# 4. Job Search

*KAT.TAL.322 Advanced Course in Labour Economics*

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- No unemployment and perfect information in classical models
- Job search theory
  - → formalised by McCall (1970) and Mortensen (1970)
  - → introduces imperfect information about available jobs
  - → studies search behaviour of workers (and firms)

*Today*

- **Stylised facts**
- **Model**
- **Empirical evidence**

# Stylised facts

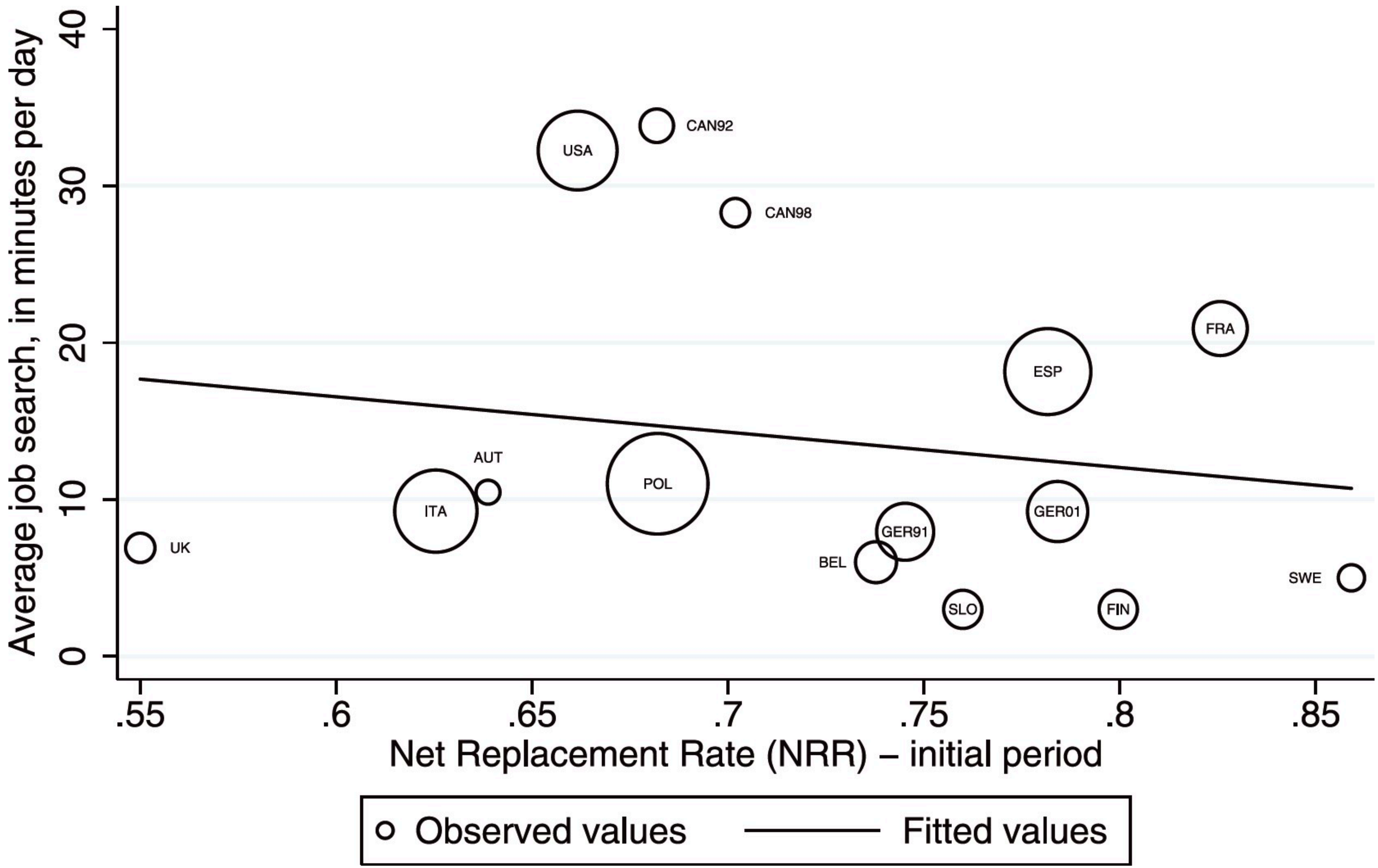
# Time use by employment status

| | Employed | Unemployed | Not working |
|---|---|---|---|
| Sleep | 8.2 | 8.6 | 8.6 |
| Personal care and eating | 1.7 | 1.8 | 1.8 |
| Home production, shopping, care of others | 3.0 | 3.4 | 3.1 |
| Leisure, travel, sports and socialising | 5.3 | 8.2 | 7.6 |
| Work | 4.2 | 0.1 | 0.1 |
| Study | 0.1 | 0.1 | 1.1 |
| Unspecified | 0.1 | 0.1 | 0.2 |

Source: Official Statistics of Finland (OSF) (2025)

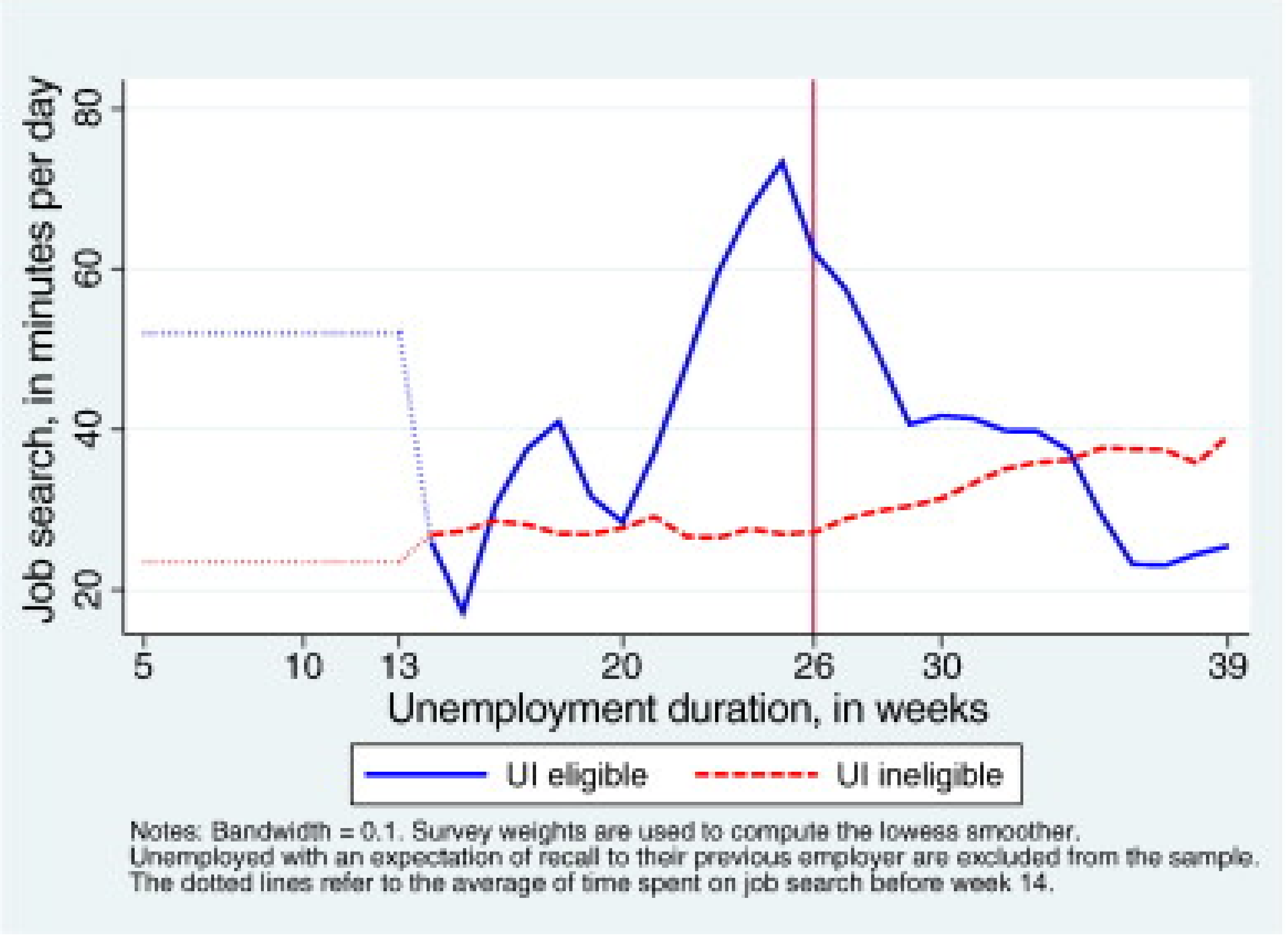
- Substitution effect: return on job search $<$ wage $\Rightarrow\downarrow$ time searching
- Income effect: income unemployed $<$ employed $\Rightarrow\uparrow$ time searching

# Job search is correlated with unemployment benefits



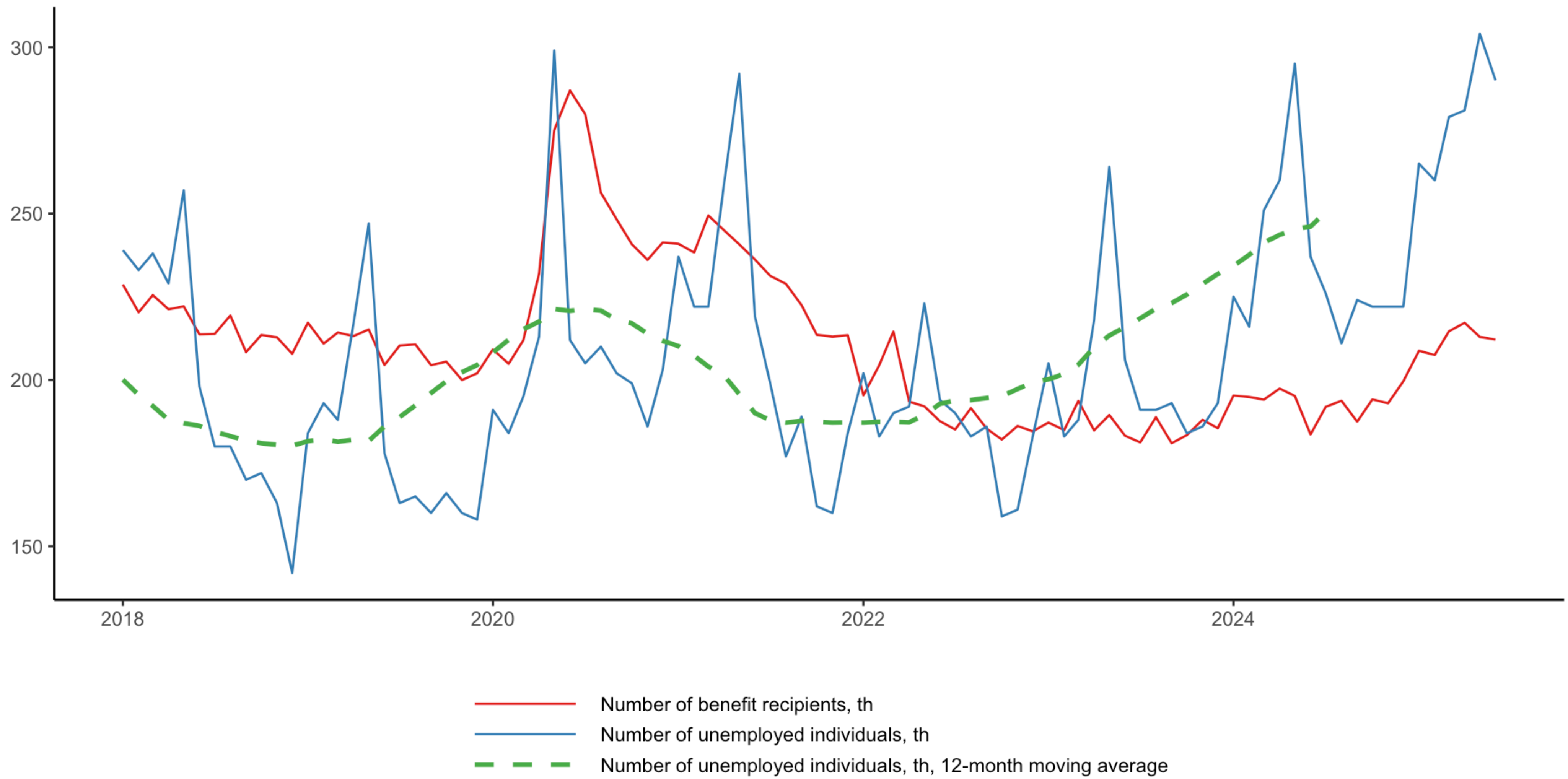

Source: Krueger and Mueller (2012)

# Job search intensifies close to end of benefits



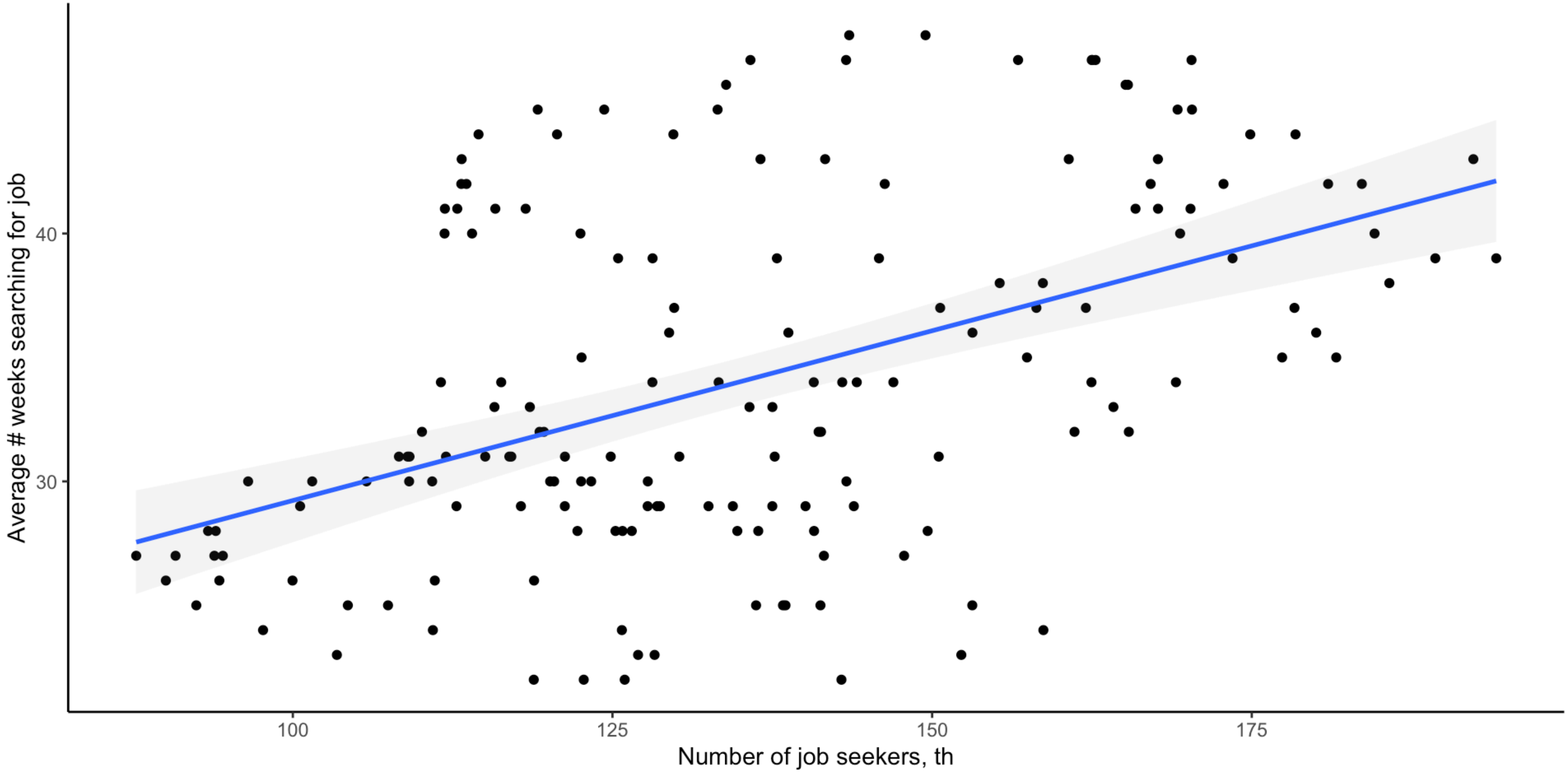

Source: Krueger and Mueller (2010)

# Not all workers receive unemployment benefits



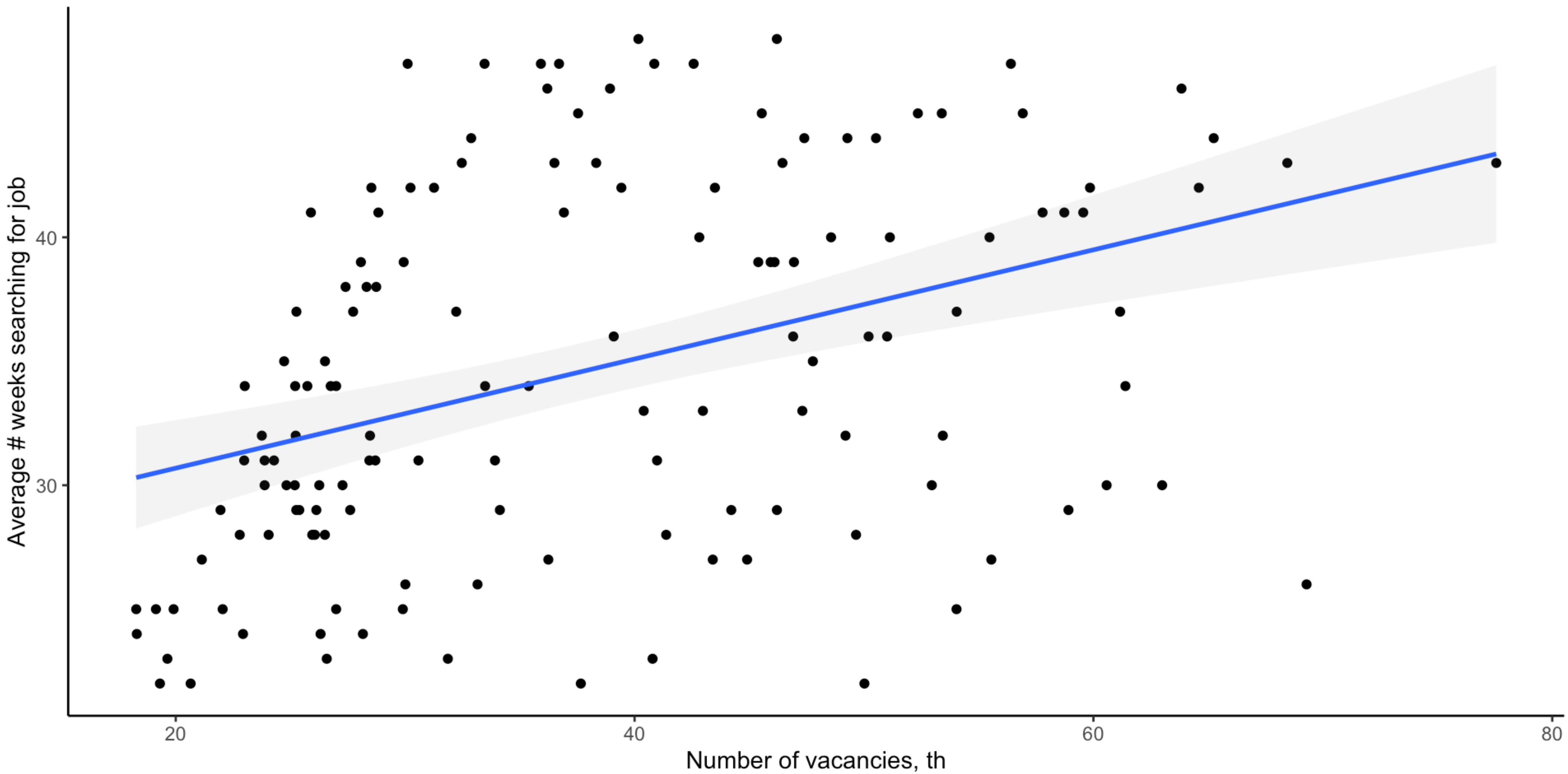

Source: Statistics Finland, KELA

# Job search longer when unemployment is high …




Source: Statistics Finland (2006-2019)

# … and when there are more vacancies




Source: Statistics Finland (2008-2019)

# Model

# Basic job search model

- Workers do not know precise wage at each job, only CDF $H(\cdot)$
- Dynamic model with continuous time $t$ (period is $\mathrm{d}t$)
- Key components
  - → Assume worker receives $\leq 1$ job offer at wage $w$ in period $\mathrm{d}t$
  - → If she is employed with wage $w$, assume her utility over $\mathrm{d}t$ is $w\ \mathrm{d}t$
  - → Exogenous job destruction at rate $q\ \mathrm{d}t$
  - → Discount future at rate $\frac{1}{1+r\ \mathrm{d}t}$
- Let $V_e$ and $V_u$ be discounted utility of employment and unemployment

$$V_e(w) = \frac{1}{1 + r\ \mathrm{d}t}(w\ \mathrm{d}t + (1 - q\ \mathrm{d}t)\, V_e(w) + q\ \mathrm{d}t\ V_u)$$

# Basic job search model and reservation wage

*Optimal job search strategy*

- If she receives no offer, she continues looking for a job
- If she receives an offer at wage $w$, she accepts iff $V_e(w) > V_u$

Rewrite employee expected utility

$$V_e(w) - V_u = \frac{w - rV_u}{r + q}$$

Since we assume $V_u$ is constant, there is $w^\star \ : V_e(w) > V_u \ \ \forall w > w^\star$

It is easy to see that here $w^\star \ = rV_u$

$w^\star$ is called **reservation wage**

# Basic job search model and reservation wage

- Expected utility $V = \int_{-\infty}^{w^\star} V_u dH(w) + \int_{w^\star}^{\infty} V_e(w) dH(w)$
- Assume job offers arrive at an exogenous rate $\lambda \,\mathrm{d}t$
- When unemployed, receive net income $z \equiv b - c$
  - → $b$ is unemployment benefit, and
  - → $c$ is total cost of job search (direct and indirect)
- Can write $V_u = \frac{1}{1+r\,\mathrm{d}t}(z\,\mathrm{d}t + \lambda\,\mathrm{d}t V + (1 - \lambda\,\mathrm{d}t)V_u)$

After simplifying and plugging in the expression for $w^\star$, can show that

$$w^\star = z + \frac{\lambda}{r+q}\int_{w^\star}^{\infty} (w - w^\star)\, dH(w)$$

# Basic job search model and unemployment duration

- Hazard rate, or exit rate from unemployment, depends on
  - → job offer arrival rate $\lambda$
  - → probability of offered wage being above $w^{\star} \equiv 1 - H(w^{\star})$
- Hence, hazard rate is $\lambda\left(1 - H(w^{\star})\right)$
- Average duration of unemployment is $T_u = \frac{1}{\lambda(1-H(w^{\star}))}$

# Basic job search model and comparative statics

Using implicit differentiation, can show that reservation wage is

$$\frac{\partial w^\star}{\partial z} > 0, \qquad \frac{\partial w^\star}{\partial \lambda} > 0, \qquad \frac{\partial w^\star}{\partial r} < 0, \qquad \frac{\partial w^\star}{\partial q} < 0$$

Therefore, average duration of unemployment is

- increasing in net income in unemployment: $\frac{\partial T_u}{\partial z} > 0$
- decreasing in interest rate: $\frac{\partial T_u}{\partial r} < 0$
- decreasing in job loss rate: $\frac{\partial T_u}{\partial q} < 0$
- ambiguous with respect to job offer arrival rate: $\frac{\partial T_u}{\partial \lambda} \ ? \ 0$

# Job search with benefit eligibility

- Two types of unemployed: eligible ($V_u$) and non-eligible ($V_n$)
  - → Non-eligible earns income $z_n < z$
  - → All workers who have worked at least once are eligible
- Expected utility of accepting offer same:
  $rV_e(w) = w + q\left(V_u - V_e(w)\right)$
- Reservation wage of non-eligible worker satisfies $V_e(w_n^\star) = V_n$
- Expected utility of non-eligible unemployed worker is
  $rV_n = z_n + \lambda \int_{w_n^\star}^{\infty} (V_e(w) - V_n)\, dH(w)$
- Using all of the above, we can write $w_n^\star$ as

$$rw_n^\star = (r+q)z_n - qw^\star + \lambda \int_{w_n^\star}^{\infty} \left(w - w_n^\star\right) \mathrm{d}H(w)$$

- Can show that $\frac{\partial w_n^\star}{\partial z} < 0$ and $\frac{\partial T_n}{\partial z} < 0$

# Other extensions of basic job search model

*Job search model with participation choice*

Let $R_I$ be net income of non-participation. Then

- If $w^\star \leq R_I$, worker decides to not participate
- If $w^\star > R_I$, but offered wage $w \leq w^\star$, the worker decides to keep looking for jobs
- If $w > w^\star > R_I$, the worker accepts the job offer

Can be useful to study discouraged workers

# Other extensions of basic job search model

*Job search model with participation choice*

*On-the-job search*

- Workers can keep searching for jobs while employed
- Let $\lambda_e$ be offer arrival rate for employed and $\lambda_u$ - for the unemployed
- Reservation wage is increasing in $\lambda_u$ and decreasing in $\lambda_e$

# Other extensions of basic job search model

*Job search model with participation choice*

*On-the-job search*

*Effort of job search*

- Job arrival rate is endogenous and depends on
  - → state of the labour market $\alpha$
  - → worker's search effort $e$
- Reservation wage is increasing in $\alpha$ and $z$
- Optimal effort is increasing in $\alpha$ and decreasing in $z$

# Other extensions of basic job search model

*Job search model with participation choice*

*On-the-job search*

*Effort of job search*

*Job search and wealth*

- Workers' value functions depend on their wealth
- Reservation wage increases with wealth
- Optimal search effort decreases with wealth

# Other extensions of basic job search model

*Job search model with participation choice*

*On-the-job search*

*Effort of job search*

*Job search and wealth*

*Job search and benefit sanctions*

- Unemployment benefits often require active job search
- If fail to meet those conditions, benefits are sanctioned
- Workers that get sanctioned increase their search effort
- Threat of sanctions makes unsanctioned workers increase search effort

# Other extensions of basic job search model

*Job search model with participation choice*

*On-the-job search*

*Effort of job search*

*Job search and wealth*

*Job search and benefit sanctions*

*Job search and non-stationary environment*

- Labour market environment is not same at every $t$
- Example: benefits often decrease or stop after some time
  - → reservation wage is decreasing over time
- Example: unemployed workers may receive fewer offers over time
  - → reservation wage is decreasing over time
  - → dynamics of average duration of unemployment is unknown

# Other extensions of basic job search model

*Job search model with participation choice*

*On-the-job search*

*Effort of job search*

*Job search and wealth*

*Job search and benefit sanctions*

*Job search and non-stationary environment*

See Section 2 in Chapter 5 of Cahuc, Carcillo, and Zylberberg (2014) for discussion of these extensions and references

# Equilibrium search models

- Basic model is partial: distribution of wages $H(\cdot)$ is exogenous
- Add labour demand to the picture to get endogenous $H(\cdot)$
- Main implications:
  - → With on-the-job search, wages rise when switching jobs
  - → No wage offered below reservation wage
  - → Wage dispersion $\uparrow$ with more competition for workers (high $\frac{\lambda_e}{q}$)
- **See Section 4 in Chapter 5 of Cahuc, Carcillo, and Zylberberg (2014)!**

# Empirical evidence

# Identification strategies

- Causal effect of $z$ on $T_u$ interesting from policy perspective
  - → Change in search behaviour of unemployed workers
  - → Confounding factors: difference in motivation, LM attachment, skills, etc.
- Need to exploit exogenous variation in benefits received
  - → RCTs: hard to ensure that control group is unaffected by treatment
  - → Natural experiments: policy changes or market shocks

# Lalive, van Ours, and Zweimüller (2006)

- Policy change in Austria in 1989
  - → Benefit replacement ratio ↑ for low earnings ($eRR$)
  - → Benefit duration ↑ for experienced workers ($ePBD$)
- Outcome of interest: duration of unemployment spell
- Use difference-in-differences approach

| | Age $< 40$ | | Age $\geq 40$ | |
|---|---|---|---|---|
| | **Low experience** | **High experience** | **Low experience** | **High experience** |
| **Low earning** | *eRR* | *eRR* | *eRR* | *ePBD-RR* |
| **High earning** | *Control* | *Control* | *Control* | *ePBD* |

# Lalive, van Ours, and Zweimüller (2006)

| | Before 1989 | After 1989 | Change over time | DiD |
|---|---|---|---|---|
| ePBD | 16.250 | 18.670 | 2.420 | 1.130 |
| | (0.080) | (0.090) | (0.120) | (0.180) |
| Obs. | 48 294 | 51 110 | | |
| eRR | 17.790 | 20.030 | 2.240 | 0.960 |
| | (0.120) | (0.160) | (0.200) | (0.240) |
| Obs. | 17 160 | 15 310 | | |
| ePBD-RR | 19.010 | 23.550 | 4.530 | 3.250 |
| | (0.170) | (0.240) | (0.200) | (0.240) |
| Obs. | 11 992 | 9 182 | | |
| Control | 15.240 | 16.520 | 1.290 | |
| | (0.080) | (0.090) | (0.130) | |
| Obs. | 33 815 | 38 958 | | |

# Lalive, van Ours, and Zweimüller (2006)

$ePBD$ increased benefit duration from 30 up to 52 weeks

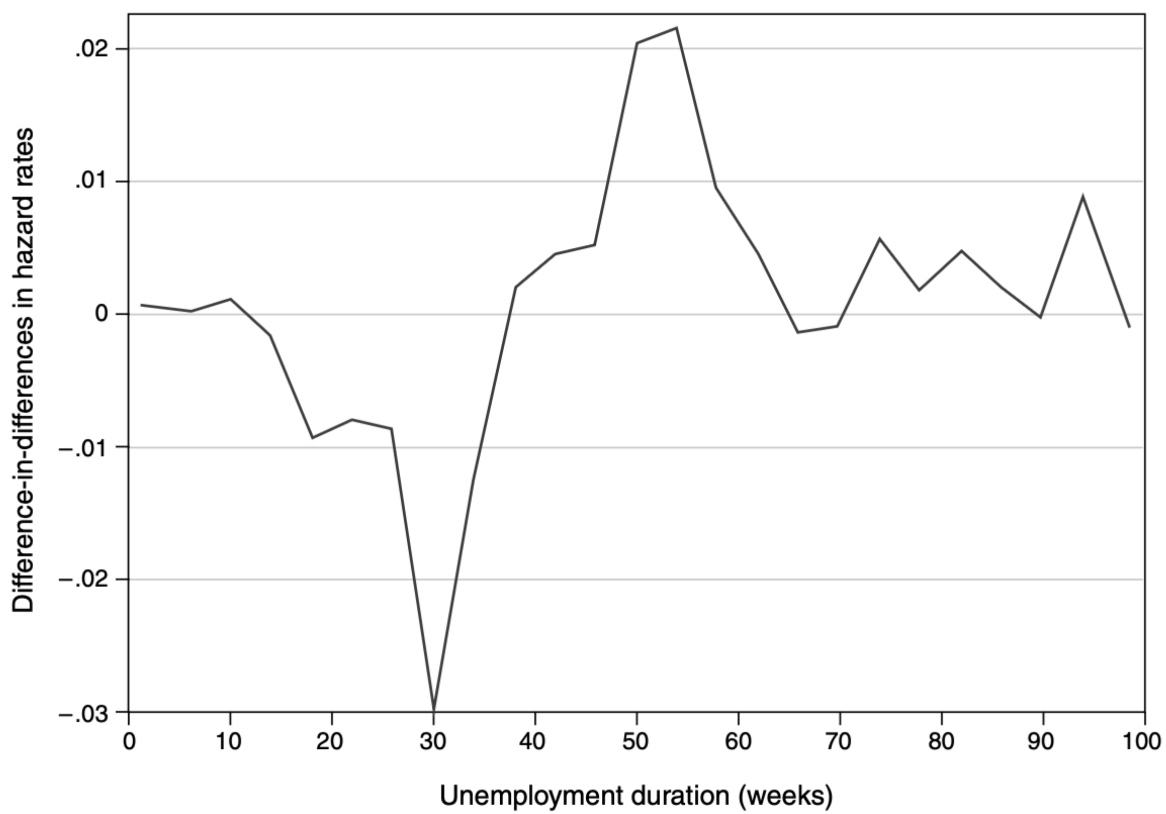


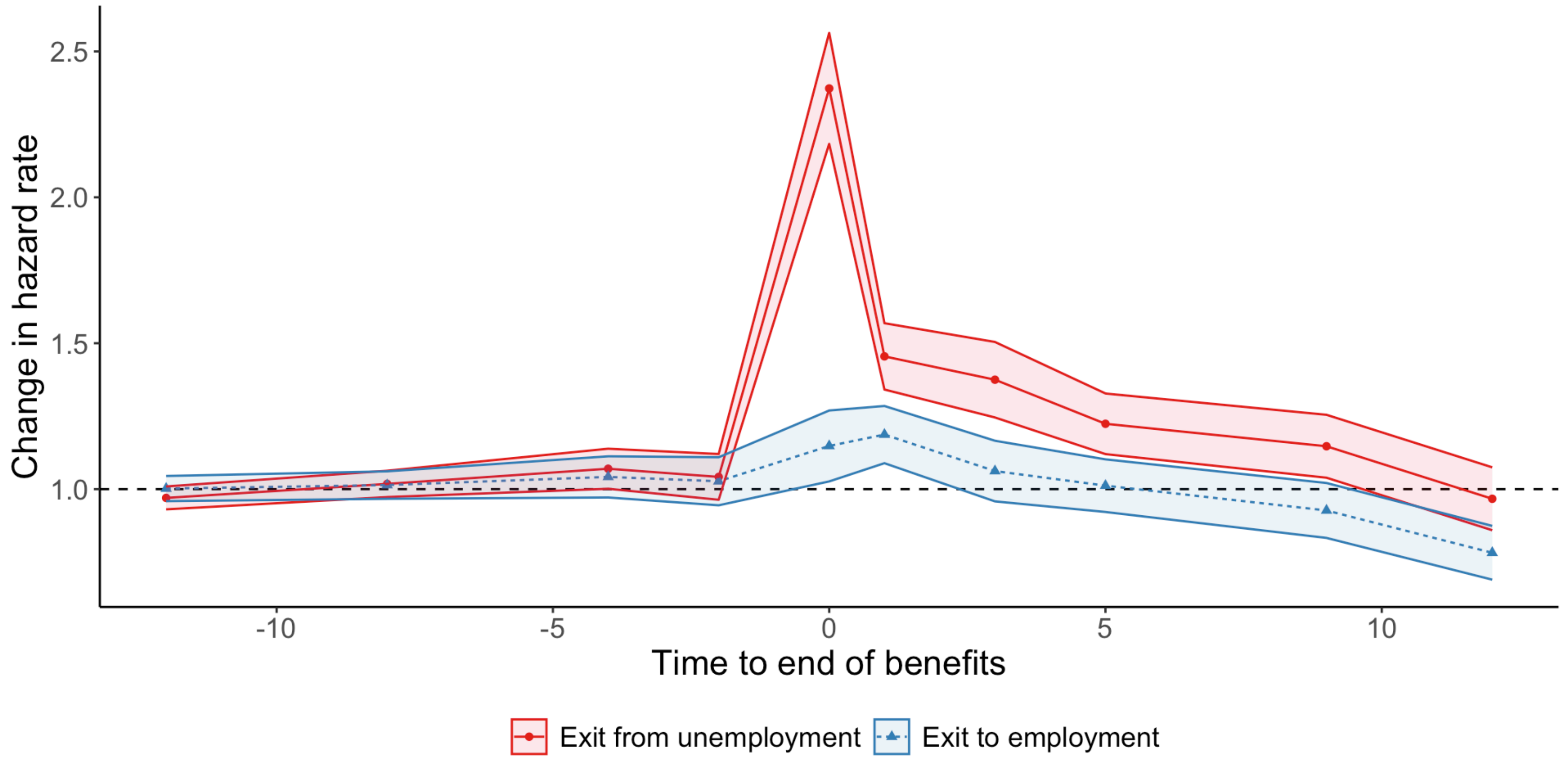

**Figure 5.6**

Difference-in-differences in Kaplan-Meier hazard functions for the group of individuals potentially eligible to the extension of potential duration of benefits and the control group. Hazard functions are smoothed on 4-week windows.

Source: Data from Lalive et al. (2006).

# Card, Chetty, and Weber (2007)

## Exit unemployment ≠ find a job

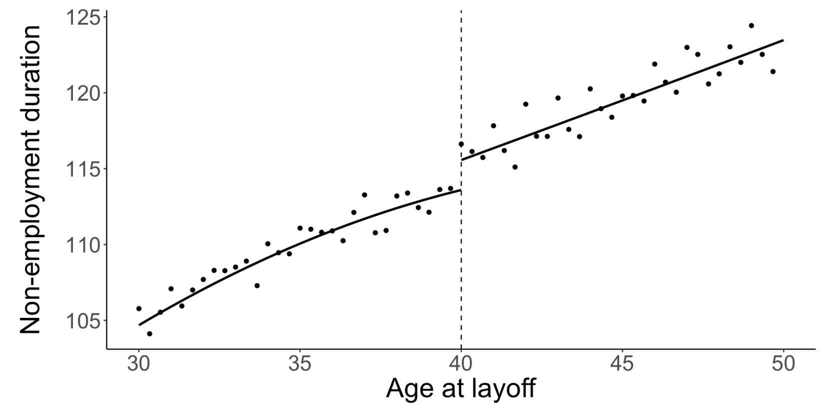


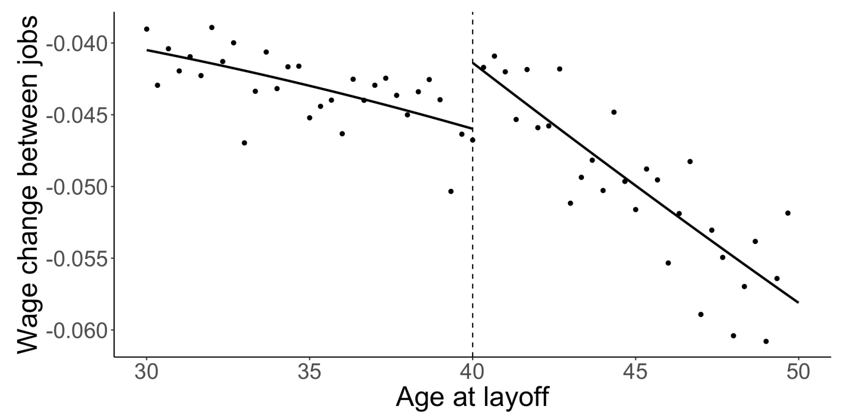

Source: Table 1 of Card, Chetty, and Weber (2007)

# Nekoei and Weber (2017)

## *Generosity of benefits and quality of next job*

- Regression discontinuity: compare Austrian workers around age 40
- Main finding: wage at next job ↑
  - → past papers: zero or $< 0$ effect
- Model: opposing forces on wages
  - → reservation wage ↑
  - → unemployment duration ↑
- Additional results:
  - → next job in higher-paying firms
- Policy impact:
  - → future tax revenue ↑
  - → current UI spending ↑




Source: Figure 3 in Nekoei and Weber (2017)

# Belot, Kircher, and Muller (2019)

*Cost of job search and re-employment*

- Recommend vacancies based on skill set of jobseeker
- RCT: labs with computer access used for job search activity
  - → search for jobs in labs 1/week for 12 weeks
  - → weekly survey about interviews/offers and out-of-lab search
  - → on week 4, introduce recommendations to a random subsample
- Measure impact on
  - → breadth of occupations searched and applied for
  - → number of interviews
  - → job finding rate

# Belot, Kircher, and Muller (2019)

| | Dependent variable | | | |
|---|---|---|---|---|
| | **Breadth of applications** | **N applications** | **N interviews** | **N offers** |
| Treatment | 0.030 | 0.010 | 0.440* | -0.130 |
| | (0.200) | (0.090) | (0.280) | (0.250) |
| Treatment x init. broad | -0.430* | -0.050 | -0.070 | |
| | (0.220) | (0.120) | (0.240) | |
| Treatment x init. narrow | 0.490* | 0.080 | 1.030*** | 0.100 |
| | (0.290) | (0.130) | (0.550) | (0.560) |
| Num.Obs. | 305 | 487 | 464 | 253 |

* p < 0.1, ** p < 0.05, *** p < 0.01

In a similar experiment, Belot, Kircher, and Muller (2022) find

- $\uparrow \Pr$ finding a stable job (at least 6 months)
- $\uparrow \Pr$ reaching earnings threshold

# Summary

- Job search models labour supply under imperfect information
  - → Useful in studying unemployment spells and job search behaviour
- Accommodate firm side to characterise equilibrium wage distribution
  - → Useful in studying wage dispersion (more in next lecture)
  - → Necessary to assess full impact of policy change
- Empirical studies focus on
  - → effects of benefits on search behaviour
  - → duration dependence of search and job-finding rates
  - → effectiveness of various job search tools

Next lecture: Wage setting on 08 Sep

# References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