	244	272
p85	1,023	438	633
p95	2,339	894	1,745

Mean Regression Results

Table: Regressions of prime-age unemployment on early-career unempl.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	Tobit	Tobit	IV	IV	Tobit-IV	Tobit-IV
					Instrument: local unemployment rate right before graduation			
Early-career unempl.	0.89*** (0.01)	0.89*** (0.01)	0.57*** (0.01)	0.57*** (0.01)	1.91*** (0.26)	2.62*** (0.33)	1.29*** (0.15)	1.98*** (0.20)
First-stage coefficient	—	—	—	—	18.27*** (2.57)	27.20*** (5.59)	18.27*** (2.57)	27.20*** (5.59)
F-statistics	—	—	—	—	50.41***	23.96***	—	—
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE	No	Yes	No	Yes	No	Yes	No	Yes
No. of obs.	739,432	739,432	739,432	739,432	739,432	739,432	739,432	739,432

Notes: The dependent variable is prime-age unemployment. Standard errors clustered at the district level in parentheses. *** indicates significance at the 1 per cent level. Each regression controls for cohort dummies, graduation age, daily remuneration, industrial sector, number of employees and median daily wage of training firm, the occupation and the local unemployment rate at the transition from youth to prime-age. IV regressions are performed with Hansen, Heaton and Yaron's (1996) continuously-updated GMM estimator; Tobit-IV regressions are calculated with Smith and Blundell's (1986) conditional maximum likelihood estimator and report the average marginal effects on the observed amount of prime-age unemployment.

Robustness

	(1)	(2)	(3)	(4)
Specification	Establishment closure as instrument	Unempl. at graduation and establishment closure as instruments		
Model	IV	IV	Tobit-IV	Tobit-IV
Regressions of prime-age unemployment				
Early-career unemployment	1.65***	1.98***	1.59***	1.67***
	(0.44)	(0.20)	(0.14)	(0.13)
Regressions of early-career unemployment				
Unemployment at graduation	—	29.47***	30.07***	29.40***
		(5.07)	(4.94)	(5.03)
Establishment closure	86.64***	81.93***	70.24***	42.93***
	(23.65)	(23.81)	(19.34)	(5.82)
First stage F-statistics	13.42***	23.23***	23.23***	70.23***
Hansen J statistic	—	0.74	—	—
District Dummies	√	√	√	√
Large establishments only	√	√	√	
Number of observations	301,730	298,471	298,471	739,158

Notes: Tobit-IV reports average marginal effects on the observed amount of prime-age unemployment. Standard errors clustered at the district level in parentheses. *** indicates significance at the 1 per cent level. Covariates are the same as before. Apart from the instrument(s), variables included in the regressions of early-career unemployment are the same as in the estimates of prime-age unemployment.

Treatment effect heterogeneity over the distribution of prime-age unemployment (1)

Table: Different Estimates of Prime-age Unemployment — Censored Quantile Instrumental Variable Regressions

	(1)	(2)	(3)	(4)	(5)	(6)
Percentile	p50	p70	p80	p85	p90	p95
Censored Quantile Instrumental Variable Regressions of prime-age unemployment (step 4)						
Early-career unemployment	3.56***	2.91***	4.09***	5.09***	6.32***	6.47
Lower bound	(2.82)	(2.84)	(3.76)	(4.17)	(3.22)	(x.xx)
Upper bound	[4.33]	[3.12]	[4.92]	[5.80]	[8.44]	[x.xx]
Marginal effect	**0.96**	**2.04**	**3.76**	**4.94**	**6.20**	**6.47**
Control term	-2.69***	-1.65***	-2.39***	-3.16***	-4.11***	-4.01
Lower bound	(-3.43)	(-1.85)	(-3.20)	(-3.88)	(-5.84)	(-x.xx)
Upper bound	[-1.92]	[-1.55]	[-2.09]	[-2.26]	[-1.12]	[-x.xx]
Marginal effect	**-0.73**	**-1.17**	**-2.20**	**-3.07**	**-4.03**	**-4.01**
District dummies	Yes	Yes	Yes	Yes	Yes	Yes
Cohort dummies	Yes	Yes	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Average marginal effects on the observed amount of prime-age unemployment. Lower bounds of bias-corrected 99% confidence intervals in parentheses and upper bounds in brackets. *** indicates that the 99% confidence interval does not include zero. All quantile regressions are calculated using Stata's *qreg* command with 50 replications. The instrument is the local unemployment rate at graduation. Covariates are the same as before.

Treatment effect heterogeneity over the distribution of prime-age unemployment (2)

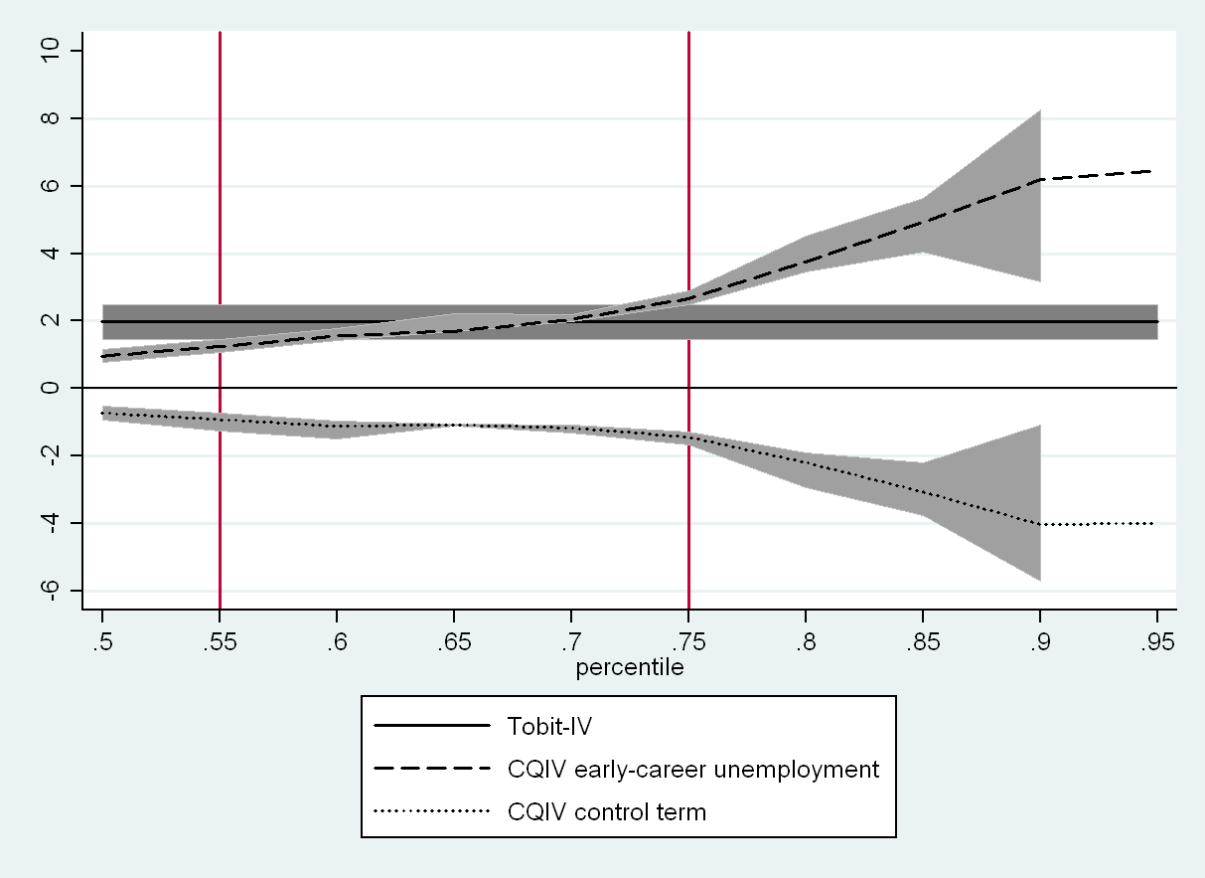

Figure: Different Estimates of Prime-age Unemployment

Notes: Average marginal effects of early-career unemployment and the control term on the observed amount of prime-age unemployment and 99% confidence intervals. The instrument is the local unemployment rate at graduation. Covariates are the same as before.

Conclusions

Main findings:

- unemployment is highly persistent
- youth unemployment causally affects prime-age unemployment
- OLS estimates *understate* this scarring effect

These findings...

- ...support theoretical models of state dependence (cf. Vishwanath, 1989; Lockwood, 1991; Pissarides, 1992)
- ...are in line with the notion that good or bad luck early in the professional career can have long-lasting consequences (cf. Raaum and Roed, 2006; von Wachter and Bender, 2006)
- ...suggest that labor market policies should emphasize the (re-)integration of youths into the labor market and the prevention of early-career unemployment

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Institute for Employment Research
Regensburger Strasse 104
90478 Nürnberg
Germany
E-Mail: achim.schmillen@iab.de
Phone: +49 (911) 179-5660

Matthias Umkehrer
Institute for Employment Research
Regensburger Strasse 104
90478 Nürnberg
Germany
E-Mail: matthias.umkehrer@iab.de
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APPENDIX

Treatment effect heterogeneity over the professional career

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Years	11–18	12–19	13–20	14–21	15–22	16–23	17–24
Early-career U	1.40***	1.48***	1.44***	1.35***	1.29***	1.20***	1.00***
	(0.34)	(0.42)	(0.41)	(0.36)	(0.33)	(0.28)	(0.22)
U in year 9	—	—	—	—	—	—	—
U in years 9–10	-0.85*	—	—	—	—	—	—
	(0.45)						
U in years 9–11	—	-0.67	—	—	—	—	—
		(0.41)					
U in years 9–12	—	—	-0.50	—	—	—	—
			(0.34)				
U in years 9–13	—	—	—	-0.33	—	—	—
				(0.25)			
U in years 9–14	—	—	—	—	-0.22	—	—
					(0.20)		
U in years 9–15	—	—	—	—	—	-0.12	—
						(0.15)	
U in years 9–16	—	—	—	—	—	—	-0.01
							(0.10)
First Stage	12.70***	11.06***	10.60**	10.75**	11.15**	11.54***	12.13***
	(4.17)	(4.20)	(4.19)	(4.22)	(4.41)	(4.43)	(4.38)

Notes: Average marginal effects on the observed amount of prime-age unemployment. Standard errors clustered at the district level in parentheses. * , (**), [***] indicates significance at the 10, (5), [1] % level. In all cases the instrument is the local unemployment rate at graduation.

Treatment effect heterogeneity between compliant subpopulations

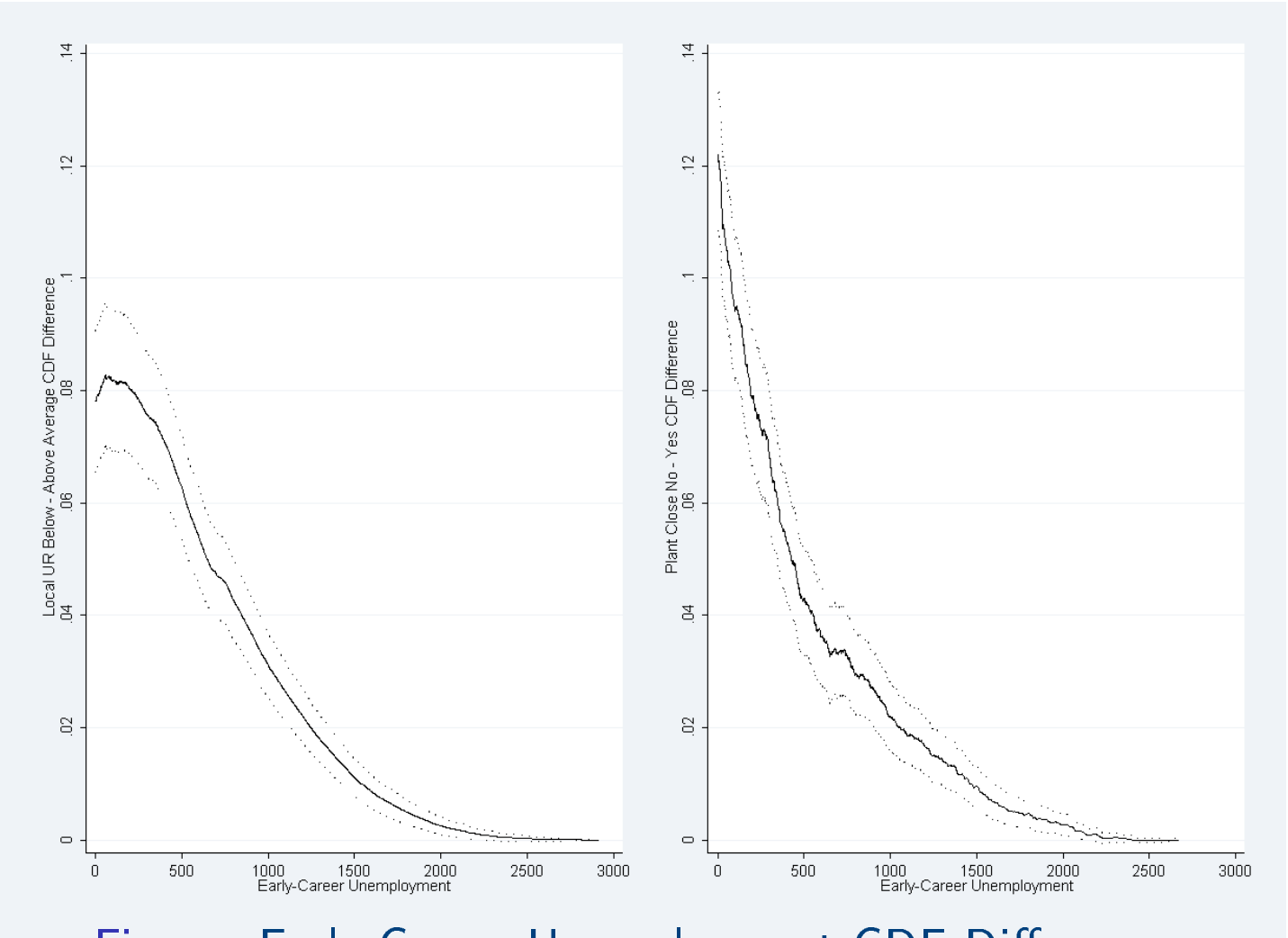

Figure: Early-Career Unemployment CDF Differences.

Notes: The left panel depicts the early-career unemployment CDF difference by treatment status where treatment is defined as initial unemployment rates being above average. In the right panel, treatment is defined as plant closure of the training firm at graduation. Dotted lines are 99% confidence intervals.

Robustness (2)

	(1)	(2)	(3)	(4)	(5)
Model	Tobit-IV	Tobit-IV	Tobit-IV	Tobit-IV	Tobit-IV
Regressions of prime-age unemployment [prime-age non-employment in (5)]					
Early-career unemployment (1-4)	2.00***	2.49***	2.15***	1.90***	1.26***
Early-career nonemployment (5)	(0.20)	(0.18)	(0.22)	(0.21)	(0.09)
Regressions of early-career unemployment [early-career non-employment in (5)]					
Instrument (local unemployment	27.54***	39.11***	27.09***	23.37***	74.53***
rate at graduation)	(5.55)	(5.29)	(5.53)	(4.86)	(11.82)
Other variables included in regressions					
District dummies	Yes	Yes	Yes	Yes	Yes
Unempl. at transition (current)	No	No	Yes	Yes	Yes
Unempl. at transition (origin)	Yes	No	No	No	No
Minimum unemployment in prime age	No	Yes	No	No	No
Number of observations	740,394	809,793	648,644	652,206	739,432

Notes: Standard errors clustered at the district level in parentheses. *** indicates significance at the 1 per cent level. Covariates are the same as before. (1) local unemployment rate at the transition from youth to prime-age for the district of the last apprenticeship spell is used as control; (2) minimum local unemployment rate during prime age is used as control; (3) excludes individuals not observed during the last four years of their prime age; (4) excludes individuals with more than five years of seasonal employment (cf. Del Bono and Weber, 2008); (5) early-career and prime-age nonemployment (cf. Fitzenberger and Wilke, 2010) are used instead of early-career and prime-age unemployment.

Robustness (3)

	(1)	(2)	(3)	(4)
Model	Tobit-IV	Tobit-IV	Tobit-IV	Tobit-IV
Marginal effect	Average marginal effect on latent variable	Average marginal effect on observed variable	Marginal effect on observed variable at the average	Average marginal effect on positive observations
Regressions of prime-age unemployment				
Early-career unemployment	5.14*** (0.60)	1.98*** (0.20)	2.14*** (0.25)	1.74*** (0.21)
Other variables included in regressions				
District FE	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes
Number of observations	739,432	739,432	739,432	739,432

Notes: **Standard errors clustered at the district level** in parentheses. *** indicates significance at the 1 per cent level. Covariates are the same as before. The instrument is the local unemployment rate at graduation. (1) marginal effects on the latent amount of prime-age unemployment; (2) average marginal effects on the observed amount of prime-age unemployment; (3) marginal effects on the observed amount of prime-age unemployment if all explanatory variables take on their average value; (4) average marginal effects on the observed amount of prime-age unemployment among the subpopulation for which prime-age unemployment is not at a boundary. Apart from the instrument, variables included in the regressions of early-career unemployment are the same as in the estimates of prime-age unemployment.

District unemployment

Table: district unemployment rate at graduation

1%	1.2	0.9		
5%	1.6	0.9		
10%	1.9	0.9	Obs	827114
25%	2.6	0.9	Sum of Wgt.	827114
50%	3.6		Mean	3.645607
		Largest	Std. Dev.	1.39423
75%	4.5	8.2		
90%	5.6	8.2	Variance	1.943877
95%	6.2	8.2	Skewness	0.5675911
99%	7.4	8.2	Kurtosis	3.050047

$\rightarrow$ 141 functional labor market units

Institutional Background (1)

Dual education systems...

- ... combine apprenticeships in a company and vocational education at a school in one course
- ...can e.g. be found in Austria, Bosnia and Herzegovina, Croatia, Serbia, Slovenia, Macedonia, Montenegro and Switzerland

Germany's dual education system:

- is often described as THE model dual education system
- around 60 percent of young people go through the system
- access is not formally linked to a specific school certificate (most individuals enter after grades 9 or 10, a few after graduating from high school)
- the period of training is usually two to three years
- the system is organized around about 300 different occupations (e.g. doctor's assistant, optician or oven builder)

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Institutional Background (2)

Often-heard critique of Germany's dual education system (Heckman, 1993; OECD, 2004; European Commission, 2010; Schneider and Zimmermann, 2010; The Economist, 2011):

- sorts people into rigid occupations early in life
- is inflexible and might in the long-term lead to unemployment for individuals in the "wrong" occupations

However:

- anecdotal reports of actual flexibility
- descriptive evidence points to relatively high level of occupational mobility (Fitzenberger and Spitz, 2003; Hagedorn, Kambourov and Manovskii, 2004)

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CQIV (1)

CQR estimator for quantile θ assumes the latent model

$$Y = \max(Y^*, 0) \tag{4}$$

$$Y^* = Q_{Y^*}(U|D, W, V) \tag{5}$$

$$D = Q_D(V|W, Z) \tag{6}$$

- Y^*: the latent lifetime unemployment
- Y: observed lifetime unemployment
- D: endogenous initial occupation
- W: vector of control variables
- V: latent unobserved regressor (control function)
- Z: local occupation-specific labor demand (instrument)
- U: Skorohod disturbance with $U \sim (0, 1)|D, W, V$

CQIV (2)

Estimation of the model: method of Chernozhukov, Fernandez-Val and Kowalski (2009) that combines

- control function approach
- improved estimation procedure for censored quantile regressions by Chernozhukov and Hong (2002)

The estimating procedure consists of four steps:
Step 1. Regress D on W and Z with OLS
$\Rightarrow$ Prediction of the control function $\hat{v}$ is obtained by predicting the residuals from the regression

CQIV (3)

Step 2. Estimate the logit model

$$\delta_i = \dot{x}_i'\gamma + \epsilon_{\gamma i} \tag{7}$$

where δ_i is an indicator of not-censoring and $\dot{x}_i$ is a transform of x_i that includes $\hat{\hat{v}}$. Select the sample $J_0 = \{i : \dot{x}_i'\hat{\gamma} > 1 - \theta + c\}$
$\Rightarrow$ Subset of observations where the quantile line $x_i'\beta_\theta$ is predicted to be above the censoring point.

Step 3. Run an ordinary QR

$$y_i = x_i'\beta_\theta^0 + \epsilon_{\theta i}^0 \tag{8}$$

on the sample J_0.
$\Rightarrow$ Consistent but inefficient estimator $\hat{\beta}_\theta^0$.
Select a sample with the properties $J_1 = \{i : x_i'\hat{\beta}_\theta^0 > 0 + k\}$.

Step 4. Run QR (8) using observations from sample J_1 this time.
$\Rightarrow$ Consistent and efficient estimator $\hat{\beta}_\theta^1$.

Table 4: Different Estimates of Prime-age Unemployment — Baseline Regressions.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Model	OLS	OLS	OLS	Tobit	Tobit	IV	IV	Tobit-IV	Tobit-IV
Regressions of prime-age unemployment									
Early-career unemployment	0.93***	0.89***	0.89***	0.57***	0.57***	2.31***	2.00***	1.67***	1.61***
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.12)	(0.18)	(0.08)	(0.13)
Regressions of early-career unemployment									
Unemployment at graduation	—	—	—	—	—	26.94***	29.58***	29.40***	29.97***
						(1.80)	(3.01)	(1.63)	(2.94)
Establishment closure	—	—	—	—	—	56.81***	76.31***	42.93***	67.04***
						(5.21)	(22.43)	(4.50)	(16.46)
Other variables included in regressions									
District dummies	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Cohort dummies	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector dummies	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unemployment at transition	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dif.-in-Sargan exogeneity test	—	—	—	—	—	185.12***	46.62***	—	—
Smith-Blundell exogeneity test	—	—	—	—	—	—	—	133.40***	51.82***
First stage F-statistics	—	—	—	—	—	174.01***	54.13***	—	—
Hansen J statistic	—	—	—	—	—	26.99***	0.17	—	—
All Establishments	√	√	√	√	√	√		√	
Large establishments only							√		√
Number of observations	827,114	739,432	739,432	739,432	739,432	739,158	300,451	739,158	300,451

Notes: Standard errors clustered at the establishment level in parentheses. * , (**), [***] indicates significance at the 10, (5), [1] % level. "Large establishments only" means that the sample only contains individuals graduating from training firms with at least 50 employees subject to social security contributions and five graduating apprentices in a given year. IV regressions are performed with Hansen, Heaton and Yaron's (1996) continuously-updated GMM estimator implemented in the Stata command *ivreg2* by Baum, Schaffer and Stillman (2003, 2007); Tobit-IV regressions are calculated with Smith and Blundell's (1986) conditional maximum likelihood estimator. In both cases the instruments are the local unemployment rate at graduation and a dummy variable for establishment closure. Tobit and Tobit-IV models report the average marginal effects on the observed amount of prime-age unemployment; for all factor variables the discrete first differences from the base categories are calculated. The delta method is used to compute standard errors. Apart from the instrument, variables included in the regressions of early-career unemployment are the same as in the estimates of prime-age unemployment. For variable definitions see Section 3.

occupation

rank	unemployment rate			plant close		
1	Skilled services	-5.3968515		Skilled services	10.457703	
2	(Semi)professions	7.9163384		Skilled manual	31.651814	***
3	agricultural	16.603265		Unskilled services	32.511855	
4	Technicians and engineers	22.342352	***	Technicians and engineers	40.92607	**
5	Skilled commercial + managers	27.972874	***	(Semi)professions	42.80175	
6	Skilled manual	29.008984	***	agricultural	43.311182	
7	Unskilled services	32.71147	***	Skilled commercial + managers	57.777979	***
8	Unskilled commercial	34.943745	***	Unskilled commercial	66.528903	**
9	Unskilled manual	35.644436	***	Unskilled manual	95.422114	***
10						

The first-stage effect in the full sample is **29.43** for the district unemployment rate at graduation and **42.32** for the closure of training firm at graduation

*,(**) and [***] indicate significance on the one, (five) or [ten] percent level. Sample of large firms.

sector

rank	unemployment rate			plant close		
1	non-profits and households	-28.551472		non-profits and households	-88.972186	
2	financial intermediation	17.837386	**	energy and mining	-13.026266	
3	agriculture	23.763603		financial intermediation	8.0960722	
4	other services	26.442436	***	other services	18.251374	*
5	transport and communications	27.530244	***	trade	35.757689	***
6	trade	28.799701	***	agriculture	35.828242	
7	public administration	30.50015	***	construction	40.592175	***
8	construction	30.859516	***	manufacturing	49.637353	***
9	manufacturing	31.060142	***	transport and communications	108.60125	
10	energy and mining	35.011051	**	public administration	141.61108	***

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