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Dynamics of Low Wage, Low Pay, and Transfer Receipt
Nürnberg

Welfare transitions before and after reforms of the German welfare system

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Outline

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Motivation and research question

- **Motivation 1**: persistence in welfare participation

Table: Time on welfare (welfare recipients Dec 2008)

Years	< 1	$\geqslant 1 \ldots < 2$	$\geqslant 2 \ldots < 3$	$\geqslant 3$
Share (in %)	26.5	14.3	11.4	47.8

Note: Social assitance benefits and UB II. *Source*: BA (2010)

- **Research question 1**: To what extent can the observed persistence be explained by true state dependence (welfare trap) and which part can be explained by heterogeneity?
- **Policy relevance**: If persistence is due to **true state dependence**, then the welfare system affects preferences and constraints that determine welfare receipt.

Motivation and research question

- **Motivation 2**:
  - 2005-reforms of German welfare system: assist and demand
  - 2005-2011: impressive developments of the German labor market
    - unemployment rate dropped from 13.0 to 7.9 percent
    - employment surged from 38.9 to 41.1 million
- **Research question 2**: Did welfare transitions change after the reforms?
- **Research question 3**: Are welfare transitions more responsive to the labor market situation after the reforms?

Literature

- **Line 1**: Studies on state dependence in welfare receipt provide evidence for a welfare trap: e.g., Hansen and Lofstrom 2009 (Sweden), Hansen et al. 2006 (Canada), Chay et al. 2004 (California), Cappellari and Jenkins 2009 (UK)
- **Line 2**: Studies of German labor market and recent reforms:
  - Fahr and Sunde 2009: Hartz I-III increased efficiency of labor market matching
  - Caliendo and Hogenacker 2012: labor market institutions became more efficient; work incentives for the unemployed increased after reforms

Institutions: what changed with Hartz IV?

1. **Incentives**: earnings allowances increased
   Expected effects:
   - reduced welfare persistence
   - increased welfare exit
   - increased welfare entry due to increase in eligibility
2. **Activation**: welfare recipients have to register as unemployed and subject to activation
   Expected effects:
   - reduced welfare persistence
   - increased welfare exit
3. **Benefit level** typically increased for former social assistance recipients (old: 297 Euro, new: 345 Euro)
   Expected effect: increased welfare entry because more households eligible

Outline

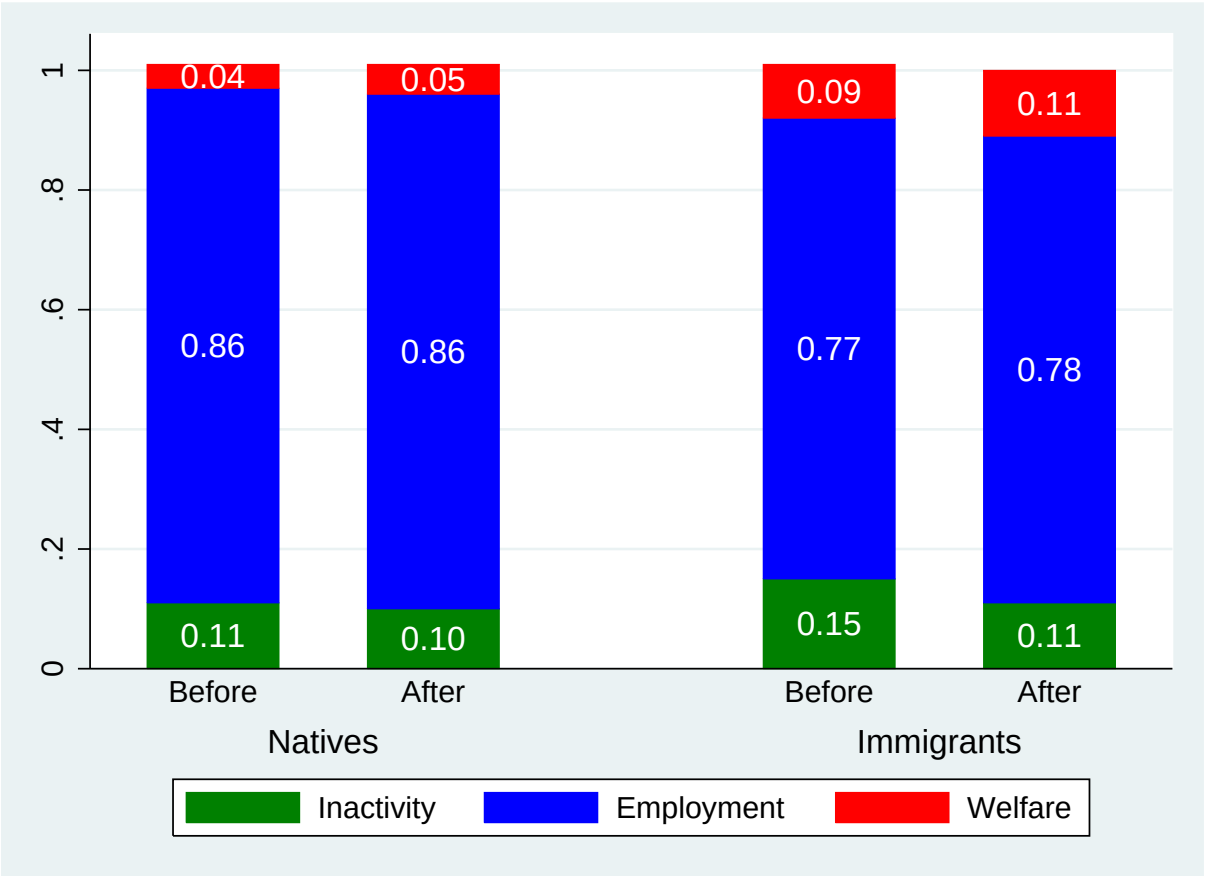
Data

- German Socio-Economic Panel Study (2000-2004, 2005-2010)
- Analysis sample:
  - Unit of observation: head of household
  - Working age (25-60) and not disabled
  - West German subsample (place of residence)
  - Observed in the initial years (2000, 2005)
- Separate analyses for immigrants and natives
- Sample sizes: number of household head-year observations

	pre reform	post reform
natives	13,781	12,977
immigrants	2,953	2,274

Dependent variable: 3 states

1. Welfare
   - Before reform: Unemployment assistance or social assistance
   - After reform: Unemployment benefit II
2. Employed or full time training
3. Unemployed or non-employed ("inactive")



Transition matrix

	State at time t					
	Natives			**Immigrants**		
State in $t-1$	Inactivity	Empl.	Welfare	Inactivity	Empl.	Welfare
Before						
Inactivity	**0.645**	0.281	0.075	**0.590**	0.242	0.169
Employment	0.043	**0.949**	0.008	0.066	**0.915**	0.019
Welfare	0.104	0.168	**0.728**	0.103	0.216	**0.681**
After						
Inactivity	**0.616**	0.305	0.079	**0.576**	0.276	0.149
Employment	0.034	**0.954**	0.011	0.050	**0.928**	0.023
Welfare	0.069	0.204	**0.727**	0.045	0.201	**0.754**

- High persistence in all states
- Possible mechanisms:
  - Observable characteristics
  - Unobservable person-specific differences
  - Causal effect of prior state (constraints, preferences)

Method: dynamic multinomial logit estimator

- Probability of a transition to state j

$$P(Y_{it} = j) = \frac{\exp\left(\beta_j' \mathbf{x}_{it} + \gamma_j' \mathbf{y}_{i,t-1} + \alpha_{ij}\right)}{\sum_{k=1}^{J=3} \exp\left(\beta_k' \mathbf{x}_{it} + \gamma_k' \mathbf{y}_{i,t-1} + \alpha_{ik}\right)}$$

- **Endogenous initial condition**: Wooldridge (2005)

$$\alpha_{ij} = \delta_{j1}' \mathbf{y}_{i0} + \delta_{j2}' \mathbf{x}_i + a_{ij}$$

$\mathbf{y}_{i0}$	initial state
$\mathbf{x}_i$	vector of explanatory variables
a_{ij}	unobserved heterogeneity, assumed $N(0, \sigma_a^2)$
δ_{j1}, δ_{j2}	vectors of coefficients

- Maximum likelihood, Gauss-Hermite quadrature
- **Interpretation**: prediction of transition probabilities for 9 transitions, setting covariates to sample average, bootstrapped confidence intervals

Outline

Estimation results

Example: immigrants and natives after reforms

Variable	Natives		Immigrants	
	Employment	Welfare	Employment	Welfare
Employed in t-1	2.221***	0.523**	2.091***	0.695
Welfare receipt in t-1	1.472***	1.941***	1.636***	1.877***
Age	0.736***	0.830***	0.726***	-0.261
Age squared	-0.875***	-0.934***	-0.913***	0.208
Female	7.876***	18.760***	7.965	-3.037
Age × Female	-0.485***	-0.908***	-0.508*	0.092
Age sq. × Female	0.600***	1.014***	0.629**	-0.092
Education	0.047**	-0.177***	0.137**	-0.060
School in Germany: no	—	—	0.101	-0.045
Married	-0.685***	-1.906***	-0.675**	-1.051***
Health status: good	-0.116	-0.911***	-0.359	-0.088
No. of kids LT 6	0.388**	0.370	0.316	-0.095
No. of kids GE 6	0.124	0.306	0.341	0.189
Year 2007	0.180	-0.486**	0.054	-0.219
Year 2008	0.330**	-0.332	0.469	-0.525
Year 2009	0.226	-0.919***	0.276	-0.090
Year 2010	0.313**	-0.199	0.061	0.175
Employed in t=0	2.562***	-0.089	2.592***	-0.992
Welfare receipt in t=0	0.371	3.203***	0.391	1.901***
M: Health status: good	0.577**	-0.257	1.209**	-0.600
M: No. of kids LT 6	-1.068***	0.110	-1.655***	-0.775
M: No. of kids GE 6	0.265	-0.054	-0.246	0.461
Constant	-15.202***	-16.502***	-14.694***	7.980

State dependence

	State at time t					
	Natives			**Immigrants**		
State in $t-1$	Inactivity	Empl.	Welfare	Inactivity	Empl.	Welfare
Before						
Inactive	**0.22** (.18 ; .27)	0.76 (.71 ; .80)	0.02 (.01 ; .04)	**0.36** (.26 ; .49)	0.52 (.38 ; .62)	0.12 (.08 ; .21)
Employment	0.05 (.05 ; .06)	**0.94** (.94 ; .95)	0.007 (.01 ; .01)	0.07 (.06 ; .10)	**0.90** (.87 ; .92)	0.026 (.02 ; .05)
Welfare	0.08 (.05 ; .12)	0.85 (.79 ; .89)	**0.07** (.04 ; .12)	0.12 (.07 ; .20)	0.69 (.51 ; .78)	**0.18** (.12 ; .36)
After						
Inactive	**0.20** (.16 ; .24)	0.77 (.73 ; .81)	0.03 (.02 ; .05)	**0.20** (.13 ; .33)	0.72 (.59 ; .79)	0.08 (.05 ; .13)
Employment	0.04 (.04 ; .05)	**0.95** (.94 ; .95)	0.013 (.01 ; .02)	0.05 (.03 ; .06)	**0.91** (.89 ; .93)	0.04 (.03 ; .06)
Welfare	0.07 (.05 ; .10)	0.88 (.83 ; .91)	**0.06** (.04 ; .09)	0.06 (.03 ; .11)	0.83 (.74 ; .88)	**0.12** (.07 ; .19)

- persistence in labor market states

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- persistence in labor market states
- small welfare persistence when controlling for heterogeneity

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- persistence in labor market states
- small welfare persistence when controlling for heterogeneity
- Immigrants: higher risk of remaining on welfare than natives

State dependence and welfare trap

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	Natives			**Immigrants**		
State in $t-1$	Inactivity	Empl.	Welfare	Inactivity	Empl.	Welfare
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Overlapping confidence intervals: probability of staying on welfare and probability of moving from inactivity to welfare not significantly different: state dependence not dominant

Outline

Before-after comparison

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- Decline in persistence in welfare and inactivity

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- Decline in persistence in welfare and inactivity
- Increase in welfare entry from employment

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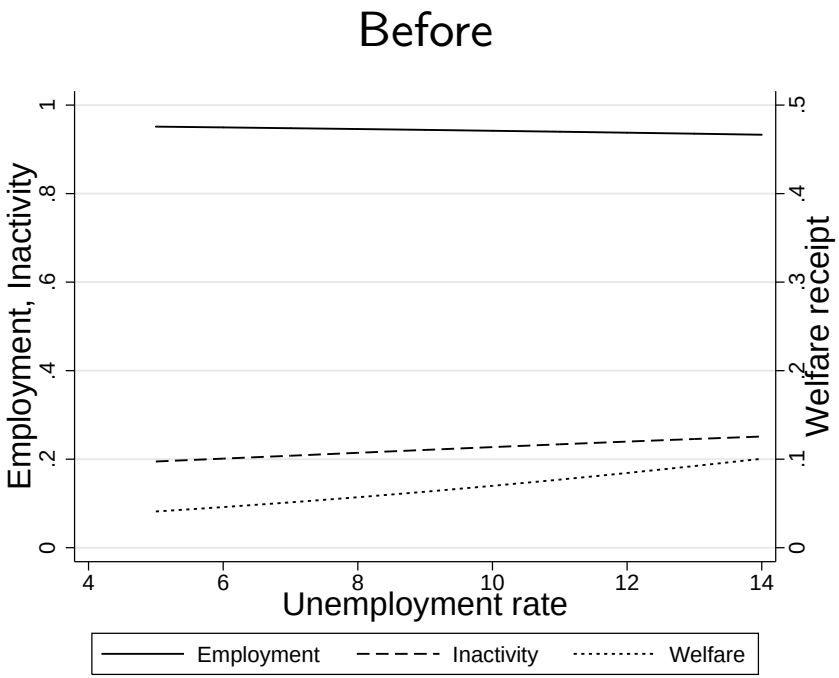
- Decline in persistence in welfare and inactivity
- Increase in welfare entry form employment
- Increased transitions to employment, for immigrants

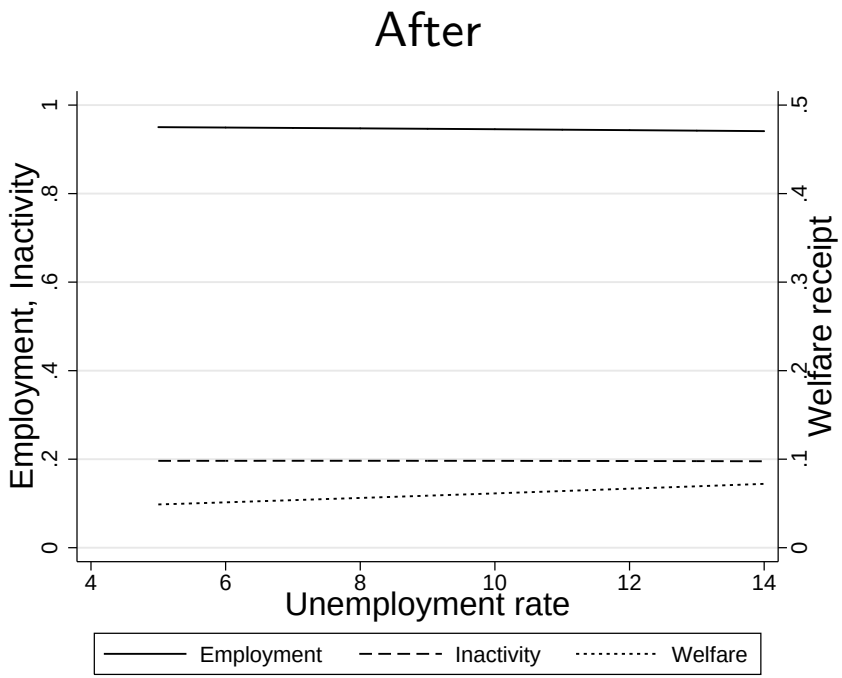
Outline

Welfare transitions and labor market conditions

- Model includes state unemployment and its interaction with the lagged indicators of the labor market state as additional explanatory variables.
- Unemployment is jointly significant.
- We predict probabilities for labor market transitions by unemployment situation.
- Findings:
  - Higher state unemployment is associated with higher welfare persistence, lower welfare exit, higher welfare entry
  - Immigrants more responsive after the reforms (persistence, welfare exit).

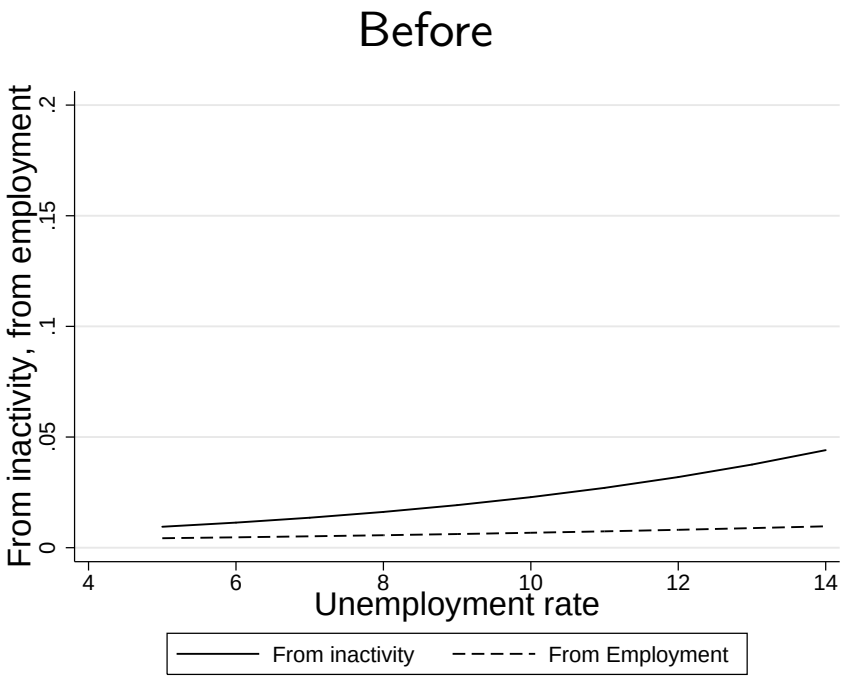
Natives - State persistence before and after reforms

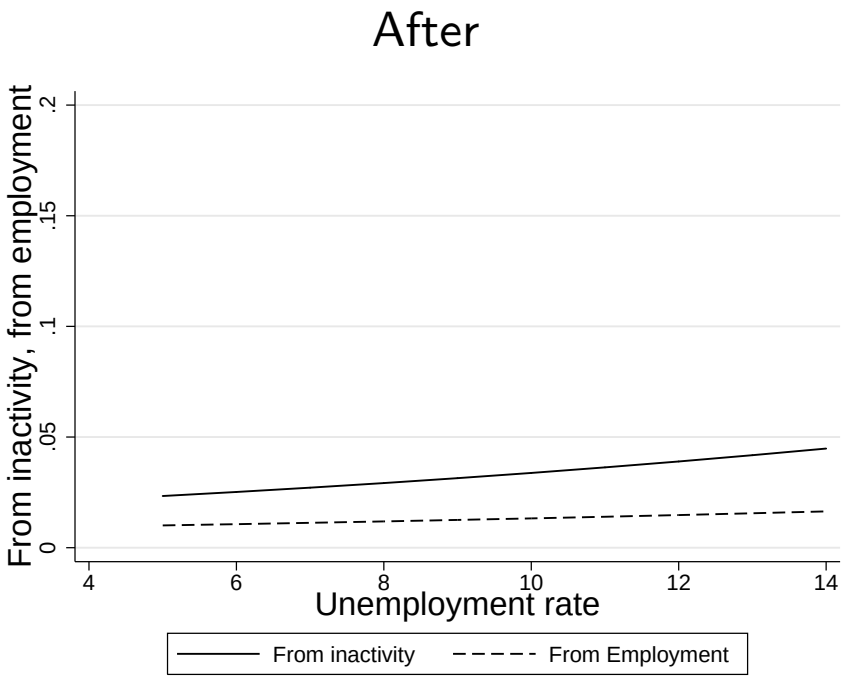




- Higher welfare persistence with increasing unemployment
- Little difference, minor changes in slope

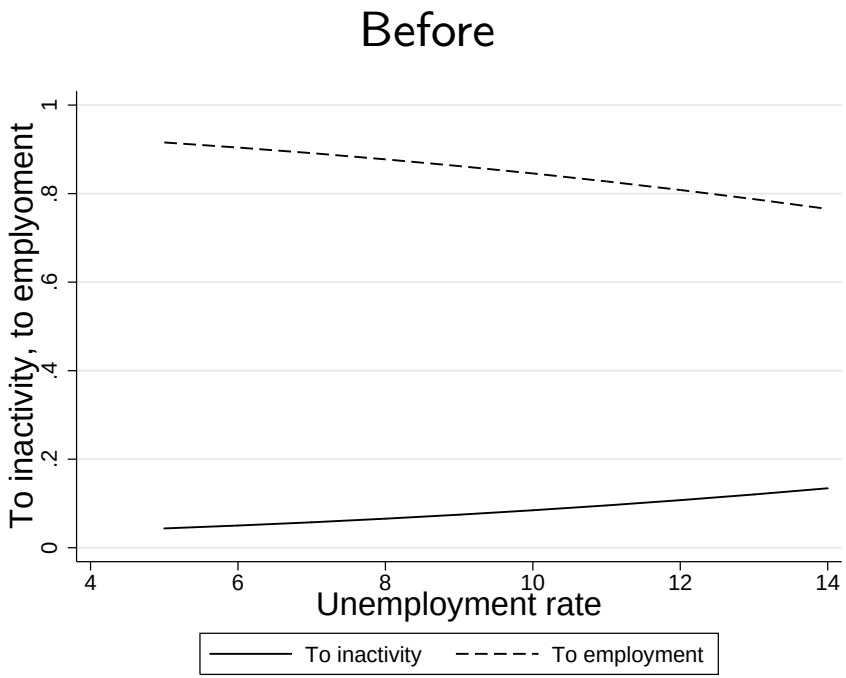
Natives - Welfare entry before and after reforms

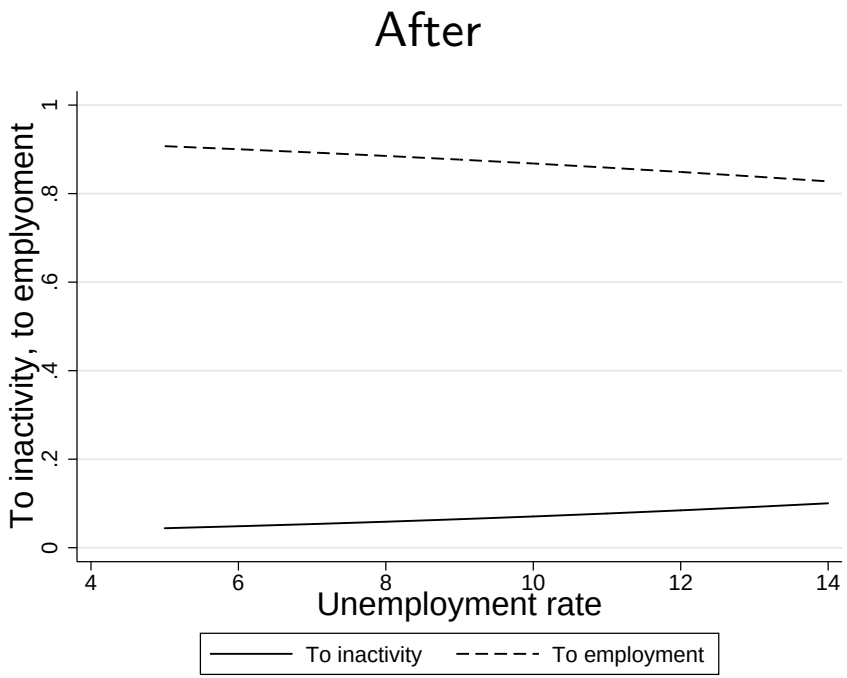




- Higher welfare entry with increasing unemployment
- Slopes hardly change

Natives - Welfare exit before and after reforms

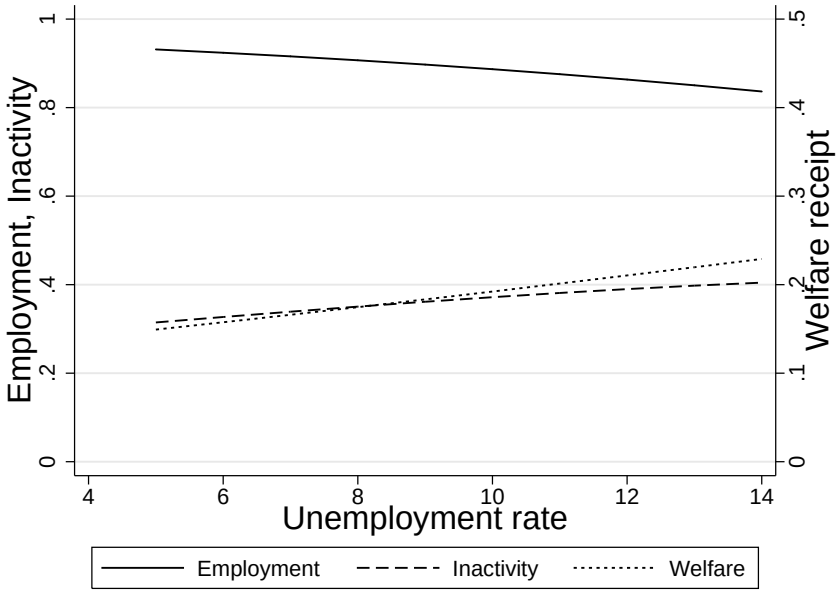




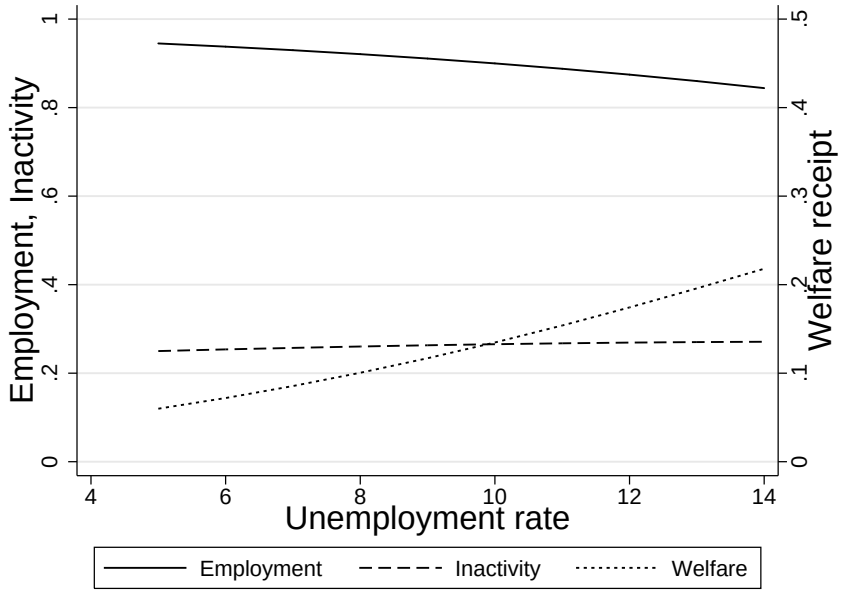
- Lower welfare exit with increasing unemployment
- Slightly higher exit rates to employment after reforms
- Minor changes in slope

Immigrants - State persistence before and after reforms

Before

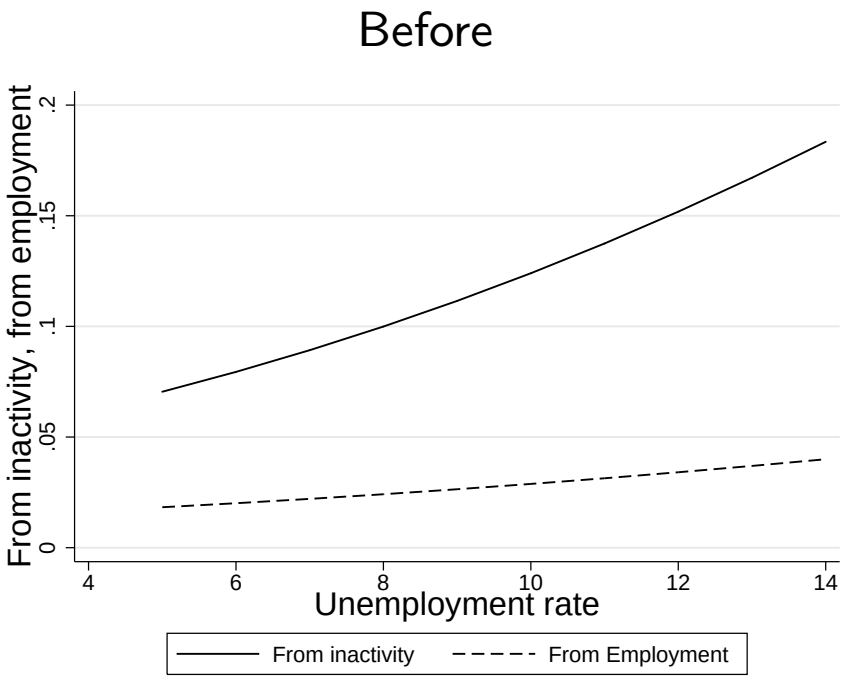


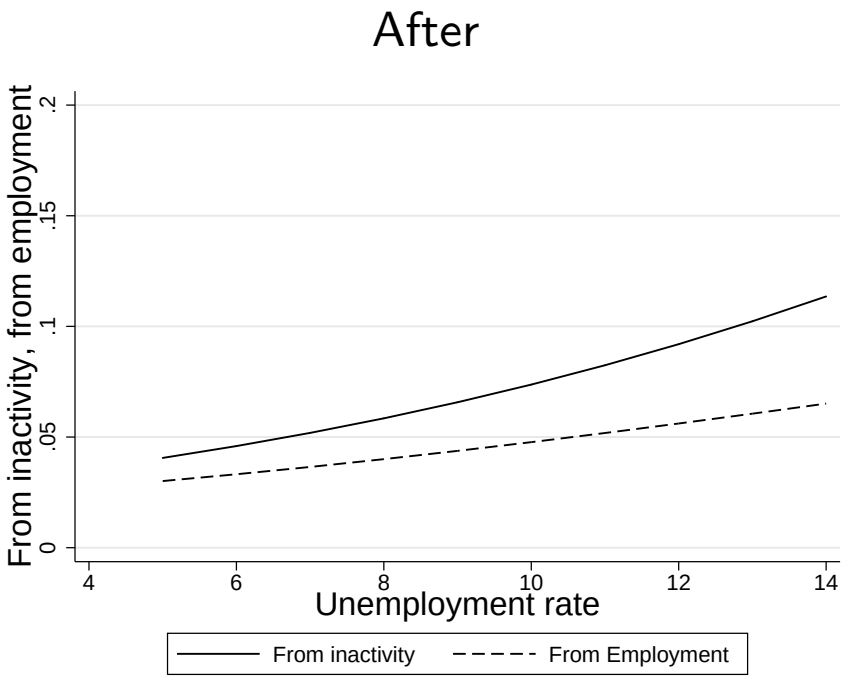
After



- Lower persistence in inactivity
- Steeper slope in welfare persistence

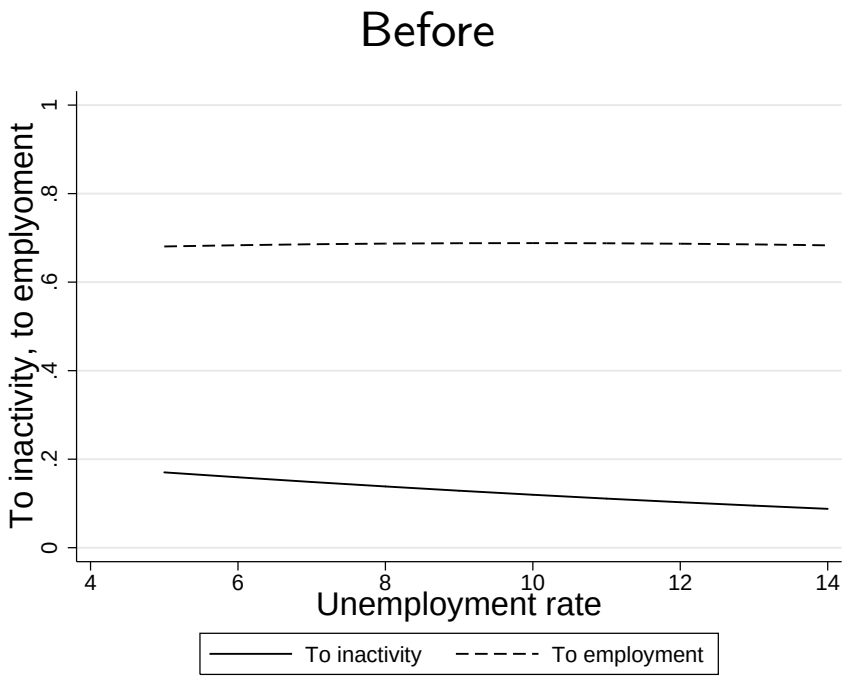
Immigrants - Welfare entry before and after reforms

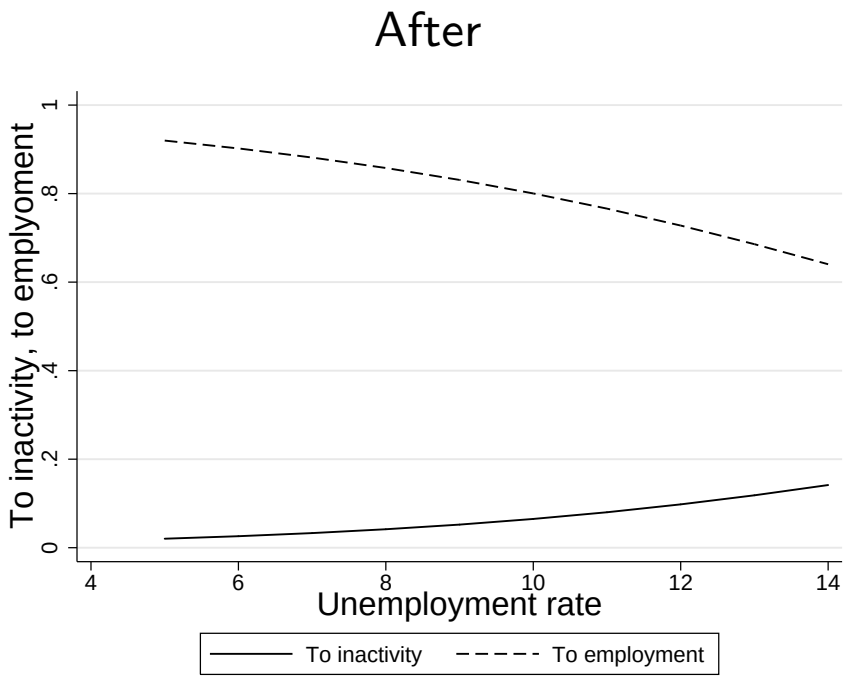




- Reduced welfare entry from inactivity
- Increased welfare entry from employment
- Less responsive to labor market

Immigrants - Welfare exit before and after reforms





- Exit to employment more likely
- More responsive to labor market, much steeper gradient

Outline

Summary

- Is there state dependence in welfare receipt?
  In sum, the case for welfare trap is not convincing.
  - Small probability of welfare persistence on average
  - Probability of staying on welfare not significantly different from probability of welfare entry from inactivity
- Did state dependence change after the 2005 welfare reforms?
  Pre- and post-reform transition patterns differ.
  - Transitions to employment became more likely.
  - Persistence in welfare and inactivity declined.
  - Welfare entry from employment increased.
- What is the relationship between welfare transitions and labor market conditions?
  Higher state unemployment is associated with higher welfare persistence, lower welfare exit, higher welfare entry

Policy implications

- **Connection between reforms and labor market transitions**: The reforms may have contributed to the German "job miracle", as non-working individuals have a higher labor market attachment after the reforms.
- **Problem**: substantial increase in employment-to-welfare transitions after the reform
  - Reform promoted creation of low-qualification, low paid jobs.
  - These jobs may not allow to acquire sufficient claims for unemployment insurance benefits.
  - Unemployment insurance may not sufficiently cover unskilled and low skilled workers in the case of job loss.

Add Ons

1. Institutions I: changes in earnings allowance
2. Institutions II: post-reform minimum income protection
3. Robustness I: setting initial condition to 2006
4. Robustness II: setting the initial state to welfare
5. Robustness III: definition of the dependent variable
6. Robustness IV: auxiliary model for unobserved effect
7. Extension: Role of characteristics and extensions
8. Data: distribution of labor market states by year and descriptive stats
9. Econometric approach
10. Results I: unobserved and observed heterogeneity
11. Results II: life cycle patterns

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Work incentives from changes in earnings allowances and marginal tax

- Under the pre-reform social assistance rules, single individuals could earn up to about 70 Euro on top of social assistance benefits without deductions.
- The marginal tax rate on additional earnings up to 700 Euro amounted to 85 percent and monthly earnings beyond 700 Euro were taxed at 100 percent, i.e., the transfer was reduced by one Euro for every Euro earned.
- After the reforms, the tax-free UB II allowance increased to 100 Euro.
- Earnings between 100 and 800 Euro are taxed at 80 percent, earnings between 800 and 1200 Euro are taxed at 90 percent, and only earnings beyond 1200 Euro per month are taxed at 100 percent.

Add Ons

1. Institutions I: changes in earnings allowance
2. Institutions II: post-reform minimum income protection
3. Robustness I: setting initial condition to 2006
4. Robustness II: setting the initial state to welfare
5. Robustness III: definition of the dependent variable
6. Robustness IV: auxiliary model for unobserved effect
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Institutions: post-reform minimum income protection

Type of benefit	Recipients (2009)	Financing	Description
Unemployment benefit I (UB I)	1.1 Mio.	contribution funded	• conditional on contribution and search, not citizenship • up to 67% replacement rate for typically 12 months • no means test
Unemployment benefit II (UB II)	4.9 Mio	tax funded	• guarantee a dignified life based on a socio-culturally determined minimum income • payout to the employed and unemployed if need • means tested, for those able to work
Social benefit (Sozialgeld)	1.8 Mio.	tax funded	• non-employable persons living in Hartz-IV households
Social assistance	0.8 Mio.	tax funded	• non-employable persons

Add Ons

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Robustness I: setting initial condition to 2006

- We address potential measurement error in the initial labor market state indicator as of 2005.
- We omitted the 2005 data, started our window of observation in 2006 instead and re-estimated the model setting the initial condition to 2006.
- Based on predictions from these estimation results, we find that the results are similar to those presented above.

Robustness I: Setting initial condition to 2006

Transition matrix

State at time $t-1$	State at time t								
	Inactive			Employment			Welfare		
	Mean	95%-CI		Mean	95%-CI		Mean	95%-CI	
A. Natives, post reform									
Inactive	0.184	0.143	0.244	0.790	0.727	0.829	0.026	0.016	0.050
Employment	0.038	0.032	0.044	0.953	0.945	0.959	0.009	0.007	0.014
Welfare	0.068	0.038	0.113	0.885	0.820	0.923	0.047	0.027	0.088
B. Immigrants, post reform									
Inactive	0.149	0.085	0.281	0.779	0.633	0.855	0.073	0.039	0.156
Employment	0.042	0.028	0.064	0.921	0.885	0.940	0.037	0.025	0.065
Welfare	0.041	0.018	0.101	0.850	0.717	0.902	0.109	0.066	0.226

Add Ons

1. Institutions I: changes in earnings allowance
2. Institutions II: post-reform minimum income protection
3. Robustness I: setting initial condition to 2006
4. **Robustness II: setting the initial state to welfare**
5. Robustness III: definition of the dependent variable
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Robustness II: setting the initial state to welfare

- Indicates how the choice of the initial condition affects the transition probabilities.
- Controlling for the endogenous initial condition explains a substantial part of the overall state dependence observed in the raw data.
- Again, we find substantial declines in the persistence of inactivity and welfare receipt for natives, however, now at higher levels.
- Among immigrants a decline in welfare persistence cannot be confirmed. However, their probability of remaining in welfare receipt is again not significantly higher than that of moving from inactivity to welfare.

Robustness II: setting the initial state to welfare

Transition matrix for natives

State at time $t-1$	State at time t								
	Inactive			Employment			Welfare		
	Mean	95%-CI		Mean	95%-CI		Mean	95%-CI	
A. Natives: pre reform									
Inactive	0.374	0.270	0.505	0.207	0.140	0.284	0.419	0.282	0.539
Employment	0.190	0.126	0.284	0.509	0.401	0.617	0.301	0.187	0.415
Welfare	0.095	0.064	0.137	0.190	0.135	0.251	0.715	0.646	0.776
B. Natives: post reform									
Inactive	0.236	0.162	0.328	0.251	0.182	0.329	0.513	0.401	0.611
Employment	0.092	0.058	0.140	0.517	0.421	0.623	0.392	0.283	0.490
Welfare	0.070	0.045	0.102	0.270	0.203	0.337	0.660	0.592	0.731

Robustness II: setting the initial state to welfare

Transition matrix for immigrants

State at time $t-1$	State at time t								
	Inactive			Employment			Welfare		
	Mean	95%-CI		Mean	95%-CI		Mean	95%-CI	
C. Immigrants: pre reform									
Inactive	0.386	0.256	0.555	0.149	0.079	0.239	0.465	0.292	0.600
Employment	0.186	0.103	0.294	0.570	0.406	0.708	0.245	0.129	0.396
Welfare	0.133	0.089	0.200	0.218	0.145	0.292	0.649	0.559	0.740
D. Immigrants: post reform									
Inactive	0.244	0.134	0.415	0.221	0.126	0.333	0.535	0.383	0.662
Employment	0.093	0.041	0.181	0.451	0.330	0.605	0.456	0.295	0.578
Welfare	0.063	0.033	0.119	0.261	0.168	0.358	0.676	0.570	0.772

Add Ons

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Robustness III: definition of the dependent variable

Aufstocker

- If earnings are insufficient to meet household needs, households receive welfare payments even if their members are employed (*Aufstocker*).
- We re-estimate our model and re-coded *Aufstocker* as employed households.
- Our key result on welfare dynamics, i.e., the decline in welfare persistence after the reform, no longer holds with redefined outcomes. This suggests that *Aufstocker* are more likely to leave welfare dependence after than before the reform.
- The other two key results, i.e. the strong increase in the transition rate from employment to welfare and the increasing transition rate from inactivity to employment are generally confirmed with the recoded dependent variable.

Robustness III: definition of the dependent variable

Aufstocker

State at time $t-1$	State at time t								
	Inactive			Employment			Welfare		
	Mean	95%-CI		Mean	95%-CI		Mean	95%-CI	
A. Total population: pre reform									
Inactive	0.253	0.211	0.303	0.723	0.669	0.764	0.025	0.017	0.037
Employment	0.053	0.048	0.059	0.943	0.936	0.948	0.005	0.004	0.007
Welfare	0.104	0.073	0.146	0.850	0.795	0.886	0.047	0.030	0.081
B. Total population: post reform									
Inactive	0.194	0.160	0.236	0.782	0.739	0.816	0.024	0.017	0.037
Employment	0.040	0.035	0.045	0.953	0.947	0.958	0.008	0.006	0.011
Welfare	0.095	0.066	0.134	0.853	0.801	0.887	0.052	0.036	0.081

Add Ons

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Robustness IV: auxiliary model for unobserved effect

1. Original model (Wooldridge 2005)

$$\alpha_{ij} = \delta'_{j1}\mathbf{y}_{i0} + \delta'_{j2}\mathbf{x}_i + a_{ij}$$

- where $\mathbf{x}_i = (\mathbf{x}'_{i1}, ..., \mathbf{x}'_{iT})'$ allows for correlation in all periods
- data set reduces to balanced panel, computationally extensive

2. Constrained model (Mundlak 1978, Akay 2012)

$$\alpha_{ij} = \delta'_{j1}\mathbf{y}_{i0} + \delta'_{j2}\bar{\mathbf{x}}_i + a_{ij}$$

- where $\bar{\mathbf{x}}_i = T_i^{-1} \sum \mathbf{x}_{it}$ are individual-specific averages
- uses unbalanced panel, but potentially over-constrained

3. Relaxed model (Rabe-Hesketh and Skrondal 2013)

$$\alpha_{ij} = \delta'_{j1}\mathbf{y}_{i0} + \delta'_{j2}\bar{\mathbf{x}}_i + \delta'_{j3}\mathbf{x}_{i0} + a_{ij}$$

- where $\mathbf{x}_{i0}$ are initial-period explanatory variables

Robustness IV: auxiliary model for unobserved effect

Variable	Constrained model		Relaxed model	
	Employment	Welfare	Employment	Welfare
Employed in t-1	2.182***	0.561**	2.182***	0.554**
Welfare in t-1	1.485***	1.789***	1.481***	1.819***
output omitted	...		...	
Employed in t=0	2.576***	-0.382	2.554***	-0.369
Welfare in t=0	0.402	2.991***	0.383	2.896***
M: Health: good	0.696***	-0.485	0.482*	0.015
M: # kids LT 6	-1.166***	0.040	-1.700***	-0.163
M: # kids GE 6	0.182	0.194	0.368	-0.111
I: Health: good	—	—	0.186	-0.424
I: # kids LT 6	—	—	0.441**	0.199
I: # kids GE 6	—	—	-0.126	0.290
# hh-year obs.	15,251		15,215	
# hh	3,882		3,860	

Source: SOEP 2000-2010.

Robustness IV: auxiliary model for unobserved effect

Total population

State at time $t-1$	State at time t								
	Inactive			Employment			Welfare		
	Mean	95%-CI		Mean	95%-CI		Mean	95%-CI	
A. Constrained model									
Inactive	0.195	0.161	0.237	0.767	0.724	0.800	0.038	0.029	0.053
Employment	0.042	0.036	0.048	0.942	0.935	0.948	0.016	0.014	0.021
Welfare	0.066	0.046	0.095	0.874	0.835	0.901	0.060	0.045	0.085
B. Relaxed model									
Inactive	0.195	0.164	0.239	0.767	0.724	0.799	0.038	0.028	0.052
Employment	0.042	0.037	0.047	0.942	0.936	0.949	0.016	0.013	0.020
Welfare	0.066	0.046	0.093	0.873	0.835	0.900	0.061	0.045	0.086

Add Ons

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Contribution of characteristics to before-after change

- Predictions for pre reform characteristics using post reform coefficients
- If simulated transitions converge to original pre reform predictions, then characteristics matter.
- If simulated transitions converge to original post reform predictions, then behavioral changes.
- Finding: in general, results similar to those for post reform characteristics.
- But: stronger increase in welfare entry and higher welfare persistence, suggests that change in characteristics dampens the propensities to enter and to stay on welfare.

Contribution of characteristics to before-after change

Simulated transition probabilities for pre reform characteristics and post reform coefficients

	State at time t					
	Natives			**Immigrants**		
State in $t-1$	Inactivity	Empl.	Welfare	Inactivity	Empl.	Welfare
Before						
Inactive	0.22	0.76	0.02	0.36	0.52	0.12
Employment	0.05	0.94	0.007	0.07	0.90	0.026
Welfare	0.08	0.85	0.07	0.12	0.69	0.18
After						
Inactive	0.20	0.77	0.03	0.20	0.72	0.08
Employment	0.04	0.95	0.013	0.05	0.91	0.04
Welfare	0.07	0.88	0.06	0.06	0.83	0.12
Simulation						
Inactive	0.21	0.75	0.04	0.20	0.70	0.10
Employment	0.05	0.94	0.018	0.04	0.90	0.05
Welfare	0.07	0.85	0.08	0.05	0.80	0.15

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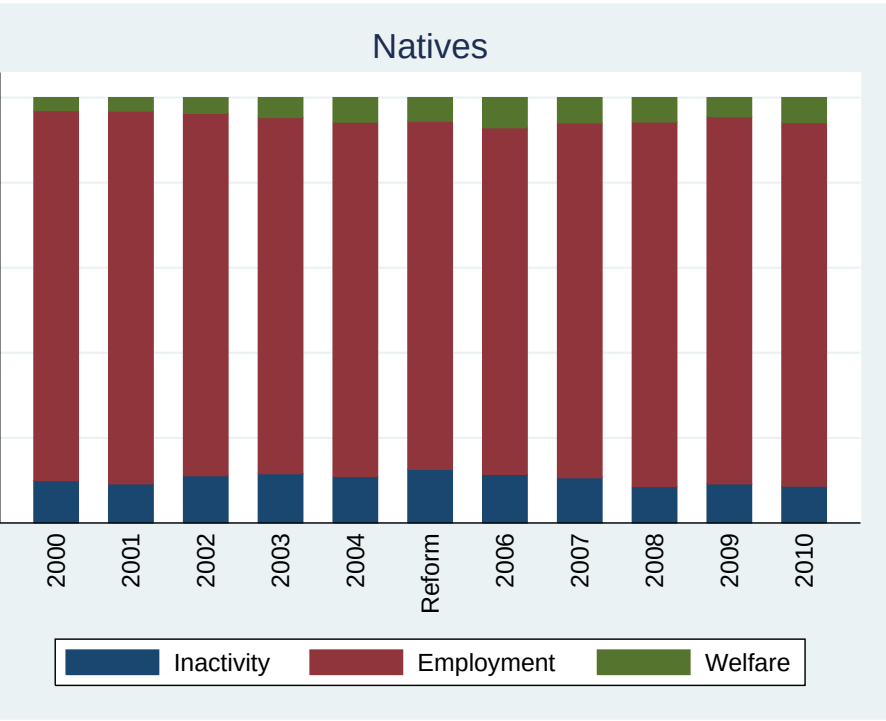
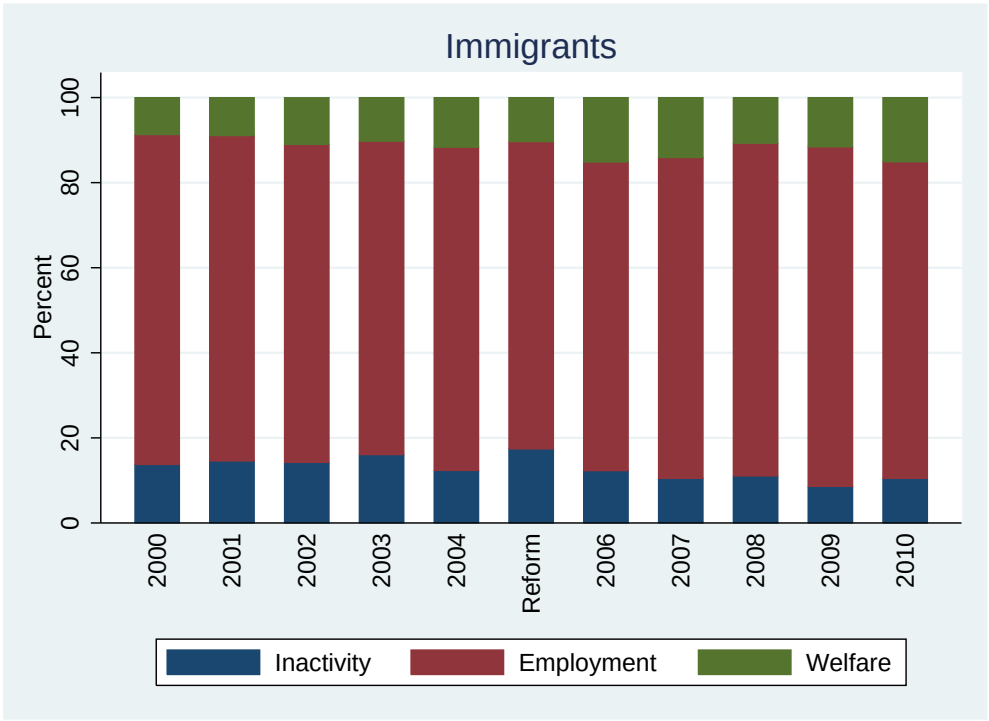
Observed distribution of labor market states by year





Natives 2010: 9, 85, 6%

Immigrants 2010: 11, 74, 15%

- Increase in welfare after reform
- Welfare gap

Descriptive statistics

	Pre reform (2000-2004)				Post reform (2005-2010)			
	Natives		Immigrants		Natives		Immigrants	
Variable	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Inactivity	0.11	0.31	0.15	0.35	0.10	0.30	0.11	0.32
Employment	0.86	0.35	0.77	0.42	0.86	0.35	0.78	0.42
Welfare	0.04	0.18	0.09	0.28	0.05	0.21	0.11	0.31
Age	43.09	8.57	42.52	9.17	44.25	8.39	43.57	8.74
Female	0.35	0.48	0.27	0.44	0.41	0.49	0.37	0.48
Education in years	12.59	2.74	11.00	2.41	12.75	2.75	11.31	2.52
Married	0.66	0.47	0.79	0.40	0.63	0.48	0.78	0.42
Health status: good	0.60	0.49	0.57	0.50	0.55	0.50	0.54	0.50
School in GER: no	0.00	0.00	0.60	0.49	0.00	0.00	0.47	0.50
# children LT6	0.23	0.52	0.33	0.60	0.17	0.45	0.24	0.52
# children GE6	0.57	0.86	0.81	0.99	0.52	0.83	0.80	0.96
Initial condition								
Inactivity	0.10	0.30	0.13	0.34	0.11	0.32	0.17	0.38
Employment	0.87	0.34	0.78	0.41	0.85	0.36	0.74	0.44
Welfare receipt	0.03	0.18	0.09	0.28	0.04	0.19	0.09	0.29
# person-year obs.	13,781		2,953		12,977		2,274	

Add Ons

Prediction of probabilities

Skrondal and Rabe-Hesketh (2009)

1. Prediction for an observation of a hypothetical individual: using particular values of the random effects, e.g. $\boldsymbol{\alpha} = \mathbf{0}$.
2. Prediction for an observation of a new individual (that is sampled randomly)

$$\overline{P}(Y_{it} = j|\mathbf{y}_{i,t-1}, \mathbf{x}^0) = \int \hat{P}(Y_{it} = j|\mathbf{y}_{i,t-1}, \mathbf{x}^0, \boldsymbol{\alpha}) h(\boldsymbol{\alpha}|\mathbf{x}, \mathbf{y}_0; \delta) d\boldsymbol{\alpha}$$

   Probability is obtained by integrating over the (prior) random-effects distribution.
3. Predicition for a new observation of an existing individual: e.g., plugging in the empirical Bayes predictions of the random effects.

Wooldridge (2005) approach

- The joint density of $(\mathbf{y}_1, ..., \mathbf{y}_T)$ given $(\mathbf{y}_0, \mathbf{x}, \alpha)$ is

$$\prod_{t=1}^{T} f(\mathbf{y}_t | \mathbf{x}_t, \mathbf{y}_{t-1}, \alpha; \theta)$$

- Initial conditions problem: exogeneity assumption (used to marginalize the likelihood with respect to the unobserved heterogeneity) cannot be used in dynamic setting because $\mathbf{y}_0$ will not be independent of the unobserved heterogeneity α.
- How to deal with α along with $\mathbf{y}_0$?
- Wooldridge: specify the density of α conditional on the initial observation. The likelihood contribution of individual i is:

$$\int \prod_{t=1}^{T} f_t(\mathbf{y}_t | \mathbf{x}_t, \mathbf{y}_{t-1}, \alpha; \theta) h(\alpha | \mathbf{x}, \mathbf{y}_0; \delta) d\alpha$$

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Unobserved and observed heterogeneity

- Unobserved heterogeneity
  - Random effects highly significant at 1% for all subsamples
  - Larger variance in transition to welfare than employment
  - Insignificant covariance
- Observed heterogeneity
  - Initial conditions highly significant $\rightarrow$ initial state matters
  - Similar correlation patterns for natives and immigrants
  - Health, education as expected, positive employment time trends

Add Ons

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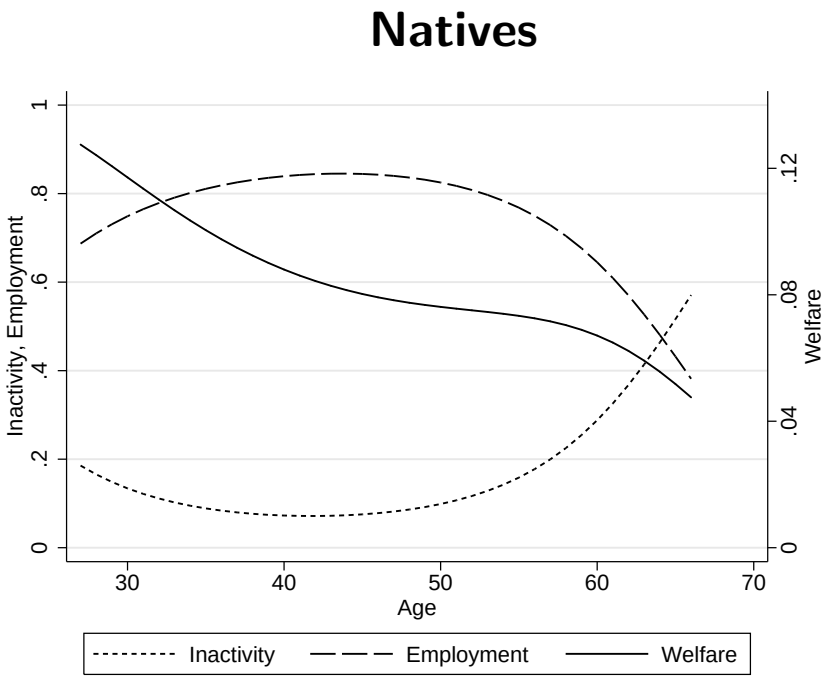
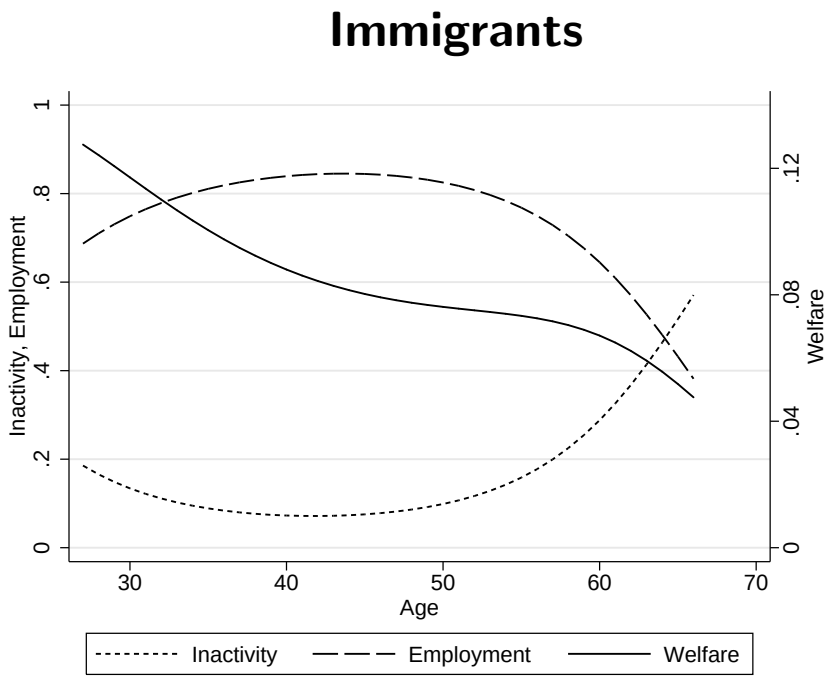
Average age profile of transitions from welfare





- Exit to employment declines with age
- Exit to inactivity increases with age
- Welfare persistence declines with age, much higher for migrants