Wage Inequality, Labor Market Participation and Unemployment –

Testing the Implications of a Search-Theoretical Model with Regional Data

Joachim Möller

Alisher Aldashev

Universität Regensburg

www.wiwi.uni-regensburg.de/moeller/

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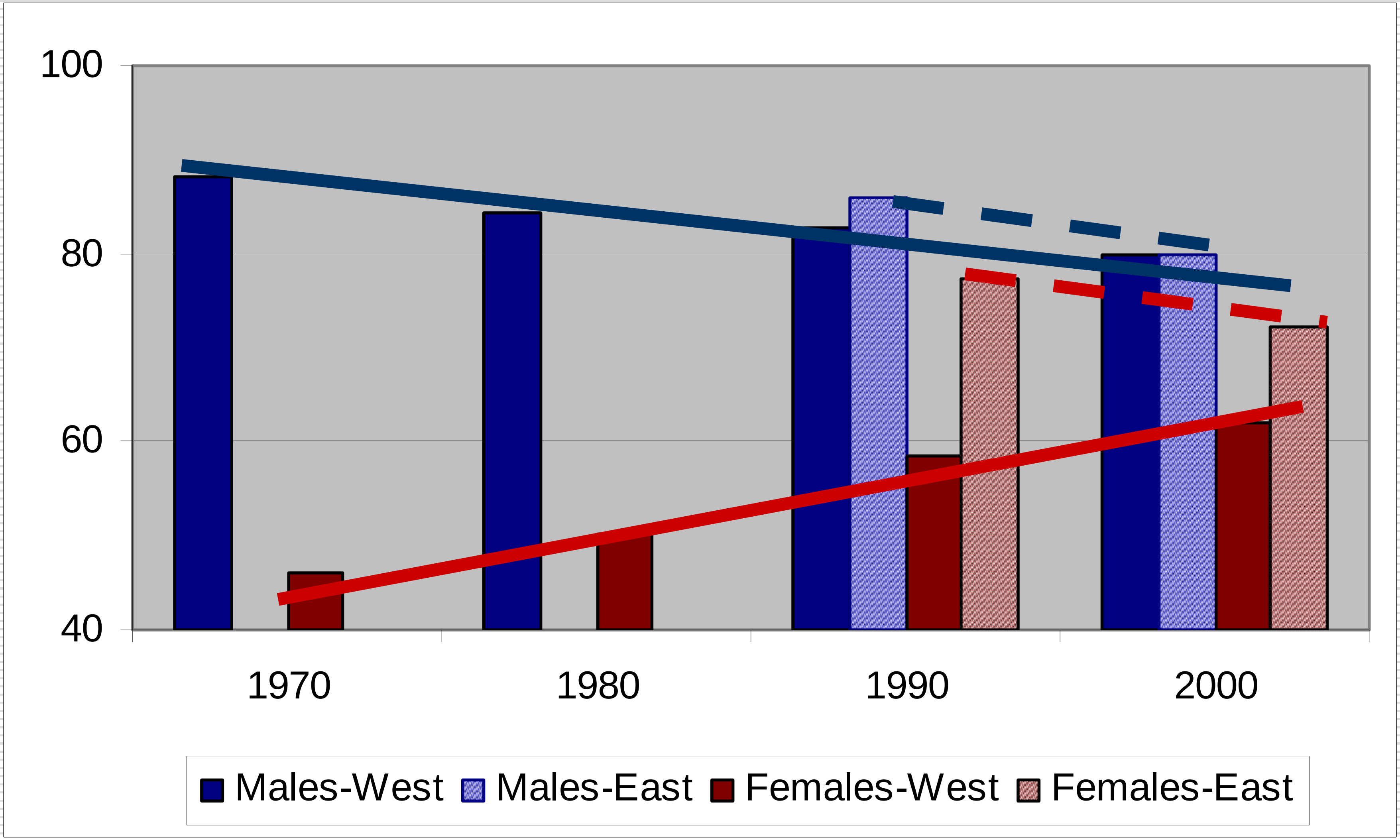
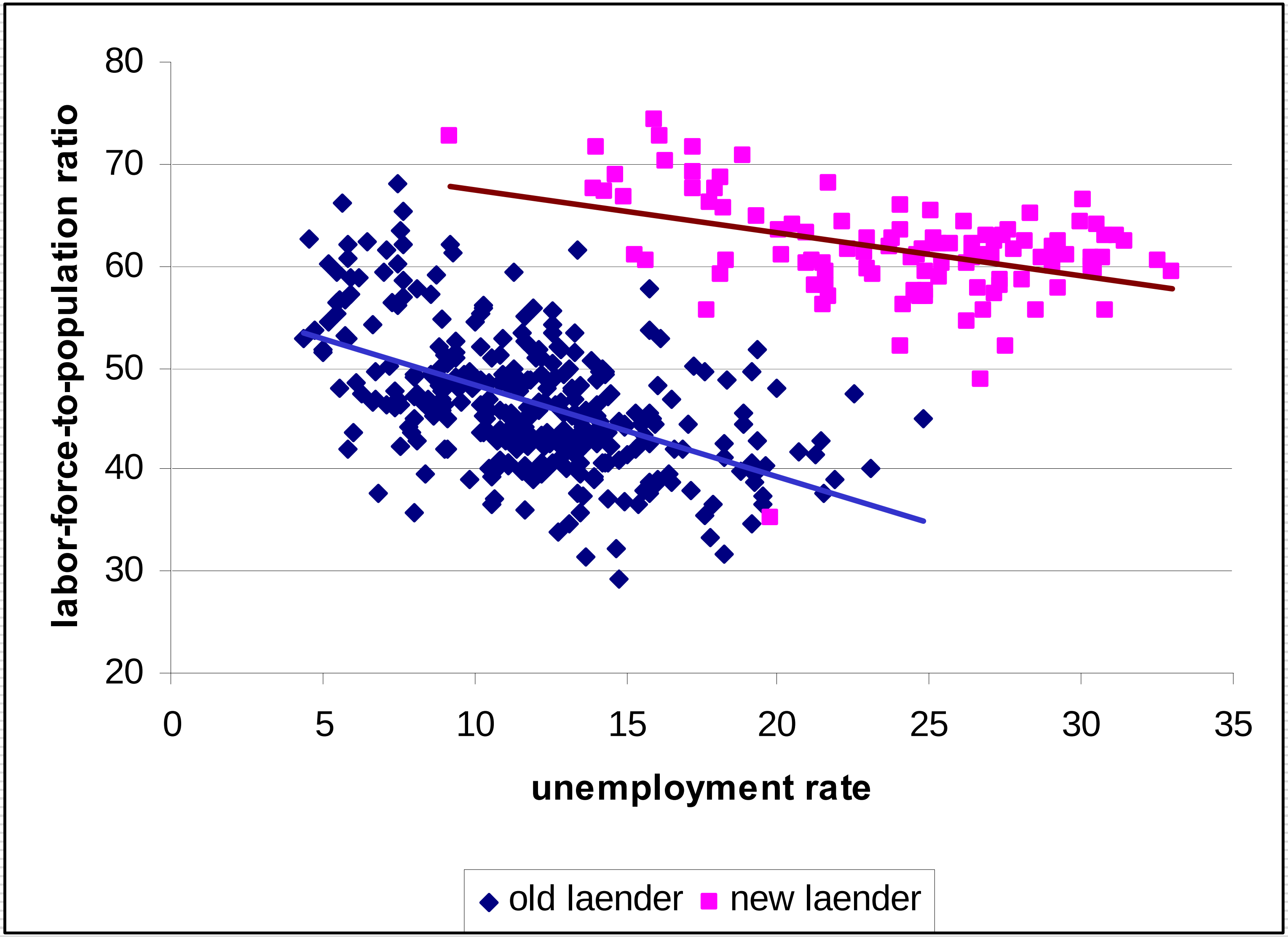
Participation rates

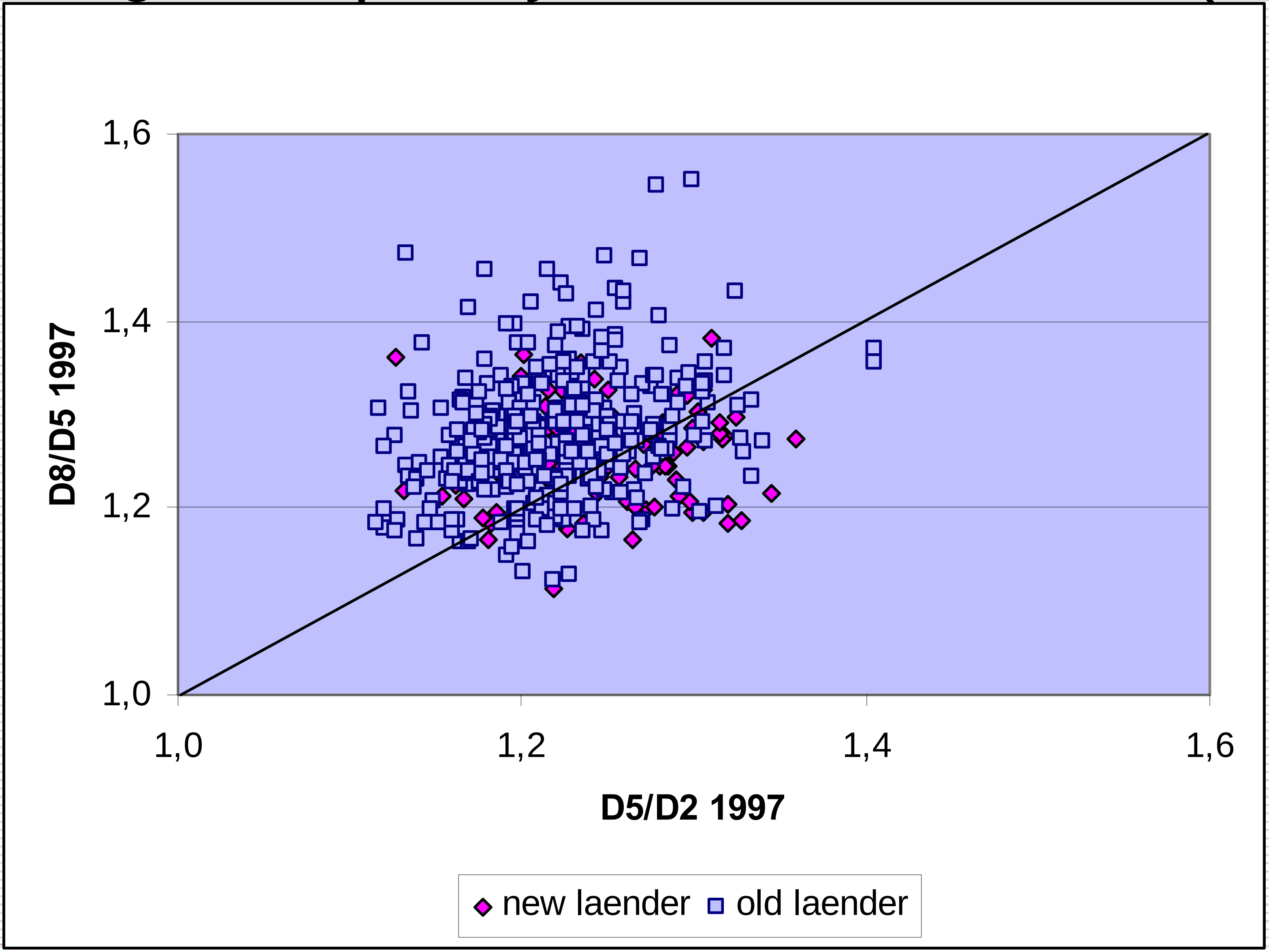


Unemployment vs. participation (all workers)

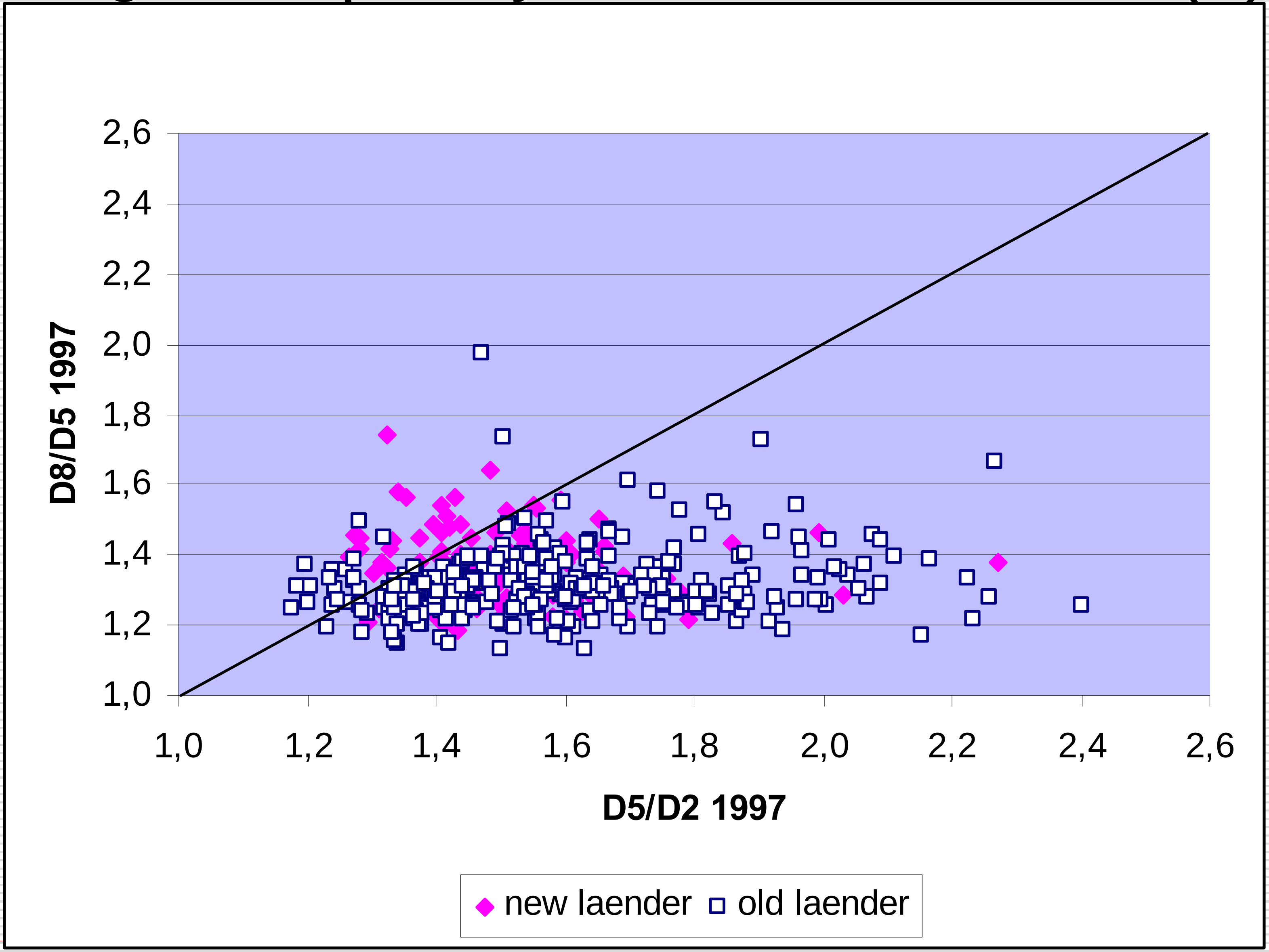
Unemployment vs. participation (female workers)



Wage inequality D5/D2 & D8/D5 (M)



Wage inequality D5/D2 & D8/D5 (F)



Structure

- Search-theoretical model
- Data
- Econometric Approach
- Results
- Conclusions

Search-theoretical model: Basic settings

Extension of standard search-theoretical approach (McCall, Mortensen, Pissarides)

- job offers as random drawings from a job offer distribution
- dynamic optimization approach
- model in continuous time

Specific characteristics here

- job offer arrival rate influenced by search intensity
- possibility of separations
- exclusion of on-the-job search

Search-theoretical model: Assumptions

- Wage offer distribution is time invariant and known to agents
- Jobs are different with respect to wages only
- Individuals live forever
- Agents are wealth-maximizing (risk neutrality)

δ

Search-theoretical model: Specifications

- Population P, number of job-seekers S, number of vacancies V;
- Search costs c and job arrival rate λ depend on search intensity θ :

$$c = c(\theta) = c_0 + \frac{1}{2} C \theta^2$$

and

$$\lambda = \lambda(\theta) = \theta \frac{V}{S}$$

Choose optimal $\theta \rightarrow \theta^*$

Search-theoretical model: Basic Relations

(i) special case $\sigma = 0 \rightarrow$

W Value of employment: $W(w) = \frac{1}{\delta}(w)$

(present value of an infinite stream of income *w*)

(ii) $\sigma > 0 \rightarrow$

W Value of employment: $W(w) = \frac{1}{\delta + \sigma}(w + \sigma\Omega)$,

where $\Omega(\cdot)$ is the value of search:

W Reservation wage r :

$$\frac{r}{\delta} = \Omega \rightarrow r = \delta\,\Omega$$

Search-theoretical model: Basic Relations

- Reservation wage:

$$r = \delta\Omega = b - c(\theta^*) + \lambda(\theta^*)\frac{K(r)}{\delta + \sigma} \qquad (1)$$

δ : discount rate; σ : separation rate;

b : income in case of unemployment

θ^* : optimal search intensity

$$K(r) := \bar{w} - r + \int_0^r F(w)\mathrm{d}w > 0$$

Comparative static results (1)

- Using FOC of optimal search intensity + substituting functions for search costs and job arrival rate in eq.(1)

$$\boxed{\rightarrow \Phi\left(r;\cdot\right) = b^{u} + \frac{1}{2C}\left[\varkappa_1 K(r)\right]^2 - r = 0 \qquad (1')}$$

with $\varkappa_1 := \dfrac{V}{S\left(\delta+\sigma\right)}; \quad b^{u} := b - c_0$

Comparative static results (1)

From

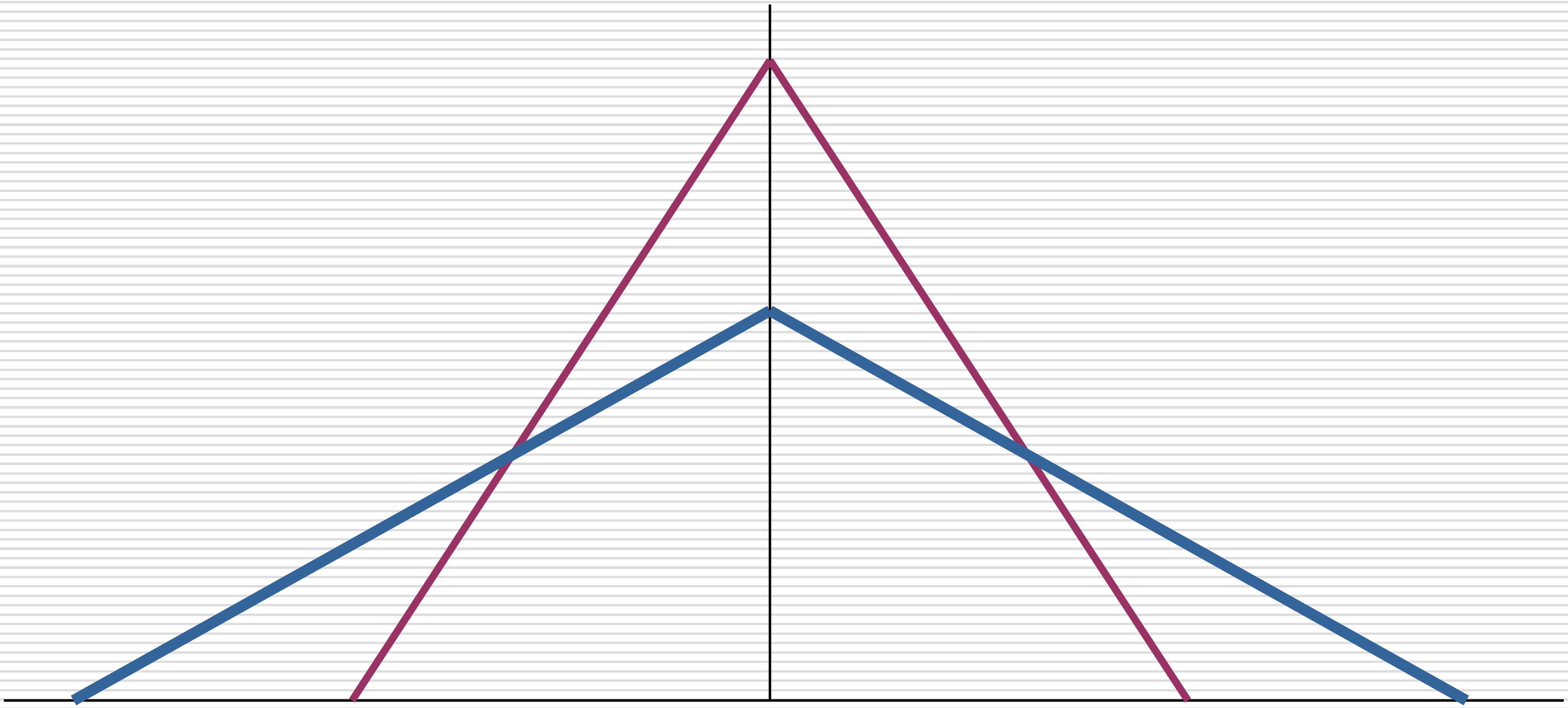
$$\Phi(r;\cdot) = b^u + \frac{1}{2C}\left[\varkappa_1 K(r)\right]^2 - r = 0 \qquad (1')$$

and $\Phi_r < 0$ one obtains the comparative static results

$$\frac{\partial r}{\partial (V/S)} > 0, \quad \frac{\partial r}{\partial C} < 0, \quad \frac{\partial r}{\partial \sigma} < 0, \quad \frac{\partial r}{\partial \delta} < 0$$

$$0 < \frac{\partial r}{\partial b^u} < 1$$

Introducing a mean-preserving spread (1)



Introducing a mean-preserving spread (2)

We include a spread parameter in the wage offer

distribution: $F(w;s)$ with $\frac{\partial}{\partial s}\int_0^x F(w,s)\mathrm{d}w \geq 0 \quad \forall x > 0$

Formal definition of a *mean preserving spread* :

For any pair of s_1 and s_2 with $s_1 < s_2$:

$$\int_0^\infty w\mathrm{d}F(w,s_1) = \int_0^\infty w\mathrm{d}F(w,s_2); \quad \int_0^x F(w,s_1)\mathrm{d}w \leq \int_0^x F(w,s_2)\mathrm{d}w$$

Effect on the reservation wage

Result:

Reservation wage increases with spread:

$$\frac{\partial r}{\partial s} > 0$$

Interpretation:

The spread increases the value of search !

Modelling participation behavior (1)

(i) Introducing heterogeneity:

Individuals differ with respect to the value of leisure l.

(ii) Differentiating between

unemployment (U) and non-participation (N)

two types of transfers:

W unemployment benefits: t^u W social assistance: t^n

wealth in both cases:

(U) : $b_i^u = l_i + t^u - c_0$

(N) : $b_i^n = l_i + t^n$

Modelling participation behavior (2)

Comparing non-participating and unemployment without searching for a job:

(N) – (U): $\nu := b_i^n - b_i^u = t^n - t^u + c_0$

Two conditions are required to prevent corner solutions:

(a) $\nu > 0$ for a participation rate $\pi < 1$

(b) $l^{\min} + \nu < w^{\max}$ for $\pi > 0$.

Modelling participation behavior (3)

A critical value of leisure $\tilde{l} > 0$ exists,

$l_i < \tilde{l} \rightarrow$ person participates on the labor market

$l_i > \tilde{l} \rightarrow$ person does not participate

$l_i = \tilde{l} \rightarrow$ person is indifferent between participating and not.

$\rightarrow$ Participation indifference condition:

$$\tilde{r} = r\left(\tilde{l}\right) = \tilde{b}^{n} = \tilde{b}^{u} + \nu$$

Modelling participation behavior (4)

$G(l)$: distribution function of the value of leisure in the population

$\rightarrow \pi := G(\tilde{l})$ with $\dfrac{\partial \pi}{\partial \tilde{l}} > 0$

π : participation rate

Comparative static results (1)

The following results can be derived:

$$\frac{\partial \tilde{l}}{\partial \bar{w}} > 0 \rightarrow \text{participation increases with the mean wage}$$

$$\frac{\partial \tilde{l}}{\partial \delta} < 0; \quad \frac{\partial \tilde{l}}{\partial \sigma} < 0; \quad \frac{\partial \tilde{l}}{\partial \nu} < 0; \quad \frac{\partial \tilde{l}}{\partial C} < 0$$

and

$$\frac{\partial \tilde{l}}{\partial s} > 0 \rightarrow \text{participation increases with the spread}$$

Extensions: Endogenous S

The number of job seekers is endogenous

$S := \pi P = G(1\%)P,$

where P is population.

$\rightarrow$ Sign of comparative static effects

not affected, but dampening effect.

Extensions: Unemployment (1)

Unemployment hazard rate

$$\varphi_i(r_i, s) = \underbrace{\lambda\left(\theta_i^*\right)}_{\text{job offer arrival rate}} \times \underbrace{\left[1 - F(r_i, s)\right]}_{\text{probability that offer will exceed the reservation wage}}$$

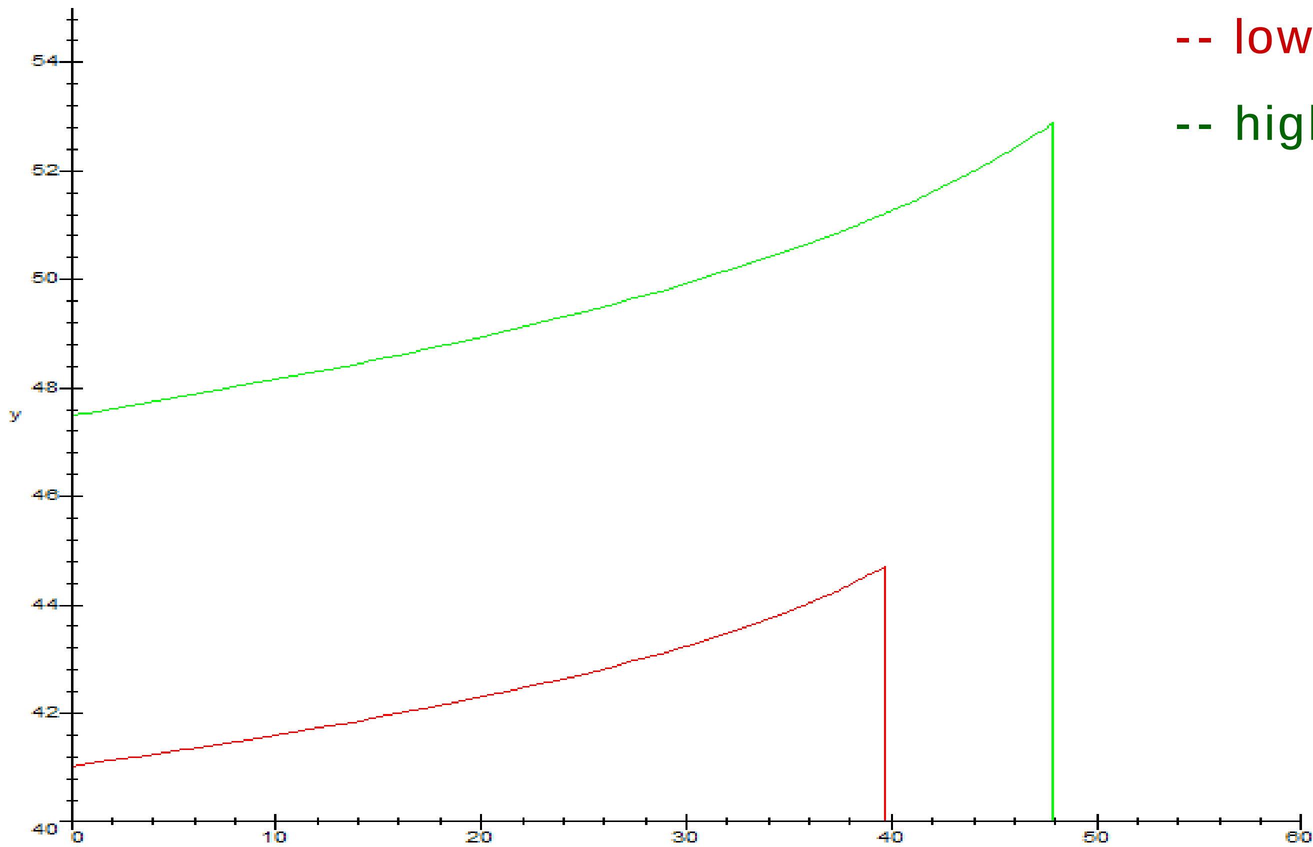
where $\theta_i^* := \theta_i^*(r_i, s)$

Equilibrium unemployment rate for type *i* workers

$$\rightarrow u_i^* = \frac{\sigma}{\varphi_i + \sigma} = \frac{\sigma}{\lambda\left[\theta_i^*(r_i, s)\right]\left[1 - F(r_i, s)\right] + \sigma}$$

Value of leisure/ reservation wage

r

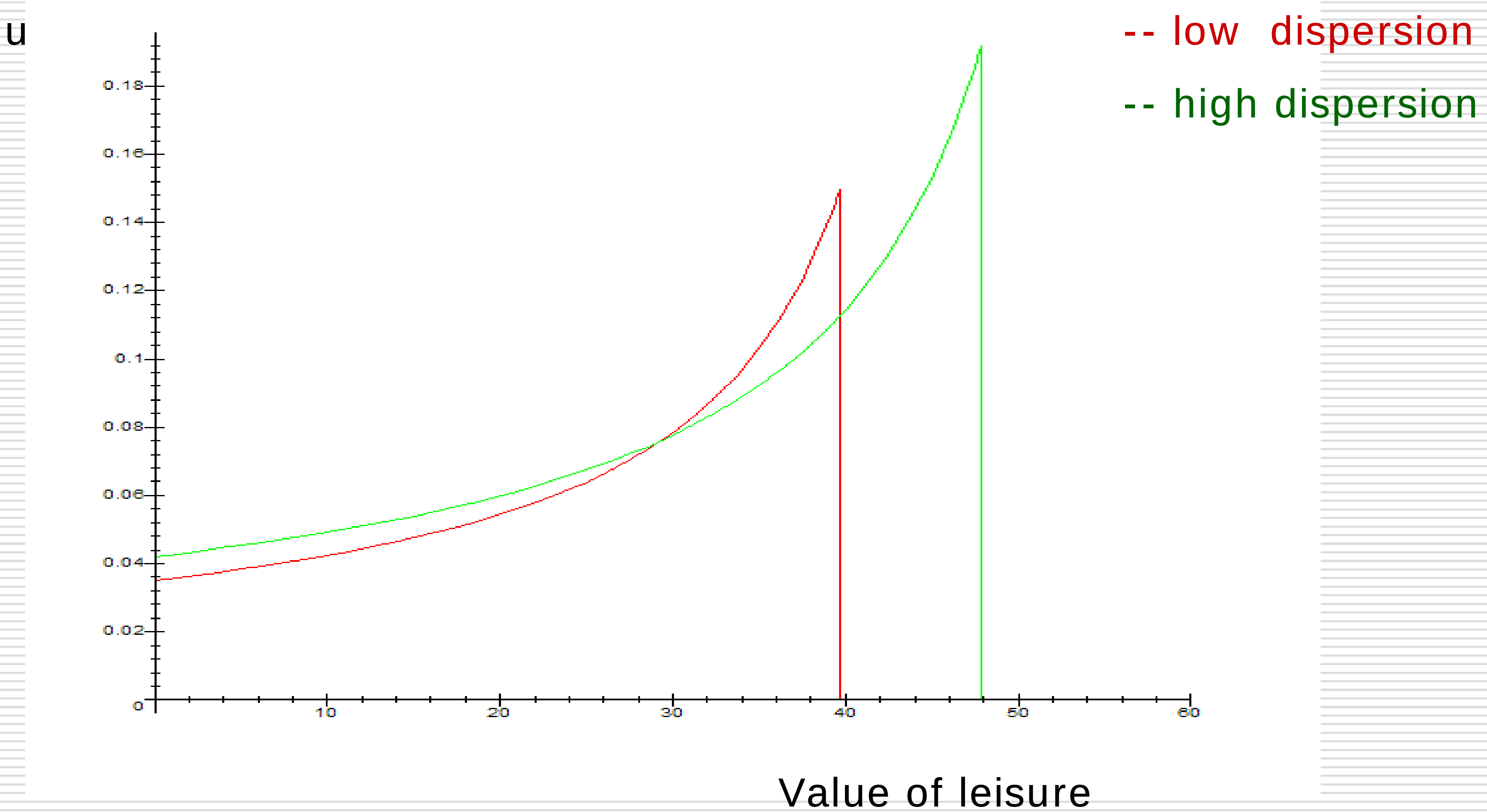


-- low dispersion

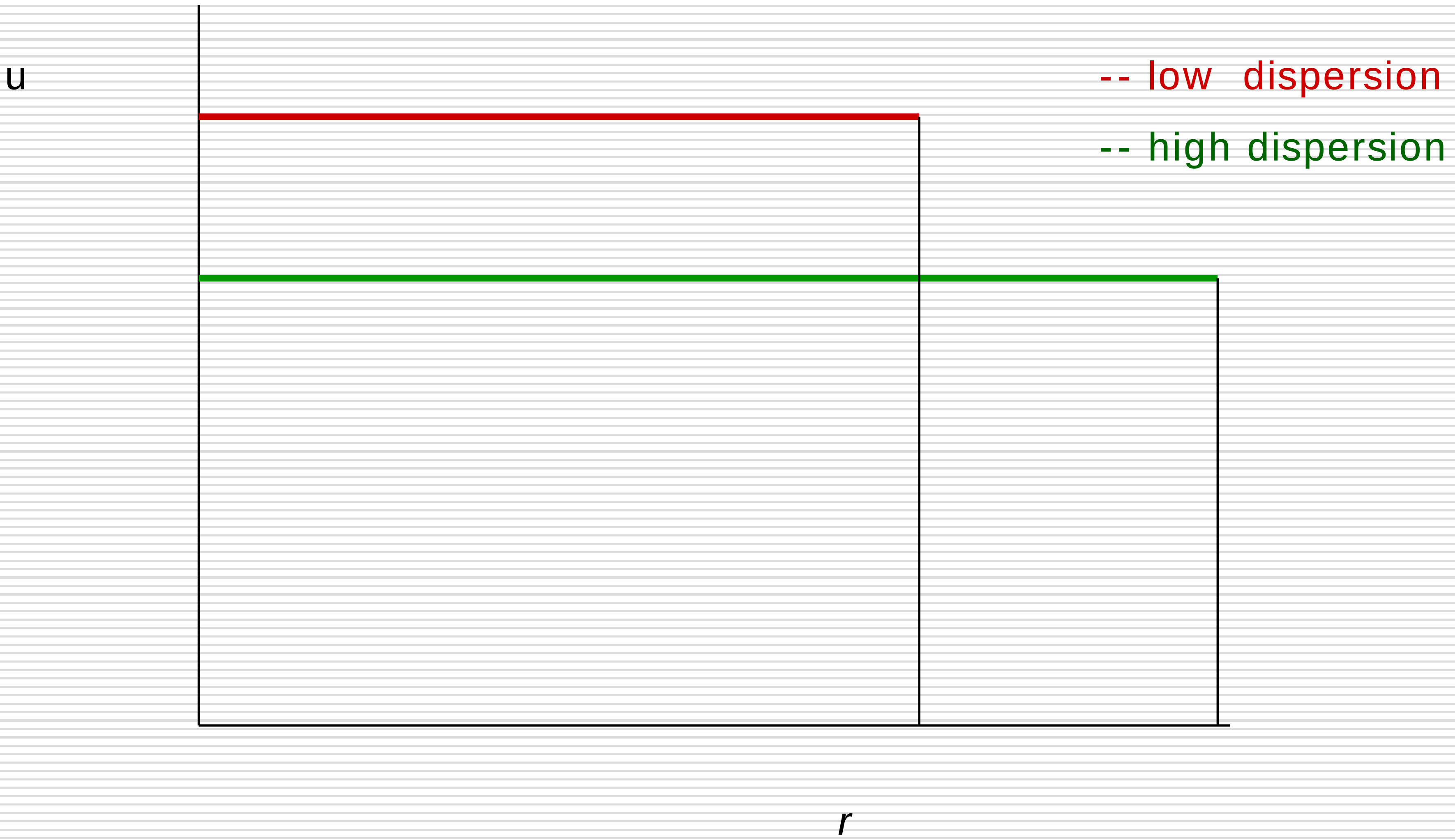
-- high dispersion

Value of leisure

Value of leisure/ unemployment



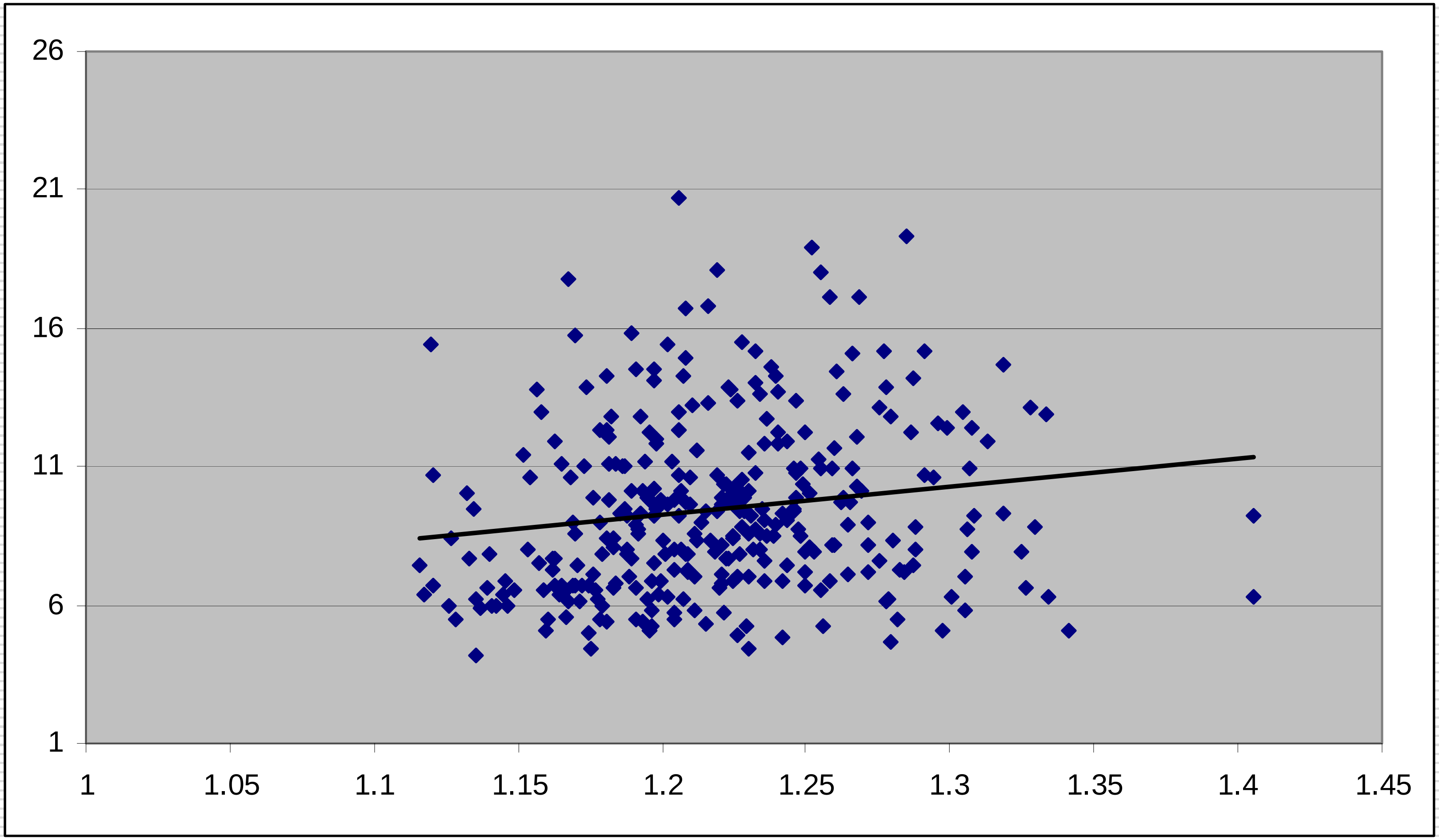
Reservation wage / unemployment



Results

The aggregate unemployment rate
is unaffected by the spread !
[the unemployment rate does not depend on
the first and second moment of the
wage offer distribution]
However, since participation increases
with the spread,
the employment-to-population rate increases
with a higher spread:

Inequality and Unemployment (male, West)



Results (2)

One can show:

$$u^* \cong \frac{\sigma}{\delta + \sigma}$$

$\rightarrow$ unemployment rate

- increases with the separation rate σ
- falls with the discount rate δ.

$\rightarrow$ if δ. is constant across regions, the regional unemployment rate can be used as an indicator of the separation rate

Summary of theoretical model

participation (labor-force-to-population ratio)

increases with

- the wage level
- the spread in the wage offer distribution

and decreases with

- job insecurity (separation rate) as measured by the unemployment rate

Data

Sources:

(i) INKAR: (aggregate) regional data on NUTS 3 level

(ii) IAB-REG: 1% random sample of social security data with regional information

- Data for 1997
- 439 NUTS 3 regions

(excluding East and West Berlin)

Empirical model (1)

Estimated equation:

$$\pi_r = \alpha_0 + \alpha_1 \ln w_r + \alpha_2 u_r + \alpha_3 SPREAD1_r$$
$$+ \alpha_4 SPREAD2_r$$
$$+ \text{regional type dummies } + \varepsilon_r$$

(allowing for different parameters in EAST and WEST)

w_r : average wage level in region r

u_r : unemployment rate

$SPREAD1\,(2)$: log differences D5-D2 (D8-D5)

ε_r is an error term

Empirical model (2)

Estimation with spatial econometrics methods

- testing for spatial lag model (SLM)

$$y = \rho W y + X\beta + \varepsilon$$

- and spatial error dependence model (SEM)

$$y = X\beta + \varepsilon \quad \text{and} \quad \varepsilon = \lambda W \varepsilon + \varepsilon^{*}$$

W is a spatial weight matrix;

data on commuter streams used for W; 2 variants:

- row normalzing (ROW)
- normalizing rows and columns (RAS method)

Test statistics

	spatial lag		spatial error dep.	
	male workers			
	ROW	RAS	ROW	RAS
spatial correlation parameter	−0.314** (0.068)	−0.125(*) (0.071)	0.340** (0.061)	0.387 ** (0.061)
	test statistics			
	$H_0: \quad \varrho = 0$		$H_0: \quad \lambda = 0$	
Double-length artificial regression [$\chi^2(1)$]	20.319 **	3.059 (*)	4.266 *	7.463 **
Likelihood-ratio test [$\chi^2(1)$]	20.770**	3.084 (*)	9.891**	14.776 **
	female workers			
spatial correlation parameter	−0.210** (0.067)	−0.110(*) (0.066)	−0.075 (0.074)	−0.086 (0.072)
	test statistics			
	$H_0: \quad \varrho = 0$		$H_0: \quad \lambda = 0$	
Double-length artificial regression [$\chi^2(1)$]	9.561**	2.739(*)	0.574	0.925
Likelihood-ratio test [$\chi^2(1)$]	9.675**	2.758(*)	0.736	1.121

Participation rates of female workers (West)

	dependent variable : labor-force-to-population ratio (in percent)				
	OLS	*spatial lag*		*spatial error*	
		*ROW***	*RAS(*)*	*ROW*	*RAS*
	West German Regions				
constant	**46.522**	**56.711**	**51.679**	**46.545**	**46.507**
unemployment rate	**-0.521**	**-0.560**	**-0.527**	**-0.509**	**-0.503**
ln wage	**0.088**	**0.098**	**0.090**	**0.084**	**0.085**
ln(D5/D2)	**-7.426**	**-7.219**	**-7.603**	**-7.490**	**-7.626**
ln((D8/D5)	-5.869	-4.447	-5.465	-6.179	-6.068
KT1	0.974	0.468	0.645	0.909	0.855
KT2	**-4.354**	**-4.327**	**-4.400**	**-4.291**	**-4.260**
KT3	**-3.406**	**-3.259**	**-3.427**	**-3.234**	**-3.172**
KT4	-1.702	-1.916	-1.872	-1.781	-1.775
KT5	**4.832**	**4.195**	**4.478**	**4.461**	**4.536**
KT6	-0.654	-0.534	-0.598	-0.587	-0.522
KT7	-0.543	-0.479	-0.511	-0.507	-0.444
KT8	0.860	1.028	0.939	0.872	0.909
N	327				

Participation rates of female workers (East)

	East German Regions				
constant	**61.506**	**74.249**	**68.189**	**61.516**	**61.551**
unemployment rate	**-0.345**	**-0.321**	**-0.336**	**-0.339**	**-0.342**
ln wage	**0.161**	**0.162**	**0.162**	**0.157**	**0.157**
ln(D5/D2)	0.508	0.983	0.642	0.639	0.400
ln((D8/D5)	1.948	2.523	2.661	1.836	1.990
KT1	0.751	0.293	0.570	0.563	0.563
KT2	-0.003	0.275	-0.004	-0.094	-0.073
KT3	-0.740	-0.374	-0.754	-0.801	-0.765
KT4	**-5.148**	**-5.115**	**-5.182**	**-5.210**	**-5.215**
KT5	2.980	2.525	2.792	2.690	2.691
KT6	0.037	0.154	0.057	-0.014	0.011
KT7	-1.089	-0.936	-1.055	-1.114	-1.117
KT8	-1.745	-2.422	-2.037	-1.807	-1.816
N	111				
s.e.	6.171	5.984	6.141	6.047	5.983
ln Likelihood	-1349.166	-1344.329	-1347.790	-1348.798	-1348.606

Conclusions

- Participation behavior across regions can be reasonably explained by the model
- Evidence for spatial correlation
- Strong persistence effects are present in the behavior of female workers in East Germany
- Unemployment reduces participation of men, but for females only in the West
- If anything, the spread in the wage distribution affects participation negatively; → contradiction to theory!