Labor Market Structure and Wages: Theory and Measurement

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Introduction

- Question: How do concentrated markets affect wages, job flows, and welfare?
- This paper: Quantify importance of concentration vs. search frictions/neoclassical sources of monopsony (e.g. preferences)

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- Question: How do concentrated markets affect wages, job flows, and welfare?
- This paper: Quantify importance of concentration vs. search frictions/neoclassical sources of monopsony (e.g. preferences)
- Theory: Develop equilibrium theory of granularity in the labor market with price discrimination
    - PE theory exists (Jarosch, Nimczik, Sorkin 2020, Zhu 2012) w/ fixed contact rates, no firm-specific preferences, OJS with U as threat
    - For policy/welfare, need GE theory of contact rates and data-consistent wages
    - Contribution: Cahuc, Postel-Vinay, Robin (2006) + non-wage amenities and M optimizing firms

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- Empirics: Provide new method of clustering occupations to form local labor markets
- Study w/in-region-occ, X-year & w/in-year-occ, X-region variation in HHIs
- Strong negative covar. b/w local employment HHIs & wages, job flows
  - Proportional selection models of Altonji, Elder, Taber (2006), Oster (2016) imply limited OVB
  - Model reproduces key covariances $\rightarrow$ new benchmark for future work

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  - Model reproduces key covariances $\rightarrow$ new benchmark for future work
- Main findings:
  - Halving HHI raises wages +2.5% (and inequality), welfare +1.7%, but no effect on markdowns/flows
  - Remove amenity dispersion (mean fixed) lowers markdowns 9pp (v. 17pp in base), $\uparrow 4 \times HHI$
  - Cutting search frictions also reduces markdowns by 9pp, $\uparrow 7 \times HHI$

Literature

1. Theory

   Competitive Card Cardoso Heining Kline (2018), Lamadon Mogstad Setzler (2019)

   Frictional Burdett Mortensen (1998), Flinn (2010), Manning (2003, 2006), Postel-Vinay Robin (2002)

   Oligopsony Bhaskar et al (2002), Berger et al (2021), Azkarate-Askasua Zerecero (2018)

   Search Burdett, Shi, Wright (2001), Zhu (2008), Jarosch, Nimczik, Sorkin (2020), Bagga (2021)

   New - PVR+finite firms, vacancy posting affects quantities, equilibrium contact rates

2. Empirics

   Concentration Benmelech et al (2018), Azar et al (2018), Rinz (2018)
   Hershbein, Macaluso, Yeh (2019), Rossi-Hansberg et al (2018)

   Wage dynamics Di Addario, Kline, Saggio, Solvesten (2022)

   New - Link concentration, job flows, inequality.

Environment

- Setup - Many labor markets indexed j. Independent. Single final good.
- Agents - Measure $\overline{N}_j$ identical workers per market. Either $\in \{e, u\}$. M_j firms $k = 1, \ldots, M_j$
- Production - Firm jk with n_{jk} workers produces $y_{jk} = z_{jk} n_{jk}$. At home, produce b.
- Preferences - When meeting a firm, worker i draws idiosyncratic preference $\varepsilon_{ijkt} \sim F(\varepsilon)$

$$u_{ijkt} = w_{ijkt} + \varepsilon_{ijkt} \quad , \quad Utility_{ij} = \mathbb{E}\left[\sum_{t=0}^{\infty} \beta^t u_{ijkt}\right]$$

- Costs - Firms post v_{jk} vacancies each period with flow cost $c(v_{jk})$
- Search - Fraction ξ_u of u apply for jobs, ξ_e of e. Meetings: $A\, m(x_k, v_k)$. δ layoff rate.
- Bargaining - As in Cahuc-PVR, Bertrand with worker bargaining power $\theta \in [0, 1]$.

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Timing: (i) apply, (ii) meet, (iii) draw preference shock/non-wage amenity, (iv) match

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Contract rates: λ_{jk} for workers, λ^f_{jk} for firms *(first subscript= origin, second=destination)*

More

Firms

Assumptions:

1. Firms take contact rates $\{\lambda^f_{uk}, \lambda^f_{k'k}\}$ as given
   - Relaxed in prior draft, quantitatively unimportant when $M > 10$
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Resulting firm objective function

$$V_k = \max_{v_k} -c(v_k) + \underbrace{v_k\, \lambda^f_{uk} (1-\theta) \int \max\left\{S(k,\varepsilon), 0\right\} dF(\varepsilon)}_{\text{Hire from unemployment}}$$

$$+ \underbrace{v_k \sum_{\varepsilon', k' \neq k} \lambda^f_{k'k} \left(\frac{n(k',\varepsilon')}{n(k')}\right) (1-\theta) \int \max\left\{S(k,\varepsilon) - S(k',\varepsilon'), 0\right\} dF(\varepsilon)}_{\text{Hire from competitors } k'}$$

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Appendix: Surplus $S(k,\varepsilon)$ and Nash equilibrium definition

Wages

Promised values delivered by fixed wage until outside offer ($\sigma :=$ worker's surplus share)

$$w\Big(\sigma, k, \varepsilon\Big) \quad = \quad \sigma z_k + (1-\sigma)\Big(b - \varepsilon\Big)$$

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\text{Backloaded offer-matching} \qquad & \quad - \beta \int \sum_{k' \neq k}^{M} \lambda_{kk'} \mathbf{1}_{[\sigma S \leq S' < S]} \Big[S(k',\varepsilon') - \sigma S(k,\varepsilon)\Big] dF(\varepsilon')
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$$\sigma'\Big(S, S', \sigma\Big) = \begin{cases} \frac{\theta S' + (1-\theta) S}{S'} & \text{if } S' > S \quad \text{(move)} \\ \max\Big\{\sigma, \frac{S'}{S}\Big\} & \text{if } S' \leq S \quad \text{(stay)} \end{cases}$$

- Forces: (i) Search: λ's, (ii) Bargaining: θ, (iii) Preferences: ε's, (iv) Concentration: M

QUANTITATIVE

Norwegian data

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$$[1 - \mathit{Gini}(\text{Mkt. Labor Forces})] \times \mathit{Goodness\ Fit}(\text{Within Mkt. Self-Flows})$$

$\rightarrow$ Penalize all markets in same cluster ($1 - \mathit{Gini}$), reward greater self-flows

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$\approx$ 40 clusters per region, conditional leakage $<$ 50% *(vs. 90% w/ naive 4-digit occ)* More

Calibration

- Calibrate monthly model to average of aggregate moments from 2006-2016
- Solve large no. mkts, take CDF of M_j straight from the data, impose $\overline{N}_j = aM_j$
- Cobb-Douglas matching function, $\xi_u = 1$, isoelastic cost $c(v) = \frac{a}{1+\gamma} v^{1+\gamma}$.
- Estimate remaining 8 parameters using SMM

Parameter	Description	Value	Moment	Model	Data
A	Match efficiency	0.16	Unemployment Rate	0.03	0.04
ξ_e	OJS intensity	0.41	EErate agg	0.01	0.01
b	Home production	0.92	Replacement Rate	0.86	0.66
γ	Vacancy cost power	1.46	Employment HHI	0.13	0.09
θ	Bargaining power	0.17	Average Log Wage Growth	0.01	0.01
$\bar{\epsilon}$	Upper bound amenity	0.57	Fraction EE Up Poach Index	0.78	0.72
σ_z	Std Dev Productivity	0.15	Std. Dev. Log Wages	0.48	0.63
α	Matching function elasticity	0.12	Coeff. of HHI on Log Market Wage	-0.09	-0.16
			Std. Dev. Log Wages Within Firm	0.41	0.43
			Std. Dev. Log Wages Between Firm	0.25	0.49

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Next: use w/in Occ-Year, X-Region & w/in Occ-Region X-Year variation to test model v. data

Empirical Results

Specification: occ o, region r, month t, two sets of fully interacted FE's $\{\text{Occ-Region}, \text{Occ-Year}\}$:

$$Y_{ort} = FE + \beta HHI_{m(o,r)t} + \gamma X_{ort} + \epsilon_{ort}$$

Controls : X_{ort} includes age, gender, educ., month, firms-per-worker, lagged LF growth

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Table: Estimated β for various fixed effects/weights, model v. data

Dep. var. (rows)	Model, Unwtd.	Occ-Year FE, Unwtd.
Log wage (target)	-0.0907	-0.04757*** (0.0099)
EE rate	-0.0041	-0.00251*** (0.0001)
SD Log Wage	-0.1425	-0.1500*** (0.0093)

Negative covariance b/w HHIs, wages, and flows w/in Occ-Yr, X-Region (Dentist in Bergen v. Oslo)

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EE rate	-0.0041	-0.00251*** (0.0001)	-0.00569*** (0.0004)
SD Log Wage	-0.1425	-0.1500*** (0.0093)	-0.2185*** (0.0166)

Similar negative covariance using w/in Occ-Region, X-Year (Dentist in Bergen t v. t+1 $\rightarrow$ not sorting)

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Log wage (target)	-0.0907	-0.04757*** (0.0099)	-0.1648*** (0.0190)	-0.3297
EE rate	-0.0041	-0.00251*** (0.0001)	-0.00569*** (0.0004)	-0.005
SD Log Wage	-0.1425	-0.1500*** (0.0093)	-0.2185*** (0.0166)	-0.2116

AET (2006)/Oster (2016) proportional selection models imply limited scope for OVB.

Why? High R^2 ($>$ .7) and β stable as *important* controls added ($\uparrow \Delta R^2$)

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Log wage (target)	-0.0907	-0.04757*** (0.0099)	-0.1648*** (0.0190)	-0.3297	-0.1860	-0.3446*** -0.0743
EE rate	-0.0041	-0.00251*** (0.0001)	-0.00569*** (0.0004)	-0.005	-0.0041	-0.0130*** -0.002
SD Log Wage	-0.1425	-0.1500*** (0.0093)	-0.2185*** (0.0166)	-0.2116	-0.1114	-0.1270*** -0.0252

Weights yield similar (stronger) results → robust negative covariance of HHIs, flows, and wages.

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Next: Use model to measure effects of concentration/neoclassical monopsony on wages/flows/welfare.

Decomposition of wages

$$w\left(\sigma, k, \varepsilon\right) \quad =$$

1. Output share (89.0%) $\quad \sigma z_k$

2. Opportunity cost (35.0%) $\quad + (1-\sigma)\left(b + \beta\theta \sum_{k'}^{M} \lambda_{uk'} \max\left\{S(k', \varepsilon'), 0\right\} dF(\varepsilon')\right)$

3. Amenity discount (-12.2%) $\quad -(1-\sigma)\varepsilon$

4. Quit / Promotion discount (-11.6%) $\quad -(1-\sigma)\beta \int \sum_{k' \neq k}^{M} \lambda_{kk'} \mathbf{1}_{[S' > S]} \left[S(k,\varepsilon) + \theta\left(S(k', \varepsilon') - S(k, \varepsilon)\right)\right] dF(\varepsilon')$

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- **Next:** Measure effect of concentration on w and its components

Decomposition of wages

Isolate concentration: Fix $[z_1, \ldots, z_{10}]$, duplicate 10x, arrange into ten identical 10-firm markets, two identical 50-firm markets, one 100-firm market

- Same high/low z in each mkt., removes mechanical granularity/ladder height

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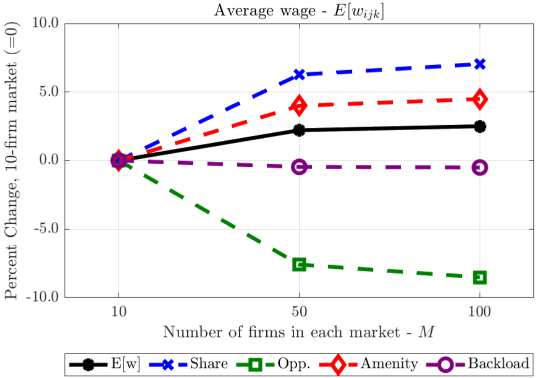

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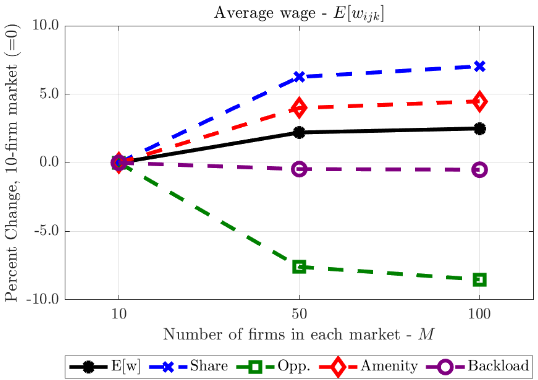
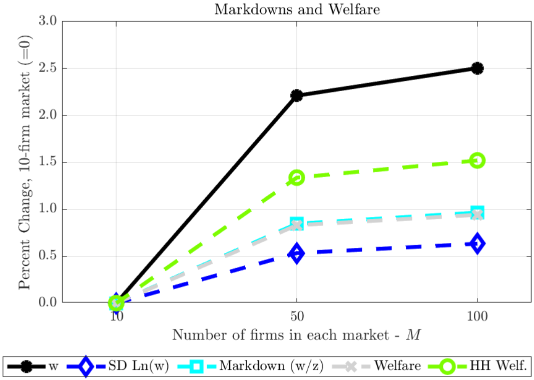


- Surplus share $\sigma \uparrow$ +5pp via comp., $\sigma z \uparrow$ +7pp as flow rates $\uparrow$ to high z's $\implies$ $(1-\sigma)b \downarrow$, $(1-\sigma)\epsilon$ less neg.
- Backloading increases, putting downward pressure on wages

Welfare and Inequality

Isolate concentration: Fix $[z_1, \ldots, z_{10}]$, duplicate 10x, rearrange into ten identical 10-firm markets, two identical 50-firm markets, one 100-firm market

- Same high/low z in each mkt., removes mechanical granularity/ladder height



- Welfare ↑ 1%, markdowns (:=w/z) improve (workers capture more of MRPL), wage inequality increases as markets become more competitive

Contact Rates

Isolate concentration: Fix $[z_1, \ldots, z_{10}]$, duplicate 10x, rearrange into ten identical 10-firm markets, two identical 50-firm markets, one 100-firm market

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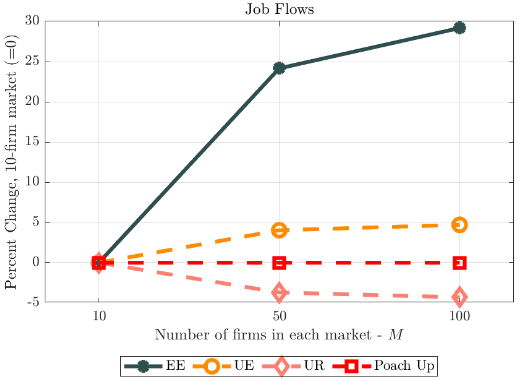

- EE rate increases (in levels 0.41%→0.53%), unemployment rate declines (in levels 4.55%→4.36%)

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- Next: competitive limits of agg. economy to measure importance of concentration v. neoclassical channels

Competitive Limits

Ideal experiments: (1) $M_j \to \infty$, (2) $\sigma_\epsilon = 0$, (3) $\xi_e \to 1$, $A \to \infty$, (5) $\theta \to 1$.

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Variable	**A.** Base, $M_j^{data} \leq 150$	**B.** $M_j = 200$	**C.** $\sigma_\epsilon = 0$	**D.** $\xi_e = 1$, $A = 1$	**E.** $\theta = 0.9$
HHI_n	0.13	0.07			
Markdown, Employment Wtd.	0.83	0.83			
EE Rate (%)	0.64	0.67			
Labor Productivity v. Baseline (%)	-	2.69			
Welfare v. Baseline (%)	-	1.69			
HH Welfare v. Baseline (%)	-	1.50			
Avg wage v. Baseline (%)	-	2.49			
SD Log wage v. Baseline (%)	-	1.72			

(B.) $Mj = 200$ does little to markdowns/flows, welfare and inequality increase +1.7pp

- Most populated markets already have $M_j = 150$ in Norway, very competitive

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HHI_n	0.13	0.07	0.41		
Markdown, Employment Wtd.	0.83	0.83	0.92		
EE Rate (%)	0.64	0.67	0.74		
Labor Productivity v. Baseline (%)	-	2.69	7.63		
Welfare v. Baseline (%)	-	1.69	-3.83		
HH Welfare v. Baseline (%)	-	1.50	-0.98		
Avg wage v. Baseline (%)	-	2.49	18.5		
SD Log wage v. Baseline (%)	-	1.72	-60.3		

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HHI_n	0.13	0.07	0.41	0.73	
Markdown, Employment Wtd.	0.83	0.83	0.92	0.93	
EE Rate (%)	0.64	0.67	0.74	1.19	
Labor Productivity v. Baseline (%)	-	2.69	7.63	10.0	
Welfare v. Baseline (%)	-	1.69	-3.83	12.2	
HH Welfare v. Baseline (%)	-	1.50	-0.98	16.4	
Avg wage v. Baseline (%)	-	2.49	18.5	22.0	
SD Log wage v. Baseline (%)	-	1.72	-60.3	-92.0	

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Variable	**A.** Base, $M_j^{data} \leq 150$	**B.** $M_j = 200$	**C.** $\sigma_\epsilon = 0$	**D.** $\xi_e = 1$, $A = 1$	**E.** $\theta = 0.9$
HHI_n	0.13	0.07	0.41	0.73	0.55
Markdown, Employment Wtd.	0.83	0.83	0.92	0.93	1.00
EE Rate (%)	0.64	0.67	0.74	1.19	0.78
Labor Productivity v. Baseline (%)	-	2.69	7.63	10.0	9.2
Welfare v. Baseline (%)	-	1.69	-3.83	12.2	13.1
HH Welfare v. Baseline (%)	-	1.50	-0.98	16.4	21.6
Avg wage v. Baseline (%)	-	2.49	18.5	22.0	29.6
SD Log wage v. Baseline (%)	-	1.72	-60.3	-92.0	-88.2

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- Most populated markets already have $M_j = 150$ in Norway, very competitive

(C.) Removing dispersion in amenities (holding mean fixed), markdowns $\downarrow$ 9pp

(D.) Less search frictions $\to\uparrow$ *HHI* as large firms siphon workers, markdowns $\downarrow$ 9pp

(E.) Increasing θ from 0.17 to 0.90 eliminates markdowns, major increase in *HHI*

Conclusion

Theory contribution: *PVR(C)+M+ε*

- GE theory w/ various sources of monopsony (concentration vs. search/neoclassical)
- By determining quantities and prices, useful for policy
- Tractable, easily estimated, reproduces key negative cov. b/w HHI's, job flows and wages

Empirical contribution:

- New clustering algorithm, establish benchmark set of HHI covariances and assess robustness to OVB using Oster (2016)

Quantative contribution:

- Halving HHI raises wages +2.5% (and inequality), welfare +1.7%, but no effect on markdowns/flows
- (Neoclassical) Amenities/Search frictions very important for markdowns

Policy analysis next...