The Long-Term Decline of the U.S. Job Ladder

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Motivation: 40 years of wage stagnation

- Real wages for average American worker have stagnated over past 40 years. **Why?**
  - technological change — Autor-Levy-Murnane '03, Acemoglu-Autor '11, Acemoglu-Restrepo '20
  - globalization and trade — Elsby-Hobijn-Sahin '13, Autor-Dorn-Hanson '13
  - institutional changes — Autor-Manning-Smith '16, Vogel '23
- **This Paper:** Job ladder model to study role of **changing structure of labour market**
  - Mismatch between open jobs & searching workers
  - Employer concentration limiting job shopping
  - less search by employed workers
- These factors combine to **reduce upward job mobility** — Topel-Ward '92

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- **This Paper:** Job ladder model to study role of **changing structure of labour market**
  - Mismatch between open jobs & searching workers
  - Employer concentration limiting job shopping
  - less search by employed workers
- These factors combine to **reduce upward job mobility** $\sim 40\%$
- Why you should care: combined effect leads to **4 p.p. lower real wages**
  - $\approx 40\%$ **of fall** in aggregate labor share!

Outline

- A simple job ladder model: illustrate how to infer mobility from wages
- Take simple model to data: Substantial decline in upward mobility
- Direct evidence: slower wage growth from job mobility in NLSY over time
- Full model: add features of data, labour market frictions
- Quantitative results: role of declining mobility for wages

A Simple Job Ladder Model

- Time is continuous, infinite horizon, focus on steady states
- Unit mass of risk-neutral workers move in and out of employment & across jobs
- While non-employed, receive **job offers** at rate λ
  - an offer = a piece rate w drawn from a **wage offer distribution F(w)**
  - assume parameters such that non-employed worker accepts all offers
- While employed, demographics $\mathbf{x} \implies Z(\mathbf{x})$ efficiency units of labour
  - earn wage w per efficiency unit supplied for as long as she is employed in the job
  - Job ends for three possible reasons:
    1. **Outside offers** at rate $\phi\lambda$ with a wage from $\mathbf{F}(\mathbf{w})$ that she **may** accept
    2. **Reallocation Shocks** at rate $\delta\lambda^f$ with a wage from $\mathbf{F}(\mathbf{w})$ that she **must** accept
    3. **Job Loss Shocks** at rate $\delta(1-\lambda^f)$ that leave her non-employed

A Simple Job Ladder Model

- In steady state, the share of non-employed workers u satisfies **flow balance**

$$\underbrace{\lambda u}_{\text{job finding = outflows from } u} = \underbrace{\delta\left(1-\lambda^f\right)(1-u)}_{\text{job loss = inflows to } u}$$

- Let $G(w)$ = CDF of wages. In steady state, satisfies **Kolmogorov Forward Equation**

$$0 = -\underbrace{\delta G(w)}_{\text{reallocation (out) + job loss}} + \underbrace{\lambda \mathbf{F}(\mathbf{w})\frac{u}{1-u}}_{\text{hires from non-empl.}} - \underbrace{\phi\lambda\Big(1-\mathbf{F}(\mathbf{w})\Big)G(w)}_{\text{outside offers}} + \underbrace{\delta\lambda^f \mathbf{F}(\mathbf{w})}_{\text{reallocation (in)}}$$

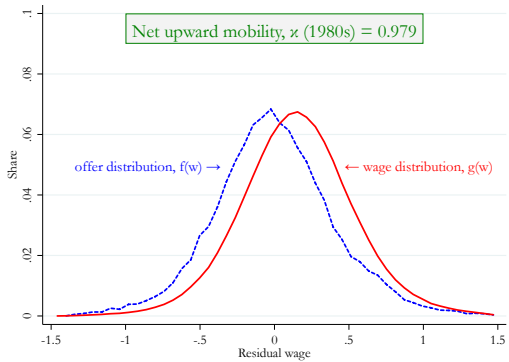
Net Upward Mobility is All You Need

- Rearrange KFE + use flow balance to obtain

$$G(w) = \frac{\mathbf{F(w)}}{1+\kappa\Big(1-\mathbf{F(w)}\Big)}, \qquad \underbrace{\kappa}_{\textbf{net upward mobility rate}} \equiv \frac{\phi\lambda}{\delta}$$

- Net upward mobility rate, κ = Average # of outside offers between two separation events
- Higher $\kappa \implies$ Faster wage growth $\implies$ larger gap btw offer & wage distributions
- What does κ look like in data? Using CPS, obtain residual wages ▸ details
- Estimate $G(w)$ and $F(w)$ non-parametrically
  - **Wage distribution G(w)**: residual wages among all workers
  - **Offer distribution F(w)**: among those who were non-employed in the previous month

The Offer and Wage Distributions



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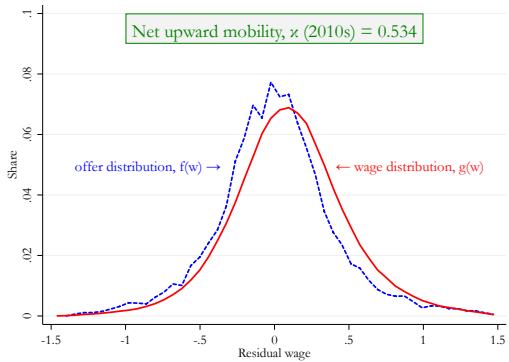
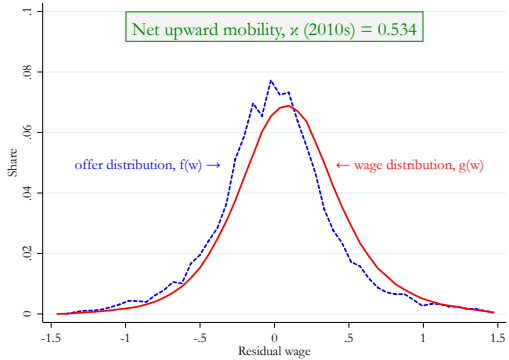
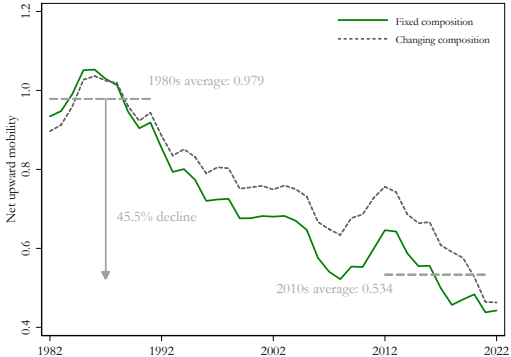


The Offer and Wage Distributions

40-50% decline in net upward mobility between the 1980s and 2010s





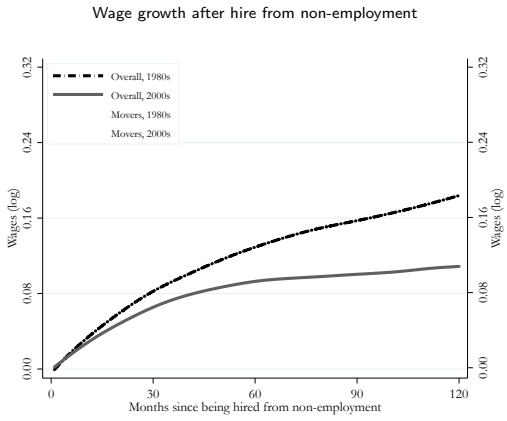
by demographic groups | ▸ Overid test | ▸ Between-occupation | ▸ Better Matched? | ▸ Direct Evidence (CPS, PSID)

Direct Evidence on Wage & Employment Dynamics

- Ideal data set contains employment & wage dynamics
- Monthly frequency individual-level panel data from NLSY
  - NLSY 1979 was aged 14–22 in 1979, has been followed annually (bi-annually since 1994)
  - NLSY 1997 was aged 12–17 in 1997, has been followed annually (bi-annually since 2014)
- We study wage growth for up to 120 months post a non-employment spell
  - Residualize wages (indiv FEs + deflate with average residual wages of same age)
  - Decompose wage growth: due to job mobility, stayer wage growth, flows in/out of non-emp

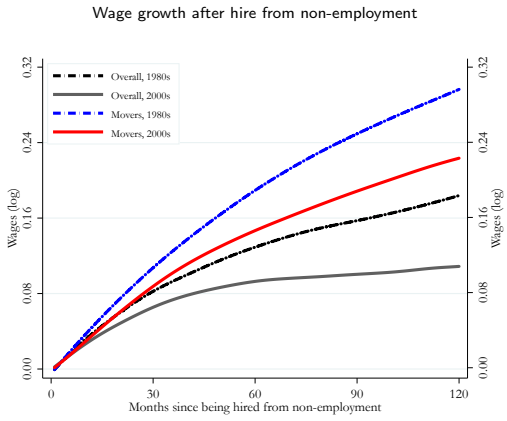
▸ wage distributions ▸ decomposition formula

Less Wage Growth from Upward Job Mobility



NLSY '97 sees much slower wage growth after hire than NLSY '79

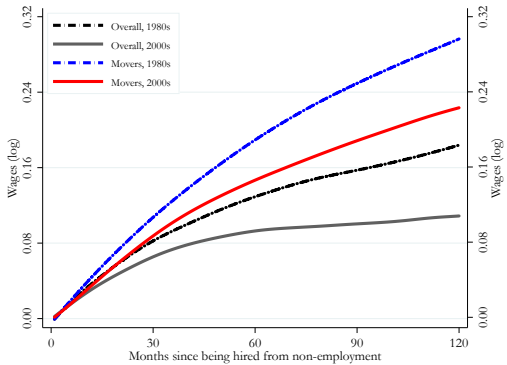
Less Wage Growth from Upward Job Mobility



driven by slower wage growth of movers in NLSY '97 than NLSY '79

Less Wage Growth from Upward Job Mobility

Wage growth after hire from non-employment



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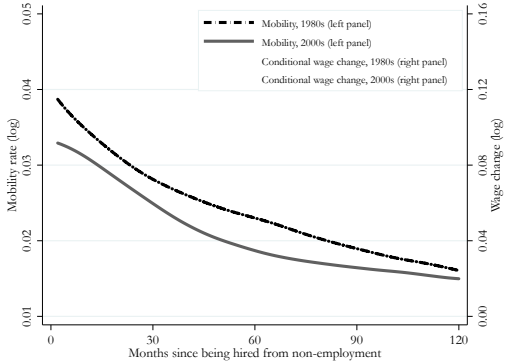
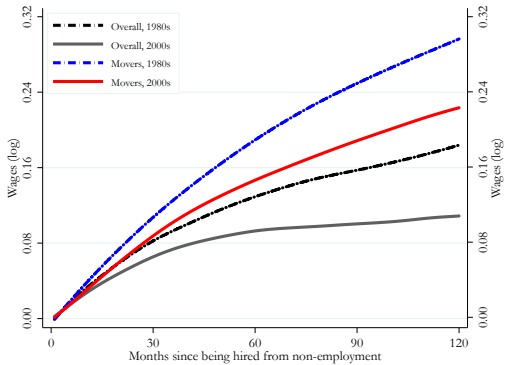
Frequency of mobility & conditional wage gain



driven by both slower mobility rates

Less Wage Growth from Upward Job Mobility

Wage growth after hire from non-employment



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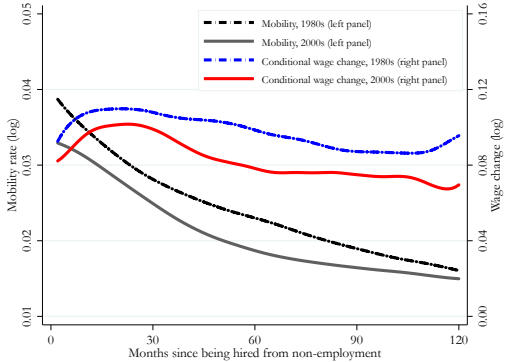

driven by both slower mobility rates and by lower wage growth for movers

Full Model: Overview

- Extension 1: on-the-job wage dynamics
- Extension 2: unobserved heterogeneity
- Extension 3: respondent error in CPS data

Full Model: Overview

- Extension 1: on-the-job wage dynamics
  - Wages evolve **on-the-job** according to an AR1 in continuous time

▸ full model KFE

$$dw = \theta\Big(\mu - w\Big)dt + \sigma dW(t)$$

- Extension 2: unobserved heterogeneity
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- Extension 2: unobserved heterogeneity
  - Two **unobserved types**, different separation rates, wage growth
  - Different offer distributions, $F^k(w)$, differing in mean values with $\mathbb{E}^2(w) = \mathbb{E}^1(w) + \omega$
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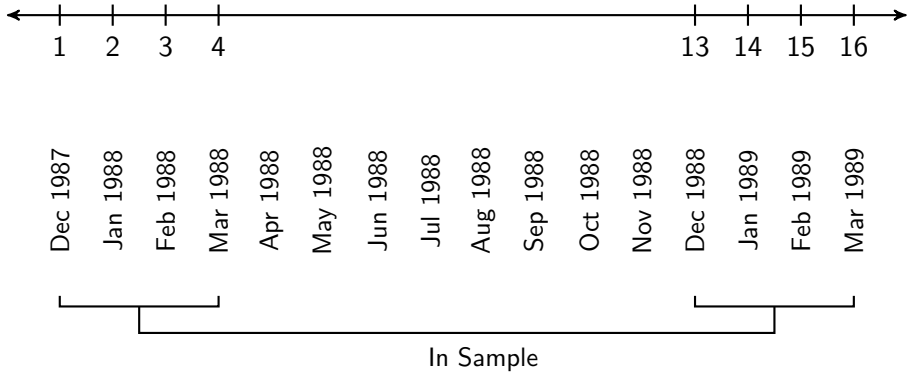
- Extension 3: respondent error in CPS data
  - Allow share ε to **misreport being employed**
  - Allow share ν to **misreport stayer status**
  - Allow persistent **nonresponse**: prob p^{in}, p^{out} of becoming nonresponsive/responsive

Our Data: The Current Population Survey



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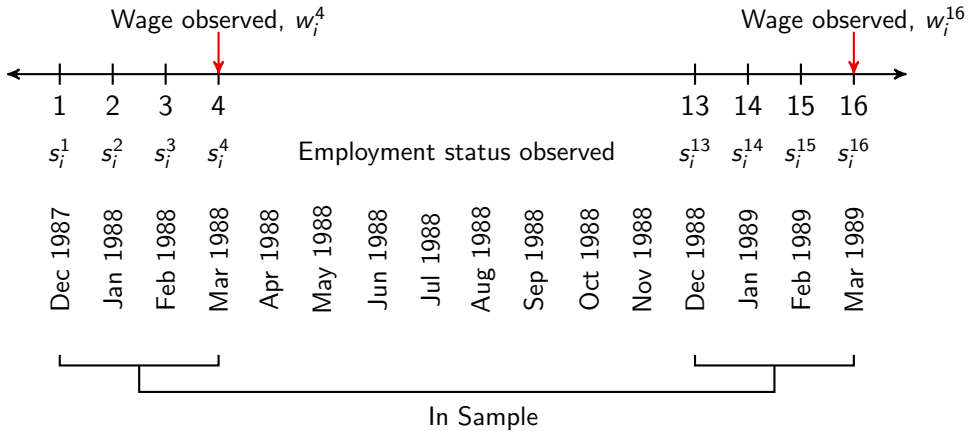

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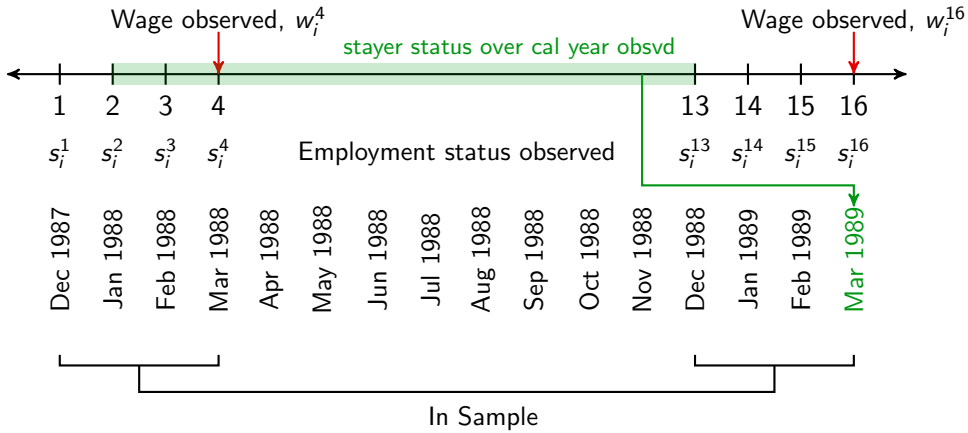


Model Estimation: Decade-by-Decade, Flexibly Vary Params

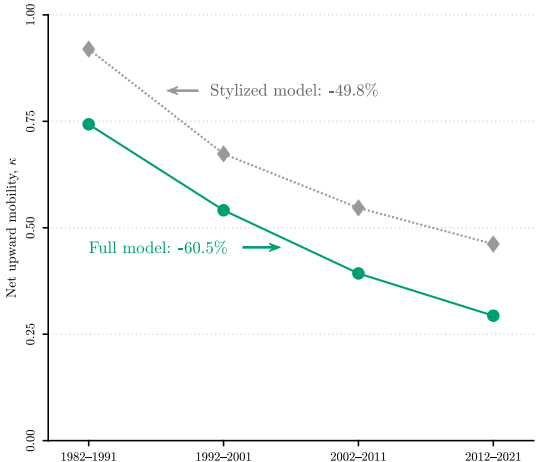
1. Take observed offer distribution $f(w)$ from the data
2. Calibrate three parameters one-to-one to hit particular data moment
   - p^{in}: share of non-missing in month m who are missing in $m+1$
   - p^{out}: share of missing in month m who are non-missing in $m+1$
   - Misclassified stayers from share non-employed in two consecutive months who are stayers
3. 11 parameters via the Simulated Method of Moments

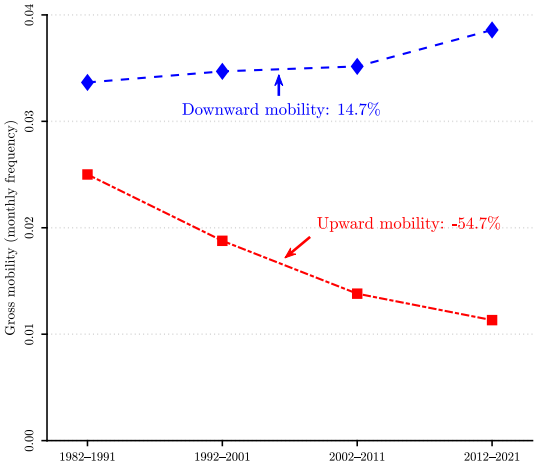
$$\Big[\ \underbrace{\lambda, \lambda^e, \lambda^f}_{\text{job offer arrival rates}}\ ,\ \underbrace{\mu\ ,\ \theta\ ,\ \sigma}_{\text{on-the-job dynamics}}\ ,\ \underbrace{\pi, \delta^1, \delta^2, \omega}_{\text{selection on unobservables}}\ ,\ \underbrace{\varepsilon}_{\text{misclassification}}\ \Big]$$

▸ true offer distbns ▸ employment flows ▸ on-the-job wage dyn ▸ job loser wage dyn ▸ job-to-job flows ▸ overall mobility
▸ role for unobsvd heterog. ▸ offers by empstat ▸ params from data ▸ SMM estimates ▸ SMM intuition ▸ share of stayers
▸ joint distbns (stayers) ▸ joint distbns (losers)

The Long-Term Decline of the Job Ladder: Full vs Stylized Model

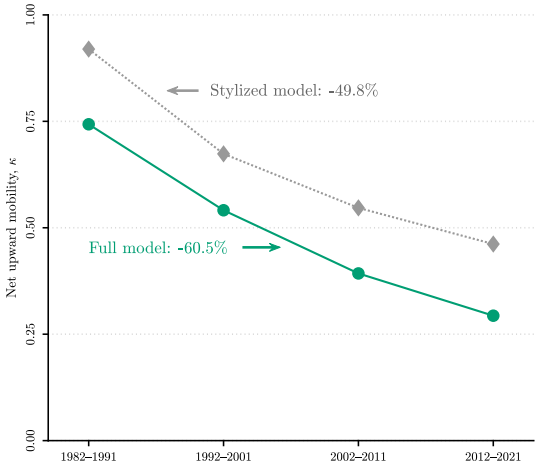
The richer model finds an even larger decline of the U.S. job ladder...

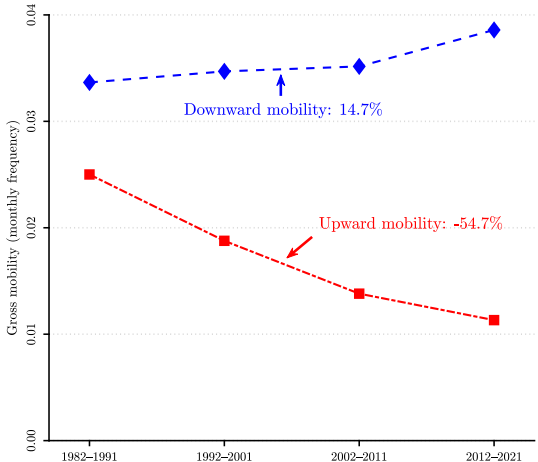




The Long-Term Decline of the Job Ladder: Full vs Stylized Model

...mostly as a result of less gross upward mobility





Why has mobility declined? Adding labour market structure

details

- Extend model: allow λ^e to depend on labour market structure
- Underlying contact rate from a standard matching fn framework
- Assume **on-the-job search**: employed workers search at relative intensity ϕ
- Assume US = many segmented labour markets, differ in mkt tightness

- Each market = finite num of firms (m). Own employees can't apply to own vacancies.

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$\Longrightarrow$ Mismatch: nonlin matching fn + dispersed tightness $\Longrightarrow$ lower effective agg. contact rate

Barnichon-Figura '15

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Gottfries-Jarosch '23

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$$\underbrace{\lambda^e}_{\text{Upward mobility}} \approx \underbrace{\chi}_{\text{matching efficiency}} \underbrace{\left(\frac{V}{S}\right)^{\alpha}}_{\text{aggregate tightness}} \underbrace{\phi}_{\text{search of employed}} \underbrace{\left(1-\tau\right)}_{\text{mismatch}} \underbrace{\frac{m-1}{m}}_{\text{employer concentration}}$$

The factors behind the Long-Term Decline of the U.S. Job Ladder

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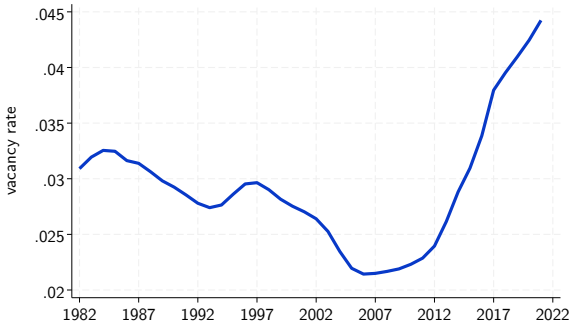

Figure: agg. vacancy rate: from JOLTS/Barnichon (2010)

Total	**-55**
Matching efficiency	-19
Aggregate tightness	25

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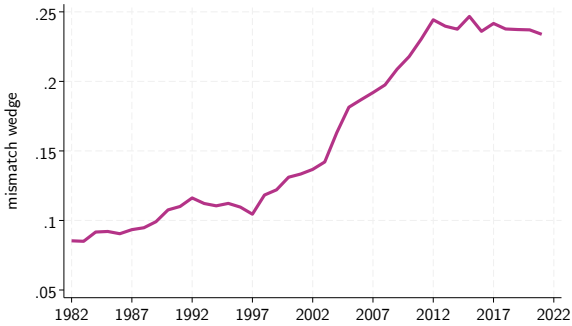

Figure: mismatch: from dispersion in job finding rates across occupations

Total	**-55**
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Aggregate tightness	25
Mismatch	-17

The factors behind the Long-Term Decline of the U.S. Job Ladder

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Concentration: infer from state-level panel. Idea:

- conditional on ϕ, higher concentration

$\Longrightarrow$ lower mobility *for emp relative to nonemp*

details

Total	**-55**
Matching efficiency	-19
Aggregate tightness	25
Mismatch	-17
Employer concentration	-13

The factors behind the Long-Term Decline of the U.S. Job Ladder

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Total	**-55**
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Aggregate tightness	25
Mismatch	-17
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Relative search intensity	-38

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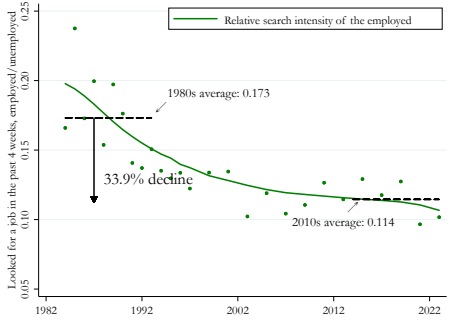
Share looking for a new job in past 4 weeks (PSID)



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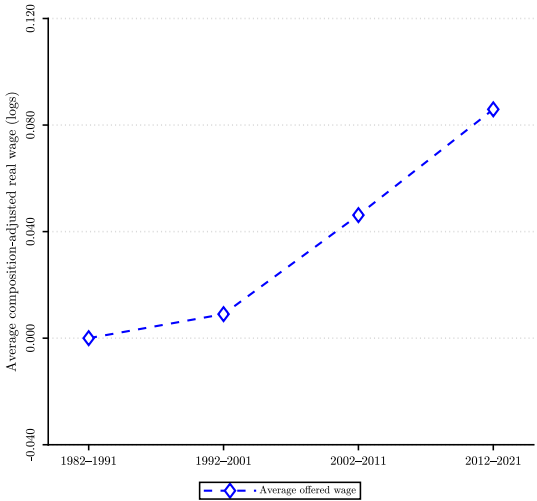
The Consequences of the Long-Term Decline of the U.S. Job Ladder



Accounting exercise:

- offered wages ($F_t(w)$): grow as in data
- Hold **one/a few params** fixed in 1980s
- Quantify impact on gap and hence

  overall wages = offered wages + gap

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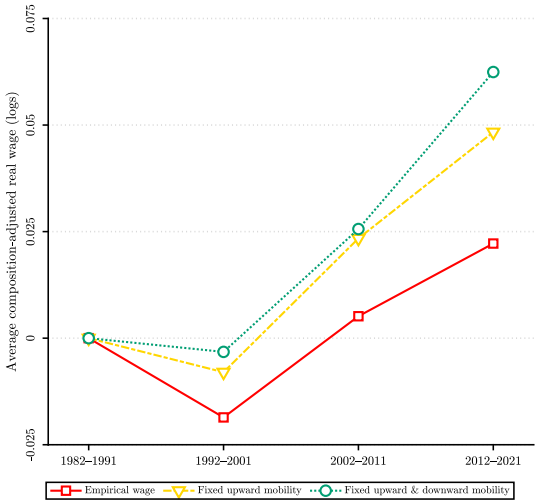

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  overall wages $=$ offered wages $+$ gap

Combined effect: -4.0p.p. real wages
($\approx$ 40% of labor share decline)

The Consequences of the Long-Term Decline of the U.S. Job Ladder

	Mobility	Wages
Total	**-55**	**-2.6**
Matching efficiency	-19	-0.5
Aggregate tightness	25	0.4
Mismatch	-17	-0.4
Employer concentration	-13	-0.4
Relative search intensity	-38	-1.4

Accounting exercise:

- offered wages ($F_t(w)$): grow as in data
- Hold **one/a few params** fixed in 1980s
- Quantify impact on gap and hence

  overall wages = offered wages + gap

Combined effect: -4.0p.p. real wages
($\approx$ 40% of labor share decline)

The Structure of the U.S. Labor Market & Wage Stagnation

We use an estimated structural job ladder model to show:

1. **Upward job mobility has fallen by 40%** between the 1980s and 2010s
2. Primarily accounted for by changes in three structural factors:
   (a) **Greater mismatch** between open jobs and searching workers
   (b) **Greater employer concentration** that has limited the scope for job shopping
   (c) **Less search by employed workers**
3. Combined effect: **4 p.p. lower real wages** ($\approx$ 40% of fall in aggregate labor share)

Appendix

Taking the Simple Model to Data

back

- Main dataset: Current Population Survey (CPS), 1982-2023
- Theory about residual wage dispersion: project log wages on observables year-by-year

$$\ln W_{it} = \underbrace{\alpha_{ry}}_{\text{race}} + \underbrace{\alpha_{gy}}_{\text{gender}} + \underbrace{\alpha_{ey}}_{\text{education}} + \underbrace{\alpha_{sy}}_{\text{state}} + \underbrace{\alpha_{oy}}_{\text{occupation}} + \underbrace{\alpha_{my}}_{\text{survey month}} + \tilde{w}_{it}$$

- Express wages relative to hires from non-employment of same age

$$w_{it} = \tilde{w}_{it} - \underbrace{\overline{w}_{at}}_{\text{average residual wage out of non-empl.}}$$

- Estimate $G(w)$ and $F(w)$ non-parametrically
  - **Wage distribution G(w)**: residual wages among all workers
  - **Offer distribution F(w)**: among those who were non-employed in the previous month

Net Upward Mobility has Declined Substantially

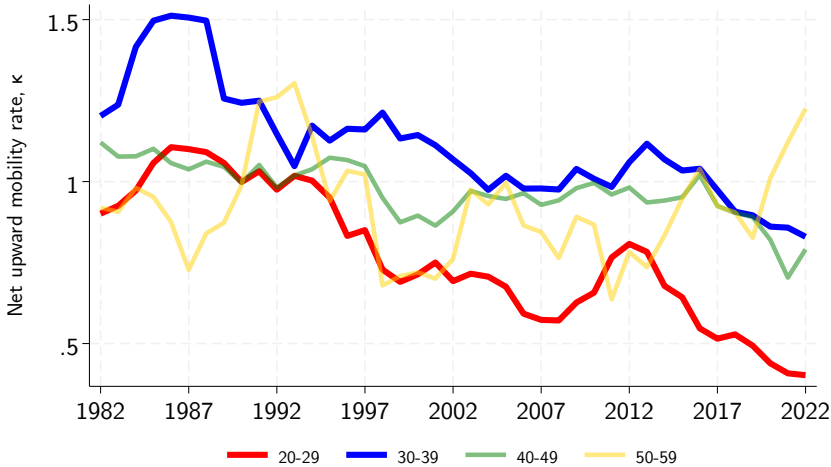
back

The decline is

- larger for younger workers (20-29 and 30-39 relative to 40+) — graph
- similar for women relative to men — graph
- similar across race groups — graph
- larger for better educated workers — graph
- mixed across occupation/industry groups — graph & graph
- largest in the middle of the occupational wage distribution — graph
- larger for occupations more exposed to non-competes — graph

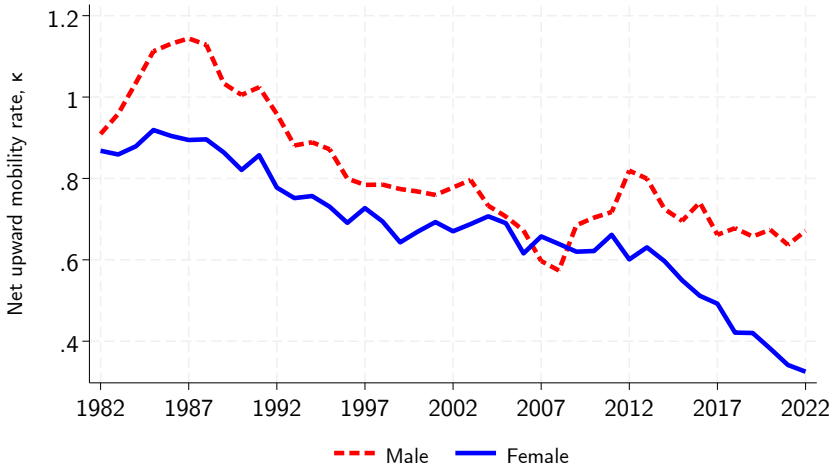
Decline in net upward mobility sharper for the youngest

back



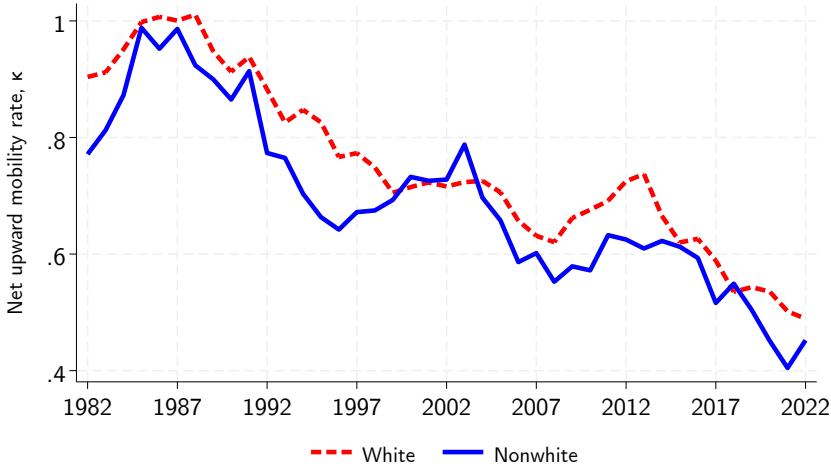
Decline in net upward mobility comparable across genders

back



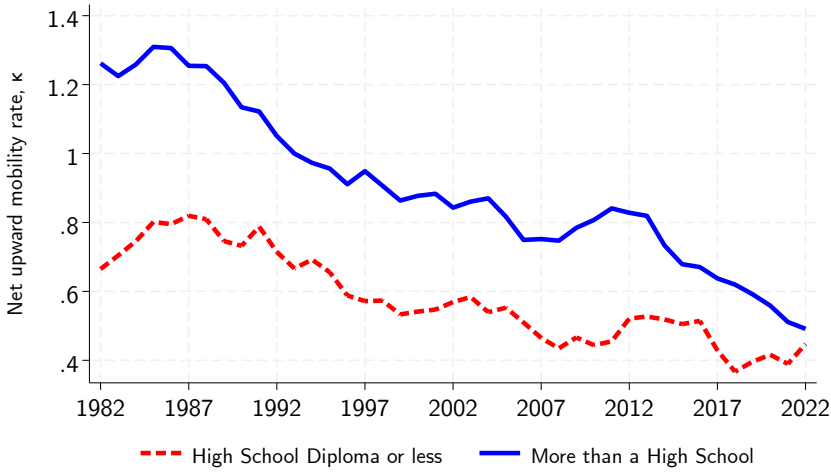
Decline in net upward mobility similar across race groups

back



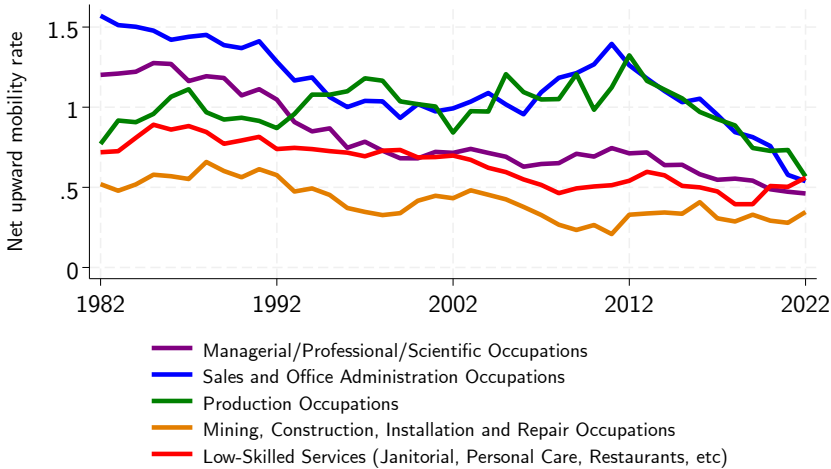
Decline in net upward mobility larger for better educated workers

back



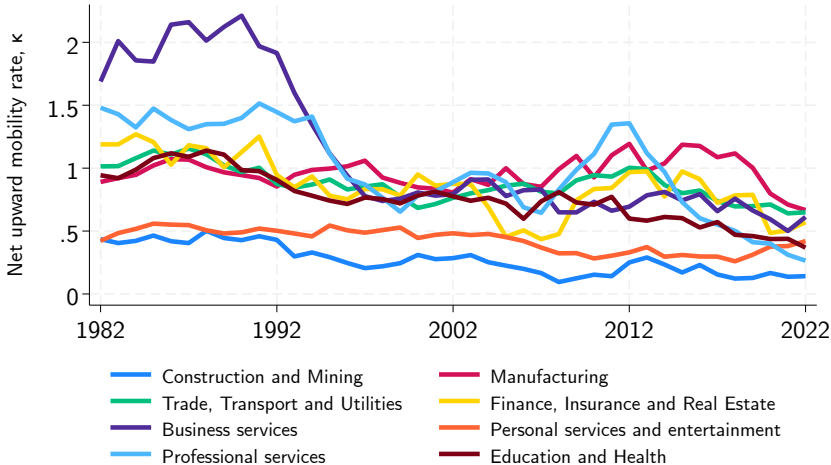
Decline in net upward mobility mixed across Occupation groups

back



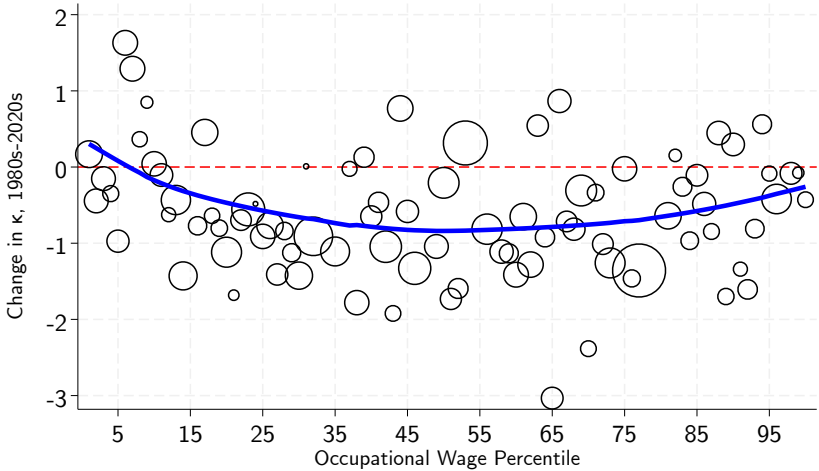
Decline in net upward mobility mixed across Industry groups

back



Decline largest in the middle of Occupational Wage Distribution

back

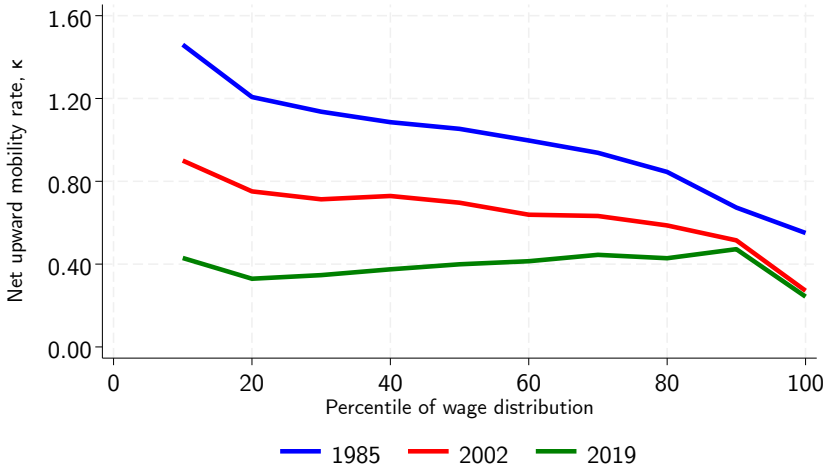


Decline larger for Occupations more exposed to Non-competes

back

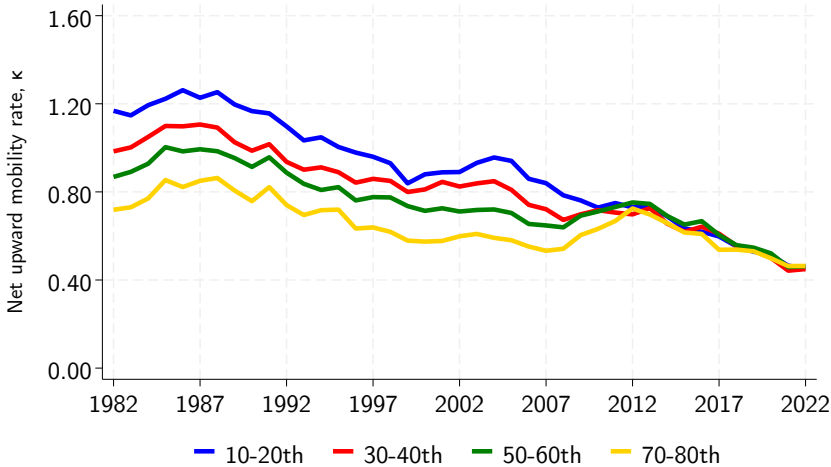
Decline in Net Upward Mobility: κ at Different Percentiles

back



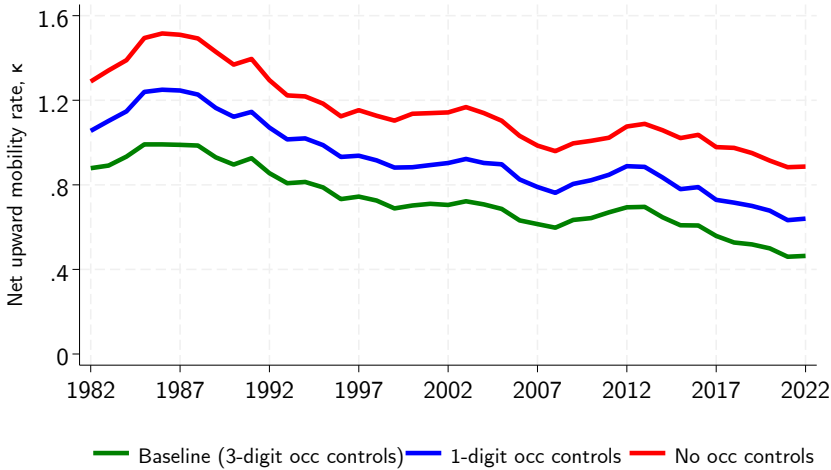
Decline in Net Upward Mobility: κ at Different Percentiles

back



Decline in Net Upward Mobility: Between-Occupation Results

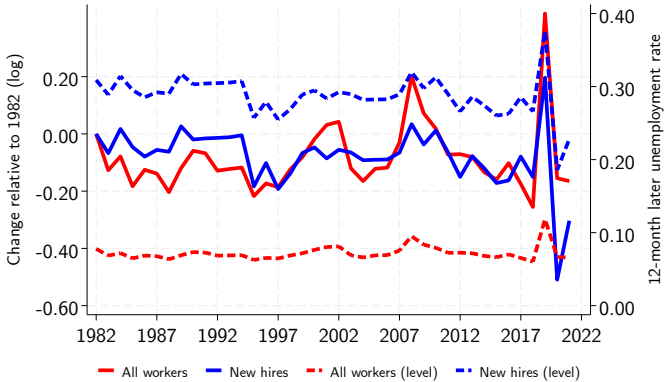
back



Decline in Net Upward Mobility: Unlikely to be better match quality

back

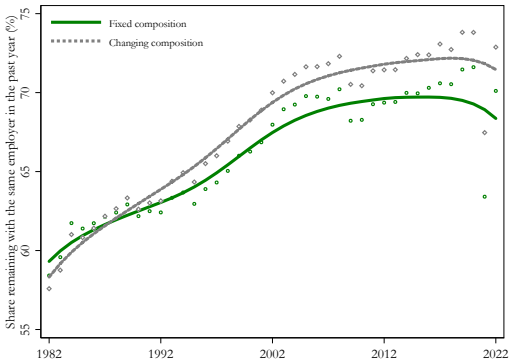
- Better screening $\Longrightarrow$ fewer bad matches form in first place
- Convergence of offer & wage distributions and fall in mobility
- However, implies decline in EN rate, especially among new matches
- Only modest decline in data



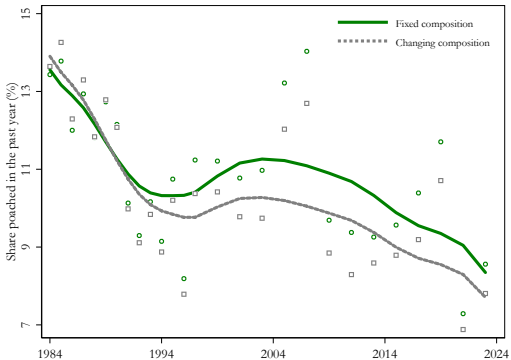
Direct Evidence on Mobility

back

March CPS: Stayed with employer throughout the year



PSID: Share of employed poached in the past year



Decomposition of Wage Growth (NLSY)

back

- Decompose residual wage growth (rel. to someone of the same age)

$$
\begin{aligned}
dw_t \;=\; & \underbrace{\sum_{i\in\mathcal{S}_t} \frac{\omega_{it}+\omega_{it-1}}{2}\left(w_{it}-w_{it-1}\right)}_{\text{contribution of stayers}} + \underbrace{\sum_{i\in\mathcal{M}_t} \frac{\omega_{it}+\omega_{it-1}}{2}\left(w_{it}-w_{it-1}\right)}_{\text{contribution of movers}} \\
& + \underbrace{\sum_{i\in\mathcal{H}_t} \omega_{it}w_{it} - \sum_{i\in\mathcal{X}_t} \omega_{it-1}w_{it-1}}_{\text{flows in and out of non-empl.}} + \underbrace{\sum_{i\in\mathcal{N}_t} \omega_{it}w_{it} - \sum_{i\in\mathcal{O}_t} \omega_{it-1}w_{it-1}}_{\text{flows in and out of missing}} \\
& + \underbrace{\sum_{i\in\mathcal{S}_t\cup\mathcal{M}_t} \left(w_{it}+w_{it-1}\right)\frac{\omega_{it}-\omega_{it-1}}{2}}_{\text{adjustment factor}}
\end{aligned}
$$

NLSY vs CPS residual wage distributions

back

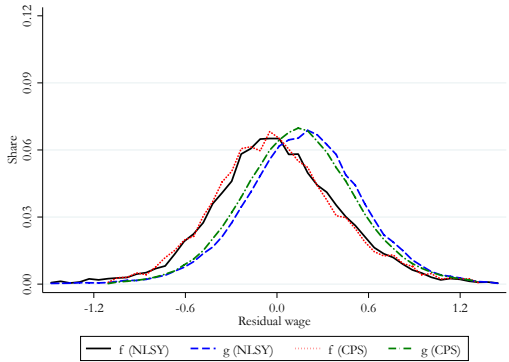


Figure: Wage and Offer Distributions in 1980s

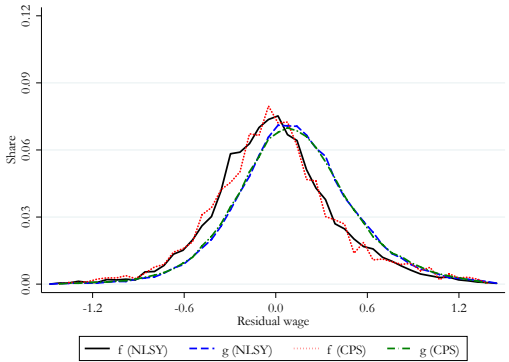


Figure: Wage and Offer Distributions in 2000s

Wage Distributions

back

- Kolmogorov Forward Equation for the wage distribution $G(w)$ is now

$$0 = -\underbrace{\delta G(w)}_{\text{reallocation + job loss}} - \underbrace{\phi\lambda\Big(1-F(w)\Big)G(w)}_{\text{outside offers}} + \underbrace{\lambda F(w)\frac{u}{1-u}}_{\text{hires from non-empl.}} + \underbrace{\delta\lambda^f F(w)}_{\text{reallocation}}$$

$$-\underbrace{\theta\left(\mu-w\right)g(w)}_{\text{drift in wages on job}} + \underbrace{\frac{\sigma^2}{2}g'(w)}_{\text{shocks}}$$

with boundary conditions $\lim_{w\to 0} G(w) = 0$ and $\lim_{w\to\infty} G(w) = 1$

- As before u satisfies flow balance equation

$$\lambda u = \delta\left(1-\lambda^f\right)(1-u)$$

Why has mobility declined? Adding labour market structure

back

- Model extension: allow λ^e to be determined by underlying labour market structure
- Assume US divided into perfectly segmented labour markets indexed by i
  - Within each market, m_i identical firms each advertise v_i vacancies. Let $V_i = v_i m_i$.
  - On-the-job search: employed workers search w/ relative intensity ϕ. Search effort $S_i = u_i + \phi e_i$.
  - Cobb-Douglas matching function: $\mathcal{M}_i = \chi S_i^{1-\alpha} V_i^{\alpha}$
  - Firm-worker contact rate $\lambda_i \equiv \frac{\mathcal{M}_i}{S_i} \equiv \chi x_i^{\alpha}$, $x_i =$ tightness
  - Firms can exclude current employees from applying to own vacancies
- This setup generates two forces affecting measured aggregate mobility:
- Mismatch: nonlinear matching fn + dispersion in tightness $\implies$ lower effective agg. contact rate

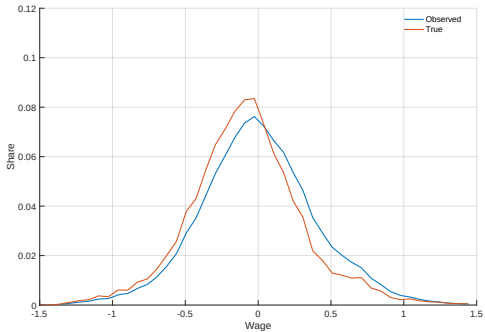
  Barnichon-Figura '15
- Concentration: lower m_i $\implies$ lower effective contact rates for the employed relative to non-emp

  Gottfries-Jarosch '23

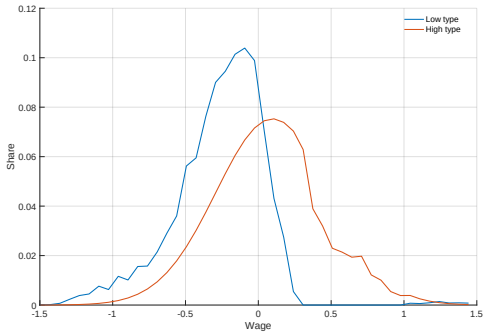
Recovering the True Offer Distributions

back

- The observed offer distribution is mixture of the true and wage distribution
- Given parameter values, we can recover the true offer distribution
  - offer distribution of the high type is log normal distribution with the same st.d and mean $+\omega$
  - offer distribution of the low type is the residual



Observed and true offer distributions"

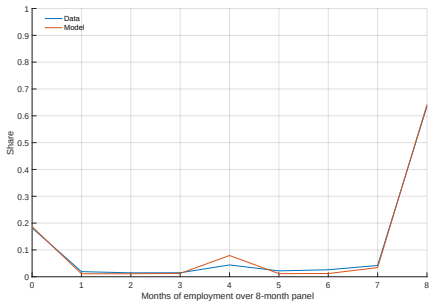


Offer distribution by type

Flows In & Out of Employment

back

$$\Big[\underbrace{\pi}_{\text{share of low type}}, \underbrace{\delta^1}_{\text{job loss of low type}}, \underbrace{\delta^2}_{\text{job loss of high type}}, \underbrace{\lambda}_{\text{job finding rate}}, \underbrace{\varepsilon}_{\text{emp.stat. misclassification}}\Big]$$



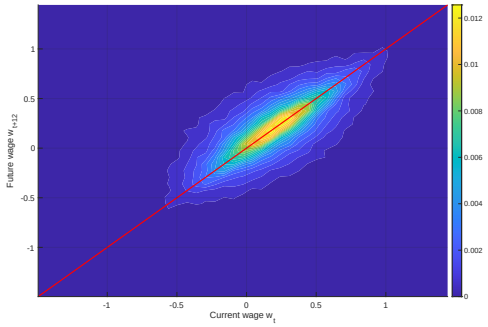
Months of employment

- Some stayers report period of non-employment
- Informs employment status misclassification

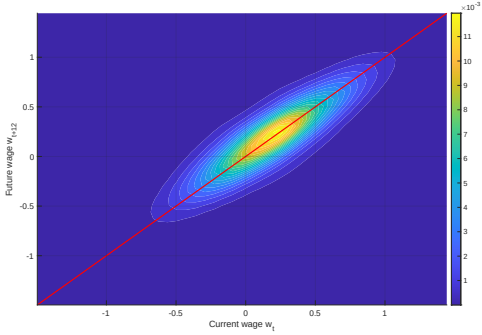
Wage Dynamics of On-the-Job

back

$$\left[\underbrace{\mu}_{\text{long-run mean}}, \underbrace{\theta}_{\text{persistence}}, \underbrace{\sigma}_{\text{st.d. of wage innovations}}\right]$$



Wages of job stayers at t & $t+12$ (data)

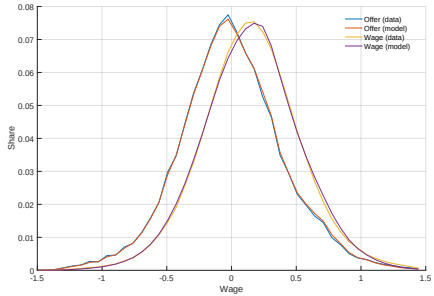


Wages of job stayers at t & $t+12$ (model)

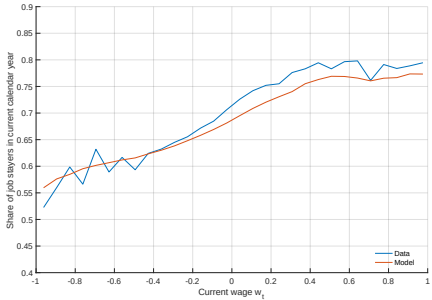
Flows Between Jobs

back

$$\Big[\underbrace{\lambda^e}_{\text{arrival rate of voluntary outside offers}}, \quad \underbrace{\lambda^f}_{\text{arrival rate of reallocation shocks}}\Big]$$



Offer and wage distributions

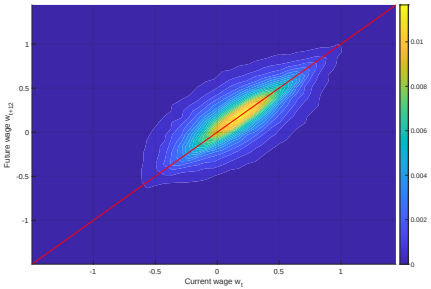


Share of job stayers by wage

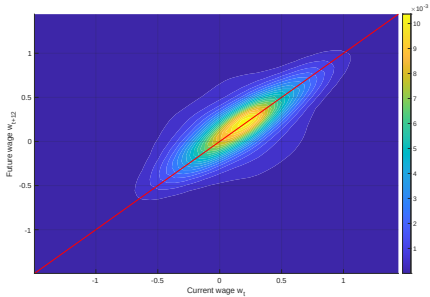
Flows Between Jobs

back

$$\Big[\underbrace{\lambda^e}_{\text{arrival rate of voluntary outside offers}}, \quad \underbrace{\lambda^f}_{\text{arrival rate of reallocation shocks}}\Big]$$



Wages of all workers at t & $t+12$ (data)



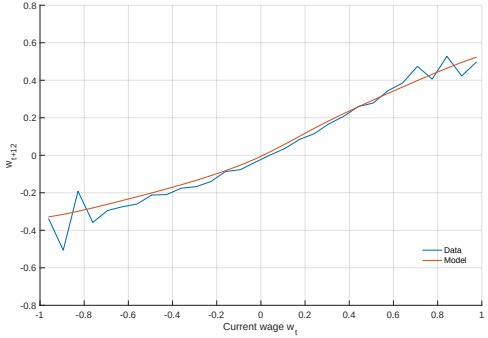
Wages of all workers at t & $t+12$ (model)

Wage Dynamics of Job Losers

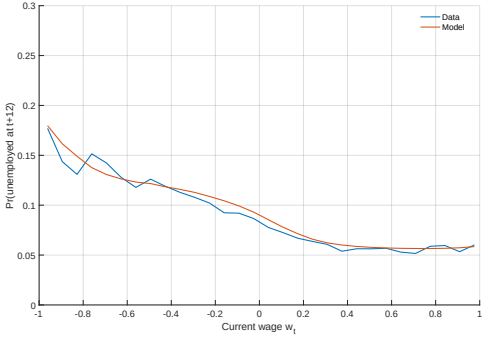
back

$\underbrace{\omega}$

mean difference in offer distribution



Wage at $t + 12$ by wage at t among job losers



Share non-employed at $t + 12$ by wage at t

Parameters Directly From the Data

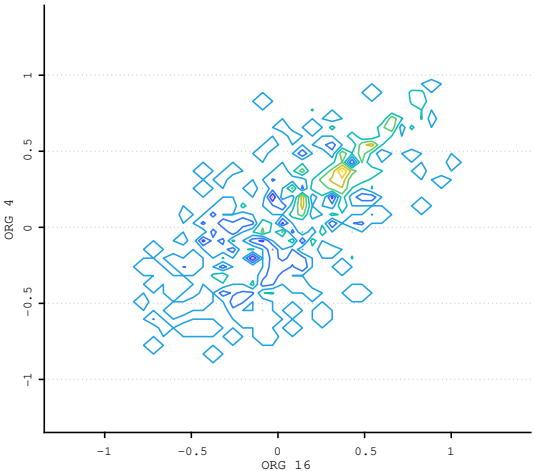
back

		(1) 1982–1991	(2) 1992–2001	(3) 2002–2011	(4) 2012–2021
in	re-entry to being observed	0.123	0.111	0.115	0.139
out	rate of dropout from survey	0.156	0.146	0.124	0.167
ε	share workers on temp. layoff	0.011	0.011	0.012	0.012
ν	recall error for stayer status (annual)	0.102	0.153	0.198	0.253
λ	job finding rate, unemp	0.055	0.054	0.046	0.046
τ	matching wedge	0.090	0.112	0.194	0.242

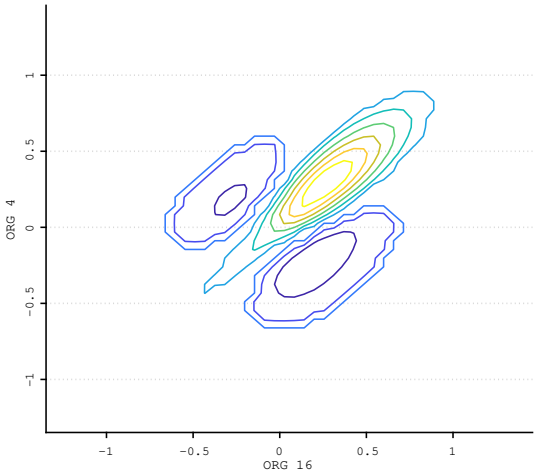
Joint Distribution of Stayers

back

Data



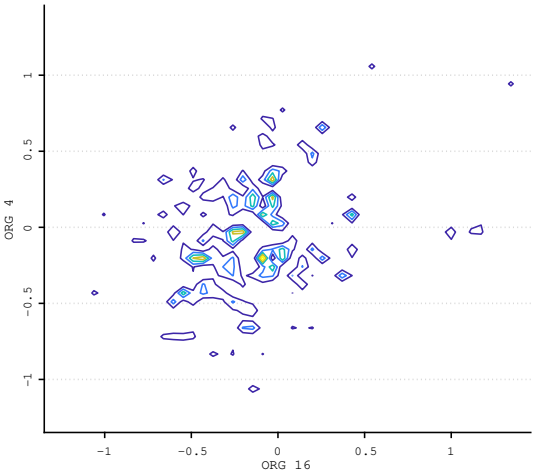
Model



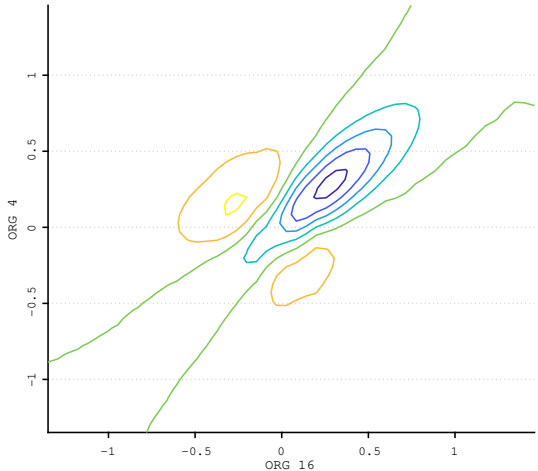
Joint Distribution of Job Losers

back

Data



Model



Eight Parameters Via the Simulated Method of Moments

back

$$\Big\{ \underbrace{\mu \ , \ \rho \ , \ \sigma}_{\text{on-the-job dynamics}} \ , \ \underbrace{\delta^1 \ , \ \delta^2 \ , \ \omega}_{\text{unobserved heterogeneity}} \ , \ \underbrace{\lambda^f}_{\text{reallocation shocks}} \ , \ \underbrace{\lambda^e}_{\text{job finding rate of employed}} \Big\}$$

- **On-the-job wage dynamics**
  - Joint distribution over wages of job stayers

joint distribution of stayers

- **Unobserved heterogeneity**
  - Joint distribution over wages of job losers

joint distribution of job losers

- **Reallocation shocks**: Joint distribution over wages of all workers and share of stayers
- **Arrival rate of outside offers**: Gap between wage and offer distribution

Eight Parameters Via the Simulated Method of Moments

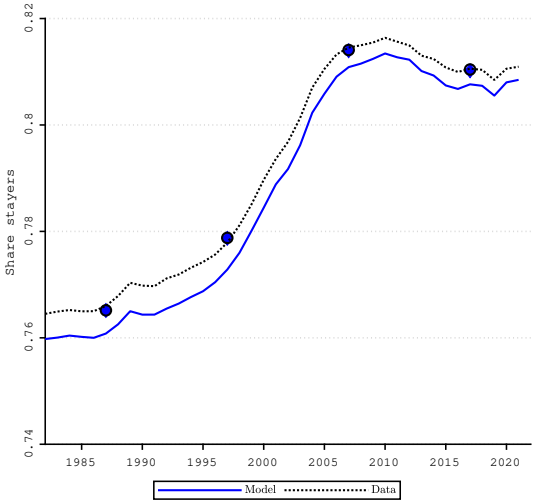
back

Table: Parameter estimates from step II

		(1) 1982–1991	(2) 1992–2001	(3) 2002–2011	(4) 2012–2021
μ	long-run mean wage	0.184	0.072	0.245	0.111
θ	autocorrelation of wage process	0.013	0.017	0.016	0.016
σ	s.d. of diffusion	0.194	0.221	0.232	0.240
ω	difference in offered wage btw types	0.103	0.151	0.019	0.090
δ^1	separation rate, low type	0.083	0.089	0.100	0.083
δ^2	separation rate, high type	0.010	0.010	0.010	0.017
λ^f	job-to-job move upon separation	0.450	0.527	0.529	0.499
λ^e	arrival rate of job offers	0.025	0.019	0.014	0.011

Share of Stayers

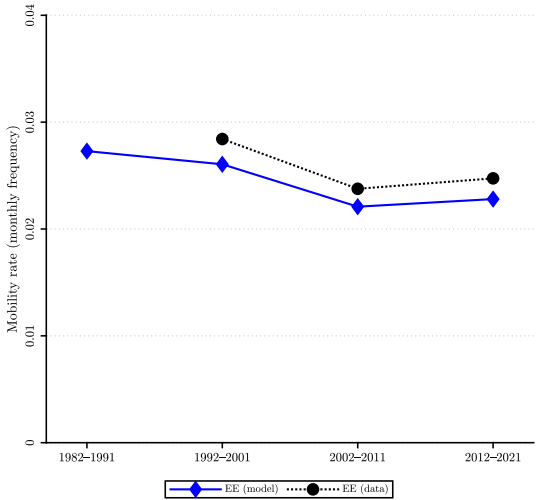
back



- The EN rate informs the model EN rate $\delta(1-\lambda^f)$
- λ^e gives voluntary job-to-job flows
- Use the share that remain in job to get λ^f

Overall Mobility is Not Informative About Reallocative Mobility

back



- Similar overall mobility as raw CPS
- But not informative about reallocative part
  - ≈55% are associated with wage gain
  - Systematic upward only 1/4 of total

$\Rightarrow$ Need to incorporate wage information

Unobserved Heterogeneity is a Crucial Factor Behind the Wage-Offer Gap

back

1. Job-to-job mobility toward higher paying jobs—important yet $< 50\%$ of gap
2. Unobserved heterogeneity is also very important—hires earn less in all jobs
3. Wage growth within jobs—return to tenure is positive

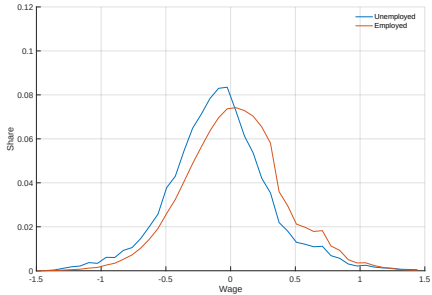
Decomposition of gap between offer and wage distributions

(1) Overall gap	(2) Job-to-job	(3) Unobs. het.	(4) On-the-job
0.104	39.6%	39.0%	33.2%

The Employed Sample Better Job Offers

back

- Faberman et al. (2024): employed get better offers
- Model replicates this through selection
- Pool of unemployed dominated by low type



Offer distribution by employment status

Employer Granularity From State-Year Panel

back

- The # of LMs in state s in period y, B_{sy}, is assumed proportional to the # of workers N_{sy}

$$\beta = \frac{N_{sy}}{B_{sy}}.$$

  That is, each market contains β workers

- It follows that the # of firms per market m_{sy} is

$$m_{sy} = \frac{M_{sy}}{B_{sy}} = \beta \frac{M_{sy}}{N_{sy}}.$$

- Then we can obtain a measure of the number of workers per market from

$$\ln \frac{\lambda^e_{sy}}{\lambda_{sy}} = \ln\left(1 - \frac{fsize_{sy}}{\beta}\right) + \alpha_s + \alpha_y + \varepsilon_{sy}, \qquad m_y = \frac{\beta}{fsize_y}$$

Employer Granularity From State-Year Panel

back

Table: Parameter estimates from cross-state panel

	(1)	(2)	(3)	(4)	(5)	(6)
β	43.454	34.133	63.754	39.185	38.834	39.143
	(5.255)	(2.050)	(17.543)	(7.510)	(9.526)	(7.186)
Trend						-0.000
						(0.000)
Controls	yes	yes	yes	yes	no	yes
Year FE	no	no	yes	yes	yes	yes
State FE	no	yes	no	yes	yes	yes
Obs.	2,000	2,000	2,000	2,000	2,000	2,000