Job Mobility and Unemployment Risk

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Motivation

Fact 1: Job ladder (Employment-to-Employment flows) is important

- Half of hires are EE hires,
- EE trigger around half of new job openings (Mercan, Schoefer (2023))
- $EE \approx EU$

Fact 2: The EU hazard rate is decreasing in tenure (Jovanovic (1979))

- Jobs feature heterogeneous EU risk (Larkin (2021), Jarosch (2023))
- **Changing jobs can be risky**

Our contributions related literature

Model: Build a *risky* job ladder model featuring

1. Risk aversion
2. Job heterogeneity: productivity and *safety/stability*
3. Compare it against a model with homogeneous *EU* risk
4. Study implications for policy and labour market dynamics

Results:

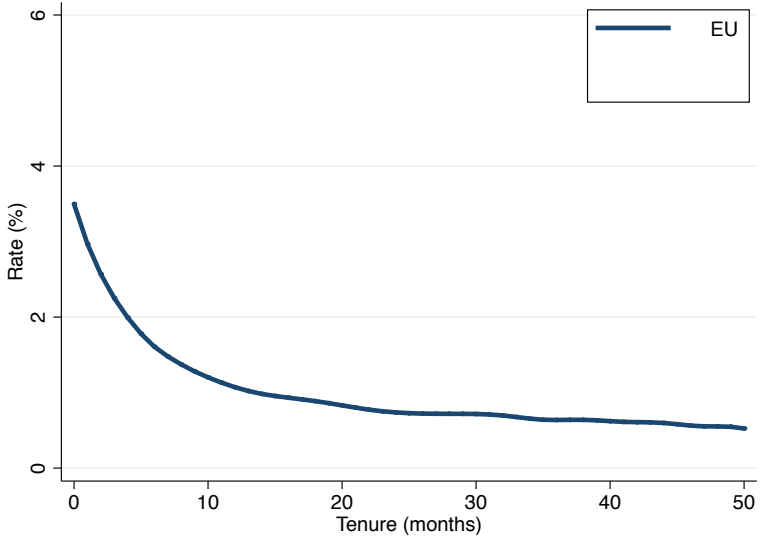
1. Resource cost of risk aversion: EE decisions account for potential ↑ unemployment risk

2. Optimal UI: Optimal benefits more generous relative to no job-safety heterogeneity

3. Business cycles: Financial conditions deterioration slows down job ladder

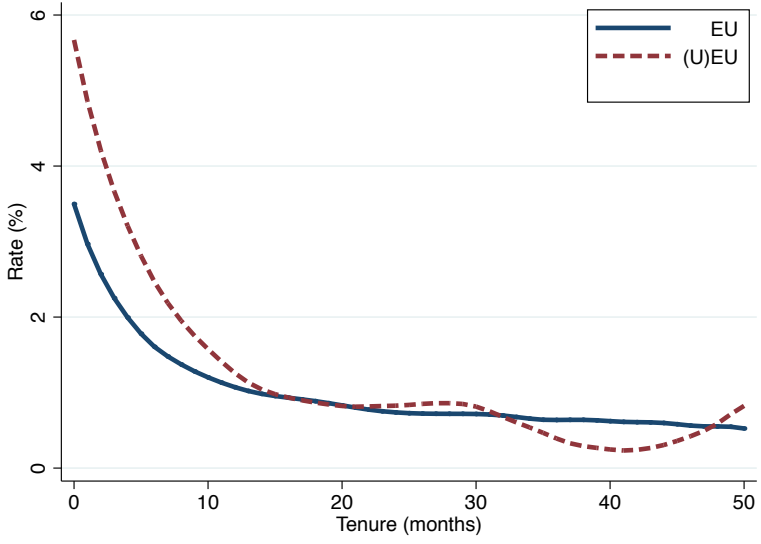
Motivation: EU Transitions By Preceding Spell Type

subjective expectations



EU Transitions: By Preceding Spell Type

subjective expectations



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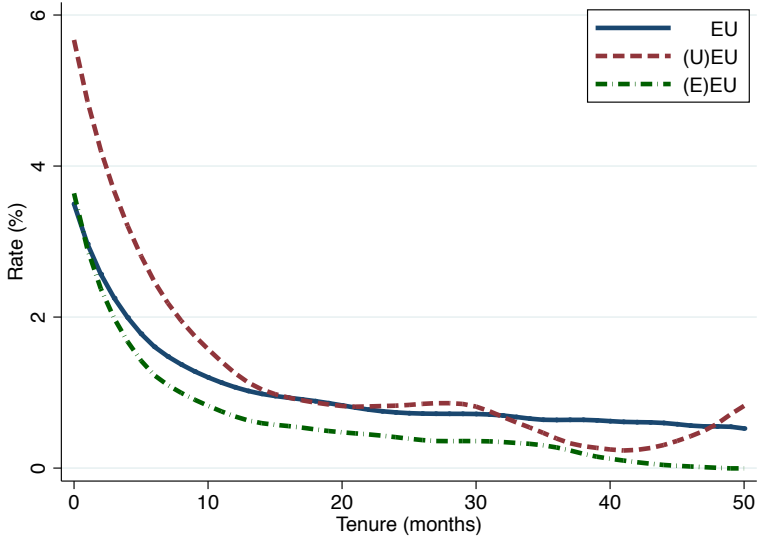

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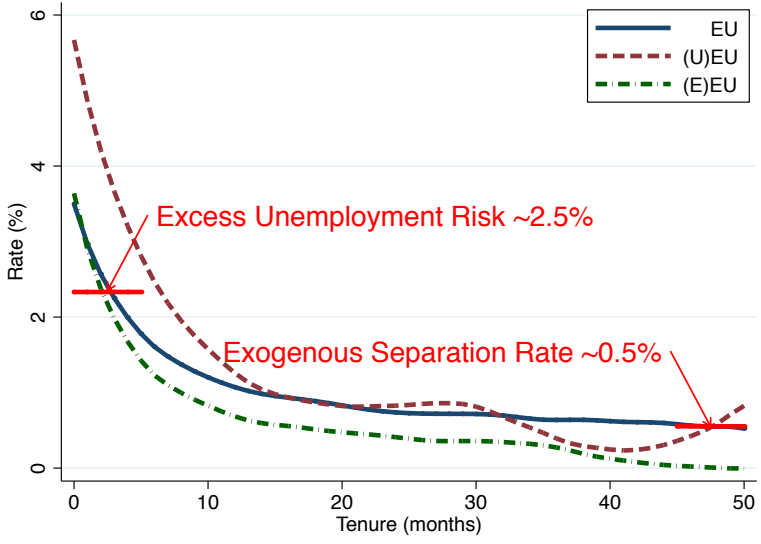


Model: Environment

- Continuous time model
- Continuum of workers of mass one
  - **Risk averse:** $u(c_t)$ with $u'(c_t) > 0$, $u''(c_t) < 0$
  - Either employed / unemployed
  - Discount rate: δ
  - Workers are hand to mouth
- Markets:
  - Output / consumption
  - Labour market

Model: Environment

- Firms / production:
  - Single worker firms produce output flow equal to match quality z
  - Discount rate δ
  - Exogenous but *heterogeneous* destruction rates + worker may quit for EE move
- Labour market:
  - Random search $\rightarrow$ match productivity & separation rate revealed $\rightarrow$ accept/reject
  - Free entry of vacancies. Offer arrival rate to workers per unit of effort: $\lambda(\theta)$
  - **Unemployed search effort** $= 1$**, employed search effort** $= s_e$
  - Wages set via bargaining over flow surplus ($\simeq$ Hall-Milgrom)
    - Assume CRRA utility, assume worker's pay if on strike = a fixed fraction of output. Can prove this $\implies$ equilibrium wage details

      $$w(z) = \zeta z$$

      for some $0 < \zeta < 1$.
- Government:
  - Tax / spending: UI, b, are government transfer, paid from linear taxation, τ.

Model: Heterogeneous separation risk

- Rate of exogenous separation is match-specific, stochastic, and denoted by $\rho \in \{\rho_1, ..., \rho_J\}$, where $\rho_1 < \rho_2 < ... < \rho_J$
- When a worker and firm meet, they draw a pair (z, ρ), representing the *permanent* match productivity and *initial* separation risk respectively, from CDF $\Gamma(z, \rho)$
- At rate s_ρ a new *weakly lower* level of separation risk, $\rho' \leq \rho$, is drawn from $\hat{\Gamma}(\rho'|\rho)$

Two sources of EU-risk heterogeneity:

1. EU-risk declines during the life of a match, i.e., jobs get safer over time. Captures features such as:
   - "Last in, first out" / probationary periods / academic tenure...
   - Learning match quality over time details
2. Heterogeneity in initial risk: workers might knowingly accept jobs with different levels of separation risk
   - Can think of jobs as "lotteries", with differing levels of downside risk
   - Some workers endogenously willing to accept more ex-ante risky jobs than others

Model: value function for employed workers: $v^e(z, \rho)$

HJB:

$$\begin{aligned}\delta v^e(z,\rho) = &\underbrace{u\left((1-\tau)w(z,\rho)\right)}_{\text{consumption}} + \underbrace{\rho\left(v^u - v^e(z,\rho)\right)}_{\text{EU risk}} + ... \\ &+ \underbrace{s_e \lambda(\theta) \mathbb{E}_{z_0,\rho_0}\left[\max\left\{v^e(z_0,\rho_0), v^e(z,\rho)\right\} - v^e(z,\rho)\right]}_{\text{on the job search}} + ... \\ &+ \underbrace{s_\rho \sum_{\rho'} \gamma\left(\rho'|\rho\right)\left(v^e(z,\rho') - v^e(z,\rho)\right)}_{\text{evolution of } \rho}\end{aligned}$$

Note: this holds for jobs with value greater than unemployment. Workers are free to quit to unemployment if $v^e(z,\rho) < v^u$.

Mechanism:

- Workers will turn down wage increases which are not worth the increase in risk (ρ_0 vs. ρ)
- The more agents value safety (i.e. the higher the curvature of u) the slower the ladder

Model: value for unemployed workers: v^u

HJB:

$$\delta v^u = u(b) + \underbrace{\lambda(\theta)\mathrm{E}_{z_0,\rho_0}\left[\max\left\{v^e(z_0,\rho_0), v^u\right\} - v^u\right]}_{\text{unemployed job search}}$$

Reservation productivity: Minimum productivity of job that an unemployed worker is willing to accept: $\underline{z}(\rho)$ such that $v^e(\underline{z}(\rho),\rho) = v^u$.

Pinnheiro, Visschers (2015) result carries over: ρ irrelevant for unemployed at $\underline{z}$.

Model: demand for labor

Firm value and equilibrium tightness:

- Match characteristics only drawn when meet a worker $\implies$ single tightness, $\theta = \frac{V}{U}$
- Vacancy posting cost, κ, determines θ, $\lambda(\theta)$, $q(\theta)$ via free entry
- Quits to new jobs:

$$\mu^e(z,\rho) = \int \mathbf{1}\left\{v^e(z_0,\rho_0) > v^e(z,\rho)\right\} d\Gamma(z_0,\rho_0). \tag{1}$$

- The value of a filled vacancy to the firm satisfies the following HJB equation:

$$\begin{aligned}\left[\delta + s_e\lambda(\theta)\mu^e(z,\rho) + \rho\right] v^f(z,\rho) = z - w(z,\rho) \\ + s_\rho \sum_{\rho'} \gamma\left(\rho'|z,\rho\right)\left(v^f(z,\rho') - v^f(z,\rho)\right).\end{aligned} \tag{2}$$

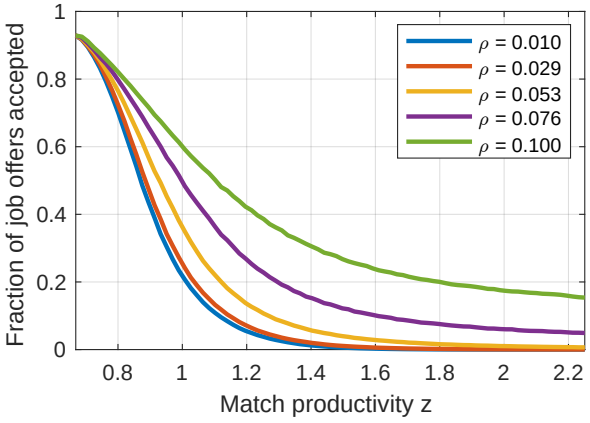
- Set $\alpha_u = u/\left(u + s_e(1-u)\right)$
- Free-entry in vacancy-posting requires:

$$\kappa = q(\theta)\mathrm{E}_{z_0,\rho_0}\left[\left(\alpha_u \mathbf{1}^u(z_0,\rho_0) + (1-\alpha_u)\zeta(z_0,\rho_0)\right) v^f(z_0,\rho_0)\right] \tag{3}$$

- $\zeta(z_0,\rho_0) \equiv \int \mathbf{1}^e(z_0,\rho_0|z,\rho) g(z,\rho) d\rho dz/n$ is the fraction of employed workers in the economy who would accept a job offer with new characteristics (z_0,ρ_0).

Steady state: Probability of accepting an EE calibration value functions

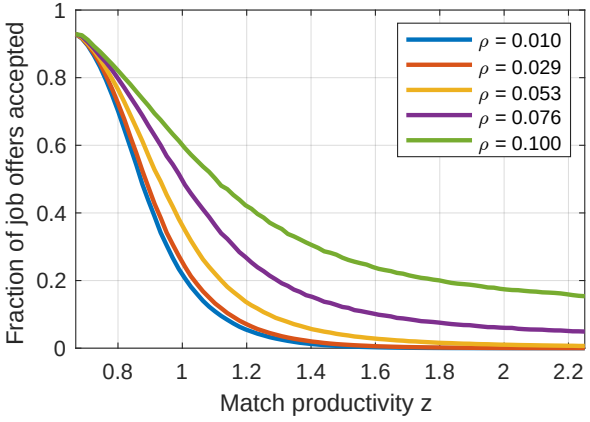
$\mu^e(z, \rho)$: Fraction of job offers a worker with current state (z, ρ) would accept



- Key point: workers appreciate safety. Agents in safer jobs (e.g. $\underline{\rho}$) accept fewer job offers than agents in riskier jobs (e.g. $\bar{\rho}$)
- Why? They need higher wage gains (less likely) to convince them to switch jobs

Steady state: Probability of accepting an EE

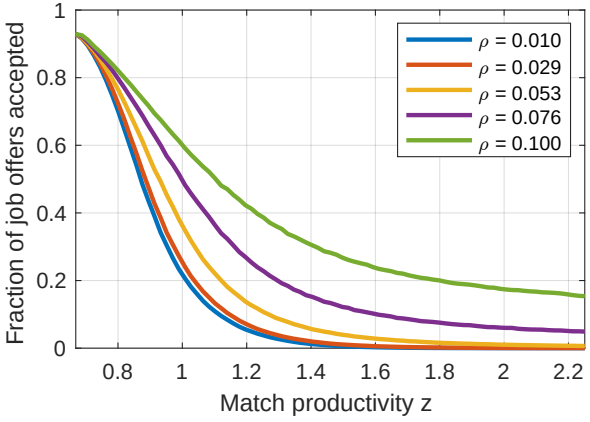
$\mu^e(z, \rho)$: Fraction of job offers a worker with current state (z, ρ) would accept



- Key point: workers appreciate safety. Agents in safer jobs (e.g. $\underline{\rho}$) accept fewer job offers than agents in riskier jobs (e.g. $\bar{\rho}$)
- This creates job ladders in both productivity and safety details

Steady state: Probability of accepting an EE

$\mu^e(z, \rho)$: Fraction of job offers a worker with current state (z, ρ) would accept



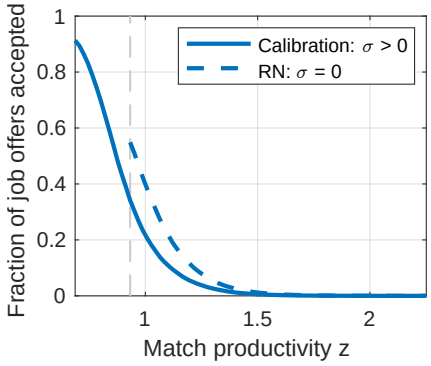
- Workers appreciate safety. Agents in safer jobs (e.g. $\underline{\rho}$) accept fewer job offers than agents in riskier jobs (e.g. $\bar{\rho}$) declining EU hazard
- Most workers end up in safe jobs $\implies$ this slows down the job ladder distributions

Experiment 1: Insuring all consumption risk

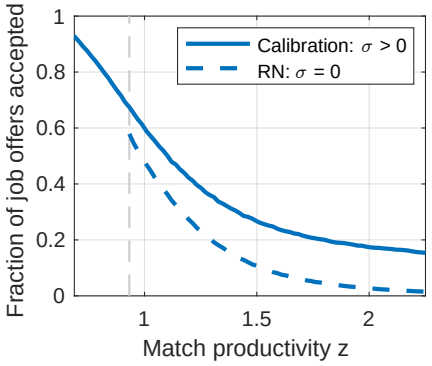
- How does risk / incomplete markets affect worker EE decisions in this model?
- To answer this, compare to counterfactual where workers are risk neutral
  - Equivalent to workers contracting with a risk-neutral insurer, in exchange for a constant consumption stream, and insurer dictating all worker choices
  - Keep all other parameters the same
- We hold the wage function, $w(z)$, and offer arrival rate, $\lambda(\theta)$, fixed
  - Isolating pure effect of worker search decisions, without additional effects from wages / tightness

Policy function comparison: Incomplete markets vs. full insurance

$\mu^e(z, \rho)$: Fraction of job offers a worker with current state (z, ρ) would accept



(a) Safest jobs ($\rho = \underline{\rho}$)



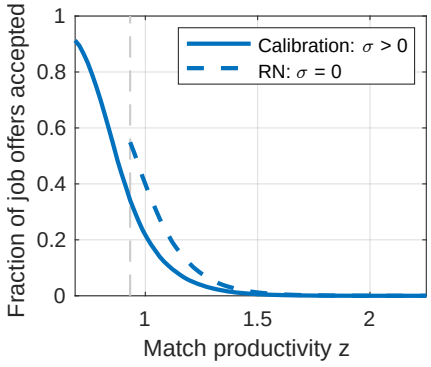
(b) Riskiest jobs ($\rho = \bar{\rho}$)

Three visible effects of increasing insurance:

1. EE rate increases in safe jobs
2. EE rate decreases in risky jobs
3. Unemployed workers reject more low productivity matches

Policy function comparison: Incomplete markets vs. full insurance

$\mu^e(z, \rho)$: Fraction of job offers a worker with current state (z, ρ) would accept



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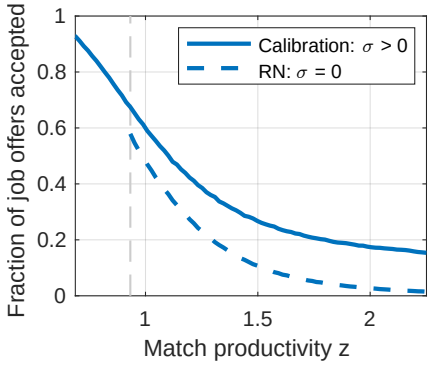


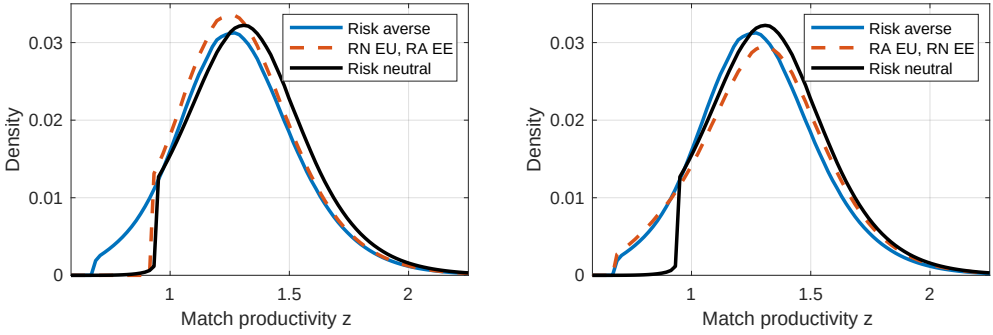
(b) Riskiest jobs ($\rho = \bar{\rho}$)

All of these channels affect aggregate productivity:

1. EE rate increases in safe jobs $\Longrightarrow \uparrow EE$ and $\uparrow$ average productivity
3. Unemployed workers reject more low productivity matches $\Longrightarrow \downarrow UE$ and $\uparrow$ av. productivity

Decomposing productivity effect of insurance: *EE* vs *EU*

Figure: Perfect consumption insurance: Productivity distribution

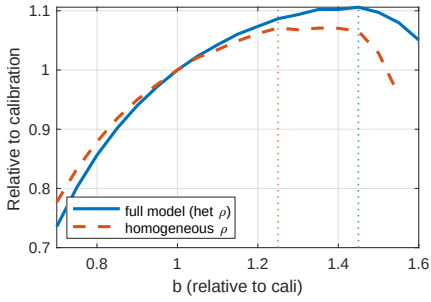


(a) Risk neutral *EU* policy only ($Y/n \uparrow 2.5\%$)

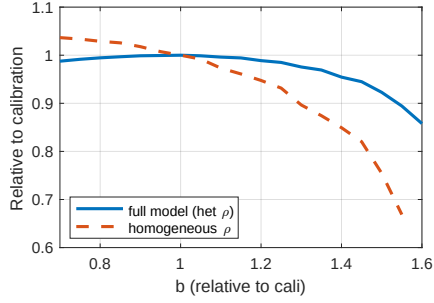
(b) Risk neutral *EE* policy only ($Y/n \uparrow 2.05\%$)

- Blue line is original risk averse model, black line is counterfactual risk neutral model
- **Key idea:** risk aversion of unemployed increases number of low productivity matches. Risk aversion of employed lowers number of high productivity matches

Experiment 2: generosity of UI details



(a) Welfare



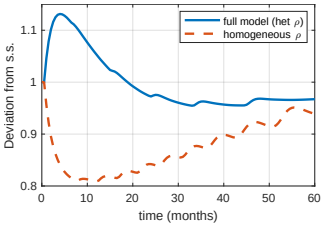
(b) Offer arrival rate (λ)

Search over UI levels to maximize steady-state welfare. Results:

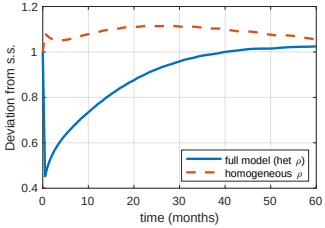
- Optimal unemployment benefits higher when account for risky job ladder. $\uparrow 45\%$ vs. $\uparrow 25\%$
- Channel: Raising benefits now encourages EE moves, encouraging vacancy posting
  - Standard model: Insurance vs. discouraging unemployed job search
  - Risky job ladder: Encouraging *employed job search* is an extra benefit

Key result: Optimal to raise unemployment benefits to "unstick" the job ladder

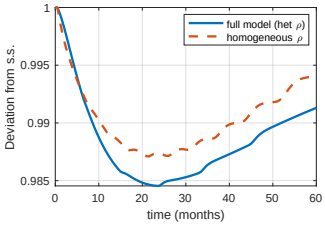
Experiment 3: "Financial shock" effects details



(a) Unemployment



(b) EE rate



(c) Mean wage

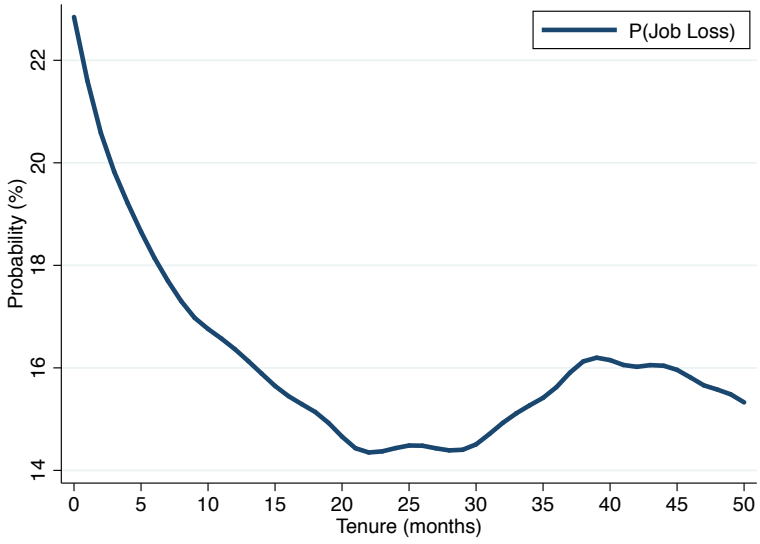
Experiment: temporary rise in risk aversion (doubling σ). Results:

- Causes rise in unemployment in our model, vs. decline in standard model
- Channel: $\uparrow \sigma \implies$ employed workers less willing to move jobs $\implies \downarrow\downarrow EE$ and $\downarrow$ mean W
- $\implies$ harder for firms to hire, so post less vacancies and U rises

Key result: Increased risk aversion during recessions slows down the job ladder further, amplifying unemployment rise. Only when you account for the risky job ladder.

APPENDIX

Beliefs about Probability of Job Loss by Tenure return



Literature return

Core literature

- Incomplete markets: Aiyagari (1994), Bewley (1983), Huggett (1993)
- Job ladder: Burdett (1978) (...) Menzio and Shi (2011), Lise and Robin (2015), MPV (2013), .

Related IM + labour market papers:

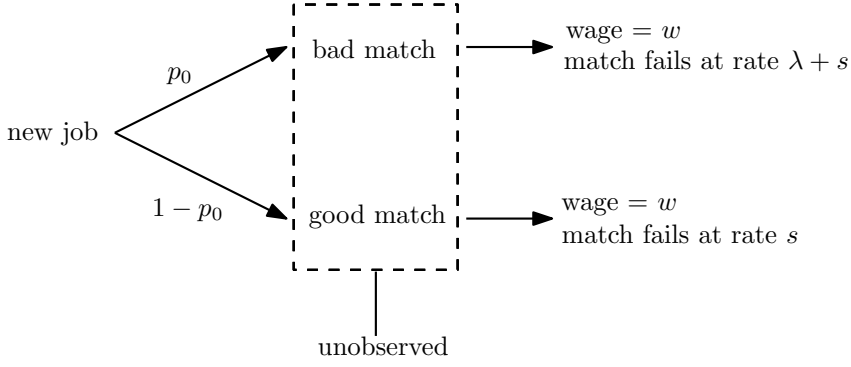
- Incomplete markets + labour market aggregates: Rendon (2006), Krusell et al. (2010), Sterk and Ravn (2017, 2018), Den Haan et al. (2018)
- Incomplete markets + UE rate: Acemoglu and Shimer (1999) Herkenhoff (2017, ...), Eeckhout and Sepahsalari (2018)
- Incomplete markets + job ladder: Lise (2013), Chaumont Shi (2018), Hubmer (2018), Larkin (2019)
- Incomplete markets + occupational mobility: Hawkins and Mustre del Rio (2017)

Job ladder + EU heterogeneity: Pinheiro and Visschers (2015), Jarosch (2023), Larkin (2021)

This paper: Optimal UI + labour market dynamics

Feature 2: Learning match quality (I)

- After successfully starting a new job, match quality is unknown to both worker and firm
- Model as different risk of match-specific productivity falling to zero:
  - Good match: match "fails" at rate s
  - Bad match: fails at higher rate $\lambda + s$
- Graphically:



Learning: "no news is good news"

- Prior: $P(\text{bad}) = p_0$
- The longer your tenure, estimate that it's less likely this is a bad match

Feature 2: Learning match quality (II) return

- Let p_t denote the current estimated probability that your match is bad
- Bayesian learning: p_t evolves according to

$$\dot{p}_t = -\lambda p_t(1 - p_t)$$

  - $\Rightarrow p_t$ falls towards 0, at speed controlled by λ
  - Higher $\lambda \Rightarrow$ bad type is revealed quicker $\Rightarrow$ if not fired you feel "safer" more quickly

- Learning creates a declining *EU* hazard with job tenure:
  - Estimated separation rate, $\lambda p_t + s$, Falls over time

- Climbing the job ladder is therefore **risky**:
  - Upside benefit: higher wage w' at new job
  - Downside risk: new match could be a "bad match" with higher separation risk (since reset belief from p_t to $p_0 \geq p_t$)

Wage determination

return

- Continuous renegotiation (Shimer, 2006, Gottfries, 2021)
- Bargain over flow surplus (Hall and Milgrom, 2008, Elsby and Gottfries, 2021)
- Nash bargain with worker bargaining power ψ:

$$\max_{w} \psi \log\left(u((1-\tau)w) - u(\chi(1-\tau)w_{-1})\right) + (1-\psi)\log\left(z-w\right)$$

  During strike worker gets wage χw_{-1} and no production happens
- FOC:

$$\frac{\psi(1-\tau)u'((1-\tau)w)}{u((1-\tau)w) - u(\chi(1-\tau)w_{-1})} = \frac{1-\psi}{z-w}.$$

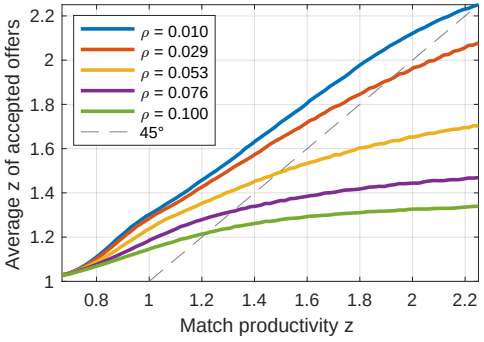
  Wages become independent of exogenous separation risk ρ
- With CRRA utility ($u(c) = c^{1-\sigma}/(1-\sigma)$):

$$w = \frac{1}{1 + \frac{1-\psi}{\psi a}} z,$$

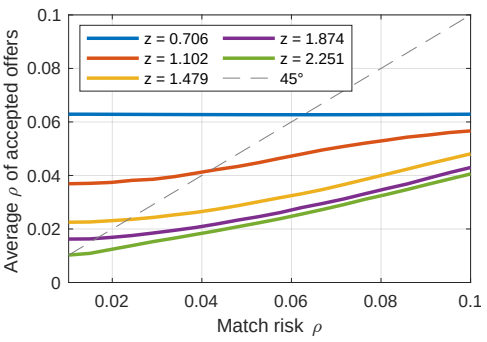
  with $a = (\sigma-1)/\left[(\chi)^{1-\sigma} - 1\right]$. This leads to $0 < w(z) < z$ for finite σ, and has a well defined limit in the case of log utility ($\sigma \to 1$).

Steady state: Productivity and risk ladders return

Figure: Productivity and safety ladders: Properties of EE moves



(a) Average z of next job



(b) Average ρ of next job

Figures represent the job ladders by productivity and size respectively. Specifically, the left panel plots the average productivity of the job offers an employed worker would accept, as a function of their current productivity and risk. The right panel does the same for the average risk of the job offers an employed worker would accept.

Calibration

- Wage dispersion and risk aversion:
  - Log normal match productivity offer distribution, std. chosen to match Mean-min ratio of 1.48 (Tjaden and Wellschmied, 2012).
  - (CRRA) risk aversion = 3.
- Separation risk process:
  - Initial risk drawn from $\pi_j = b_\rho(j)^{a_\rho}$ (uncorr from productivity)
  - a_ρ, $\underline{\rho}$ and s_ρ chosen to match EU-tenure profile in our data (month 1 and 12 are 5.4 and 2.8 times higher than EU rate at long tenures, overall EU rate 2% from Krusell et al. (2012))
- $s_e = 0.41$ chosen to match EE rate from our data (1.5% per month)
- b set to 40% of average wage
- κ chosen to achieve UE rate to hit 6.5% unemployment rate

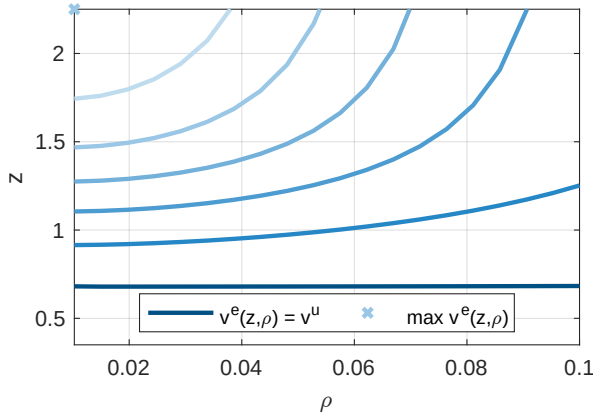
Calibration results return

Table: Model Parameters

Parameter	Description	Value	Source/Target
	Pre-determined		
δ	Discounting	0.0043	Risk-free interest rate of 5%
σ	Risk aversion	3	See text
τ	Linear tax rate	0.2	Personal income tax rate
η	Matching elasticity	1.27	[**?**]
ψ	Nash-product weight	0.5	Symmetric bargaining
χ	Penalty for going on strike	0.707	Labour share of 2/3
$\bar{\rho}$	Highest unemployment risk	0.1	See text
	Matched		
b	Unemployment benefit	0.275	Net replacement rate
$\lambda(\theta)$	Offer arrival rate per unit of search eff.	0.313	Unemployment rate
s_e	Search efficiency on the job	0.408	Average EE rate
$\underline{\rho}$	Lowest unemployment risk	0.010	Average EU rate
a_ρ	Initial ρ distribution	1.052	EU rate in first month
s_ρ	Speed of decrease of ρ	0.475	EU rate in 12th month
μ_z	Mean of marginal density of z_0	-0.030	Average z_0 normalised to 1
σ_z	Std. dev. of marginal density of z_0	0.244	Mean-Min ratio
κ	Vacancy posting cost	1.845	Free-entry

Steady state: Value function return

Figure: v^e indifference curves

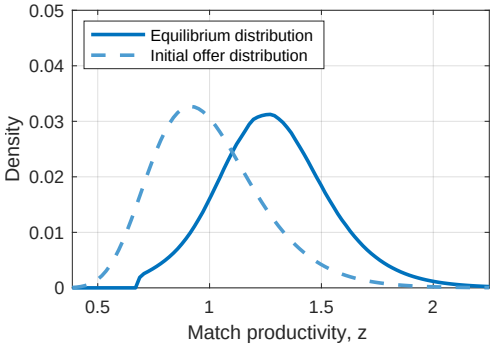


Panel plots the employed value function, $v^e(z, \rho)$ represented as indifference curves. The lowest line gives the points with indifference with unemployment, and the cross is the highest attainable value. Value is increasing in the north-west direction.

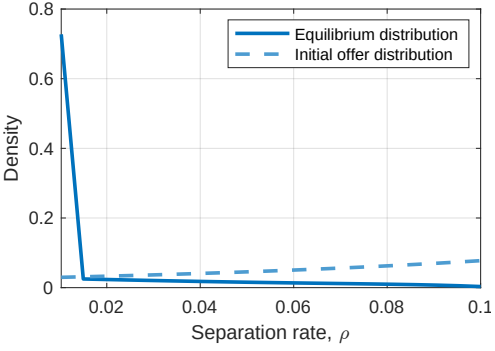
- The higher the wage (i.e. productivity), the more workers care about safety

Steady state: Distributions return

Figure: Steady state: Marginal productivity and separation risk distributions



(a) Marginal z distribution



(b) Marginal ρ distribution

Figures plot the marginal distributions in steady state. That is, the integration of the joint distribution $g(z, \rho)$ over each of its two dimensions. The offer distribution for each variable is also plotted for comparison.

Productivity effect of insurance

Table: Perfect consumption insurance

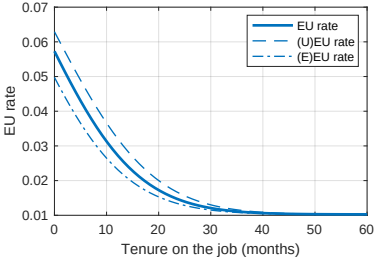
Full model					
	Y/n	u rate	EE-rate	UE-rate	$\lambda(\theta)$
Calibration	1.287	0.065	0.015	0.291	0.313
Perfect insurance	1.352	0.117	0.013	0.187	0.299
% difference	5.05%	80.35%	-13.67%	-35.86%	-4.59%
Homogenous ρ model					
	Y/n	u rate	EE-rate	UE-rate	$\lambda(\theta)$
Calibration	1.223	0.065	0.015	0.289	0.336
Perfect insurance	1.321	0.225	0.005	0.121	0.208
% difference	8.00%	246.89%	-64.82%	-58.08%	-38.21%

This is a general equilibrium experiment, where market tightness is allowed to adjust.

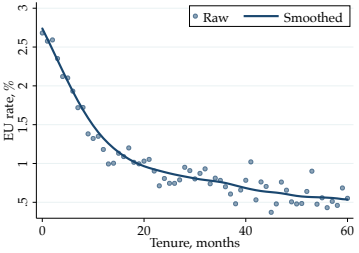
Steady state: EU distribution, model vs. data

return

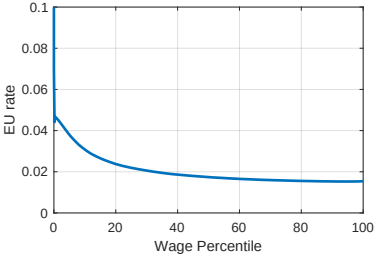
Negative EU-wage correlation (untargeted) is generated by (targeted) EU-tenure profile + EE behaviour



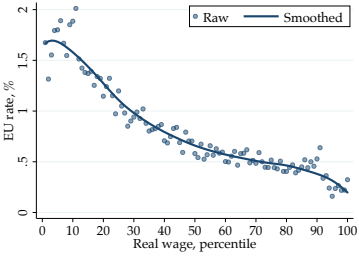
(a) EU-tenure: Model



(b) EU-tenure: Data



(c) EU-wage: Model

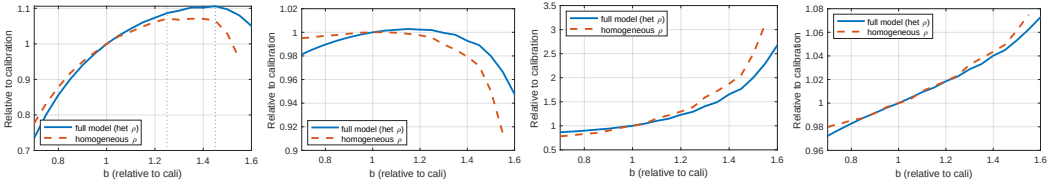


(d) EU-wage: Data

Unemployment benefits: further plots

return

Figure: Effect of varying UI benefits: Full model vs. standard model



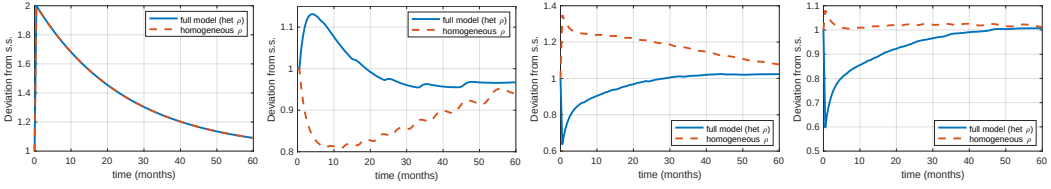
(a) Average welfare (b) Output (Y) (c) Unemployment (d) Productivity (Y/L)

(e) EE rate (f) UE rate (g) EU rate (h) Offer arrival rate (λ)

All lines are deviations from the original steady state. Raising b too far leads to an equilibrium with positive employment ceasing to exist, and we plot the lines up to the maximum value with a valid equilibrium.

Business cycle: further plots return

Figure: Impulse response to risk aversion shock: Full model vs. standard model



(a) Risk aversion (b) Unemployment (c) UE rate (d) Offer arrival rate (λ)

(e) EE rate (f) Mean Wage (g) EU rate (h) Output (Y)

All lines are deviations from the original steady state. The jumps in the EU rate are due to endogenous quits from nodes, given our discretized grids.