Labor Market Power and Optimal Tax Progressivity

David Berger
Duke University

Kyle Herkenhoff
University of Minnesota

Jaehun Jeong
Duke University

Simon Mongey
Federal Reserve Bank of Minneapolis

The views expressed herein are those of the authors and not those of the Federal Reserve System.

Optimal taxes should take into account where people choose to work

- **Higher tax progressivity distorts numerous decisions**
  - How many hours to work?
  - How much to invest in human capital?
  - Which country or state to live in?
  - Which firm do you choose to work at?

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- **What do you need to know to answer optimal progressivity questions?**
  1. Elasticities - How elastic is labor supply *across firms*?
  2. Revenue - How much output is lost when supply *across firms* changes?

$$\frac{\partial \text{Revenue}^i}{\partial \text{Tax}^i} = \frac{\partial \text{Firm choice}^i}{\partial \text{Tax}^i} \times \frac{\partial \text{Revenue}^i}{\partial \text{Firm choice}^i} \tag{1}$$

  - This is complicated. Across workers, both of these pieces vary.

Necessary model features + Necessary data to discipline them

1. How much heterogeneity is there in firms & workers and complementarity between them?
   - Data - *Firm, worker effects and their covariance account for large parts of dispersion in wages*
2. How elastic is firm choice? For Low wage workers, High wage workers?
   - Data - *High wage workers are less elastic than Low wage workers*
3. How elastic is firm choice at Low productivity firms, High productivity firms?
   - Data - *High productivity firms face less elastic supply than Low productivity firms*
4. How do firms' wages respond to changes in taxes?
   - Fill this in with an equilibrium monopsony model. Validate against $dEarnings/dTaxes$.

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Result - *Higher progressivity distorts **Sorting** and **Wage setting**, on top of **Hours**. These additional distortions halve optimal tax progressivity, and halve the associated welfare gains.*

Environment

- Large number of labor markets indexed $m \in \{1, \ldots, M\}$
- Finite firms in each labor market indexed $j \in \{1, \ldots, J_m\}$
- Firms have heterogeneous productivity z_{jm}
- Measure $\overline{\Gamma}$ of workers indexed $i \in [0, \overline{\Gamma}]$
- Differ by skills $e^i \sim \Gamma(e)$ and tastes for firms ζ^i_{jm}
  - Distributed according to a *nested Gumbel distribution*. Two parameters:
  - η - How different are firms within markets
  - θ - How different are markets

Quantitative model - *Add heterogeneity in unearned income* a^i

Worker problem

- Worker i with skill e^i and tastes $\{\zeta^i_{jm}\}$ takes e-dependent wages w^e_{jm} as given
- Choose firm j, market m and hours h^i_{jm} subject to HSV taxes (τ_0, τ_1)

$$\max_{j,m} \quad \left\{ V^i_{jm} + \zeta^i_{jm} \right\}$$

$$V^i_{jm} = \max_{c^i_{jm}, h^i_{jm}} \frac{c^{i\,1-\sigma}_{jm}}{1-\sigma} - \frac{1}{\overline{\varphi}^{1/\varphi}} \frac{h^{i\,1+1/\varphi}_{jm}}{1+1/\varphi}$$

$$c^i_{jm} = \underbrace{\left(1-\tau_0\right)\left(w^e_{jm} h^i_{jm}\right)^{1-\tau_1}}_{\text{After-tax labor income:}=\tilde{y}^i_{jm}}$$

- Probability that a worker with skill e chooses firm j in market m: $\rho^e_{jm} = \rho^e_{j|m} \cdot \rho^e_m$

Quantitative model - *Add transfers T*

+ Full + Nesting + Choice probabilities

Firm problem

- Perfect substitutes across worker types (Costinot Vogel, 2010)
- Output per hour $A(z_{jm}, e)$ determined by worker and firm productivity
- Set wages by worker skill e, can't observe tastes ζ^i_{jm}

$$\max_{\{w^e_{jm}\}} \int_E \left(A^e_{jm} - w^e_{jm}\right) n^e_{jm}\, d\Gamma(e)$$

$$n^e_{jm} = \rho^e_{jm} h^e_{jm}$$

$$\rho^e_{jm} = \text{Extensive margin of labor supply}$$

$$h^e_{jm} = \text{Intensive margin of labor supply}$$

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- Example: $A^e_{jm} = z_{jm} e$ and *competitive wages*, then $w^e_{jm} = z_{jm} e$

Firm problem - Optimality

- Wages are variable markdown on MRPL

$$w_{jm}^e = \underbrace{\frac{\varepsilon_{jm}^e}{\varepsilon_{jm}^e + 1}}_{\text{Markdown}} A_{jm}^e \quad , \quad \varepsilon_{jm}^e = \left. \frac{\partial \log n_{jm}^e}{\partial \log w_{jm}^e} \right|_{\mathbf{w}_{-jm}^e} \quad , \quad n_{jm}^e = \rho_{jm}^e h_{jm}^e$$

- Elasticity ε_{jm}^e sums (a) Extensive margin $\varepsilon_{jm}^{\rho,e}$, (b) Intensive margin $\varepsilon_{jm}^{h,e}$

$$\varepsilon_{jm}^e = \varepsilon_{jm}^{\rho,e} + \varepsilon_{jm}^{h,e}$$

Labor supply elasticity - Extensive margin

$$\varepsilon^{\rho,e}_{jm} = \left.\frac{\partial \log \rho^e_{jm}}{\partial \log w^e_{jm}}\right|_{\mathbf{w}^e_{-jm}} = \underbrace{\left(\eta\left(1-\rho^e_{j|m}\right)+\ \theta\rho^e_{j|m}\right)}_{\text{Oligopsony}}\ \underbrace{u'\left(c^e_{jm}\right)\widetilde{y}^e_{jm}}_{\text{Wealth}}\ \underbrace{\left(1-\tau_1\right)}_{\text{Progressive tax}}$$

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✓ High skill workers less elastic $u'(\widetilde{y})\widetilde{y} = \widetilde{y}^{-(\sigma-1)}$

✗ Low skill workers more elastic → Sort into high wage jobs → Negative sorting.

Extend neoclassical labor supply model with few additional parameters

1. **Labor supply elasticities**
   - Across margins: Hours vs. Firms
   - Across workers: Low skill workers less elastic than High skill workers
   - Across firms: Productive firms have less elastic supply
2. **Allocation of workers across firms**
   - Heterogeneity in worker and firm productivity
   - Complementarities between workers and firms
   - Endogenous sorting
3. **Endogenous wages - Household labor supply elasticities show up in wages**
4. **Nest 'standard' neoclassical model where each of these elements is 'off'**
5. **These elements respond to taxes in equilibrium**

QUANTITATIVE

Calibration - Overview

Three facts identify key parameters:

σ - Fix firm type, labor supply of high-earnings workers *less elastic* (Seegmiller 2024, Bils et al 2025)

ψ - High-productivity workers sort into high-productivity firms (Bonhomme et al 2018, Kline et al 2020)

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+ Analytical expressions for sorting + Log additive

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- Matched through size-based market power

+ Analytical expressions for sorting + Log additive

Calibration

- Environment: Add unearned income a^i and lump sum T (Ferriere et al 2023)
- Workers: $\log e^i \sim N\left(-\frac{1}{2}\sigma_e^2, \sigma_e\right)$ to match $\mathbb{V}[\log c^i]$. Asset inc $a^i = r \cdot \textit{Wealth}$ from SCF.
- Firms: Technology $A\left(z_j, e^i\right) = z_j e^i \exp\left\{-\frac{\psi}{2}\left(\widetilde{z}_j - \widetilde{e}^i\right)^2\right\}$
- Pareto tail ξ_z and complementarity ψ match wage decomposition (Kline et al 2020):

$$\text{Shares:} \qquad \frac{\mathbb{V}\left[\text{Firm FE}_j\right]}{\mathbb{V}[\log w_j^i]} \quad , \quad \frac{\mathbb{C}\left[\text{Worker FE}^i, \text{Firm FE}_j\right]}{\mathbb{V}[\log w_j^i]}$$

- Markdowns: η, θ, σ match elasticity (i) level, (ii) x-firms, (iii) x-workers (Seegmiller 2024)
- MPE: φ to match earnings response to unearned income shocks (Golosov et al 2023)

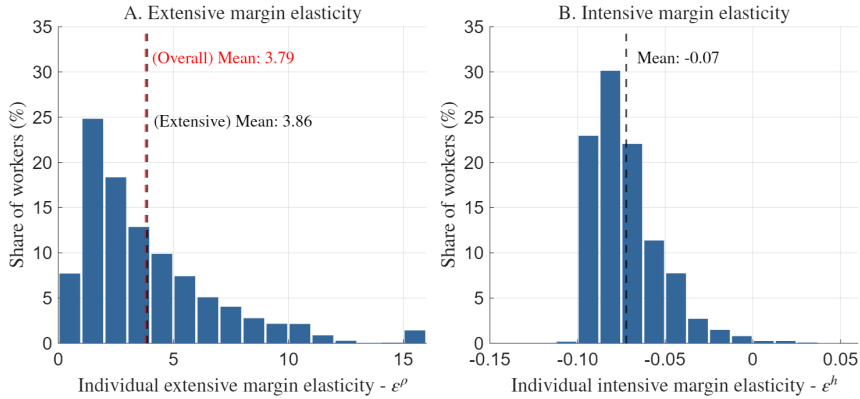
Calibration

Parameter		Value	Moment	Data	Model
Government transfer	T	\$2,251	Ferriere et al (2023)		
Tax function - Progressivity	τ_1	0.06	Ferriere et al (2023)		
Tax function - Shifter	τ_0	-0.35	Ratio: Income tax / Payroll	0.29	0.30
Productivity shifter	$\overline{Z}$	44.56	Average earnings	\$45,207	\$45,459
Labor disutility shifter	$\overline{\varphi}$	15,351	Average hours	1,777	1,785
Worker prod. dispersion	σ_e	0.73	Variance of log consumption	0.27	0.26
Firm prod. dispersion	σ_z	0.50	Share of log wage variance - Firm effects	0.13	0.12
Complementarity coefficient	ψ	0.09	Share of log wage variance - Covariance	0.16	0.16
			Share of log wage variance - Error$^+$	0.10	0.05
			Share of log wage variance - Worker effects$^+$	0.61	0.67
Within-market dispersion	η	2.35×10^7	Average elasticity*	5.34	4.73
Relative risk aversion	σ	2.48	Elasticity gap: Low - High wage workers*	5.69	5.90
Across-market dispersion	θ	$0.15 \times \eta$	Elasticity gap: Low - High wage firms*	1.69	1.71
Frisch elasticity	φ	0.09	MPE after \$7,500 windfall gain	-0.52	-0.52
Number of firms	J	16	HHI - Payroll	0.11	0.12

Note: $*$ denotes from Seegmiller (2024), $^+$ denotes non-targeted

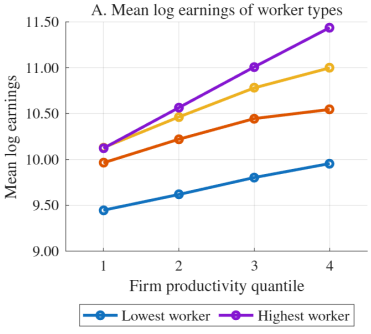
Seegmiller Replication

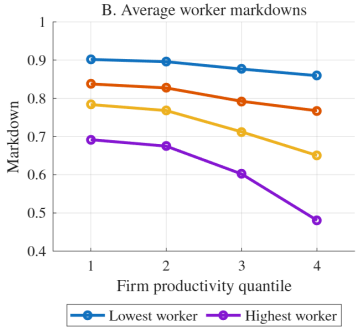
Labor supply elasticities determined by extensive margin

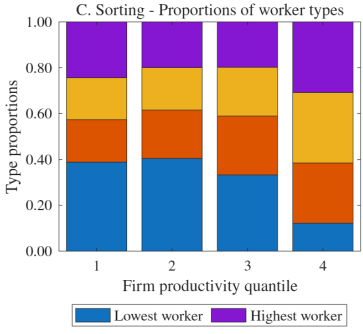


- Large values for extensive margin. Hours margin within range of CBO [-0.10, 0.20]
- Validate against ↑Downward EE moves following windfall gains (Golosov et al, 2023) S G

Firms and Workers in Equilibrium

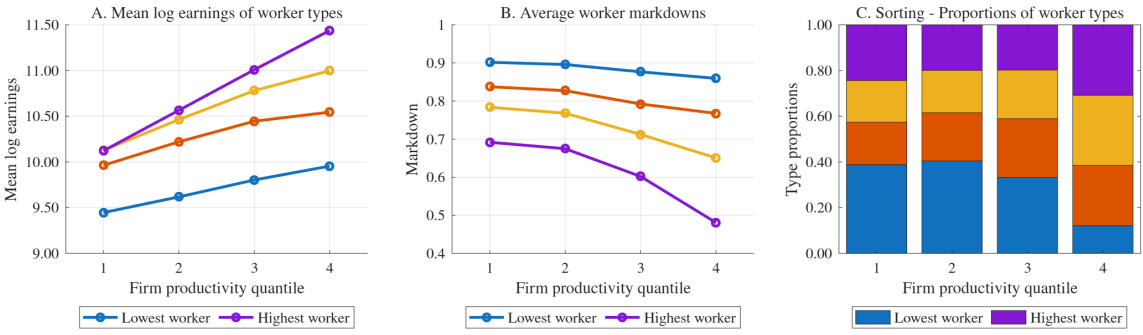






1. Positive sorting despite Wealth effects. Why? Comparative advantage
2. Log additivity despite Comparative advantage. Why? Markdowns widest at high e, high z

Firms and Workers in Equilibrium



1. Result - **89%** of gap across large vs. small firms due to worker heterogeneity
2. Result - Competitive wages yield (i) **2x** sorting, and (ii) **30%** more wage inequality

What are implications for tax policy?

Optimal taxes should take into account where workers work

1. **Theory** - Analytical results deliver two new distortions
   - Literature - Hours
   - Our paper - Sorting, Markdowns
2. **Positive** - These new distortions are large
   - Macro - They double the elasticity of $\downarrow$Output to $\uparrow$Taxes
   - Micro - Account for 80% of the large $\downarrow$Earnings^i response to $\uparrow$Taxes^i we see in the data
3. **Quantitative**
   - Optimal taxes - New distortions reduce optimal progressivity by one-third
   - Welfare - New distortions reduce welfare gains by more than 50 percent

What are implications for tax policy? **Theory**

Optimal progressivity in simplified environment

- Log utility $(\sigma = 1)$, No complementarity $(\psi = 0)$, Log normal z, No oligopsony $(J \to \infty)$
- Partial profit tax $\tau_\pi \in [0, 1]$

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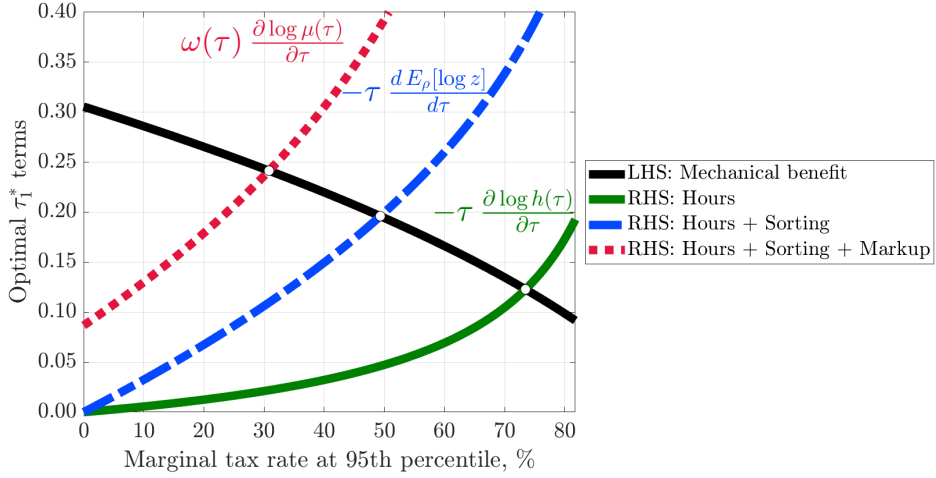
$$\underbrace{\left(1 - \tau_1^*\right)\left(\sigma_e^2 + \sigma_z^2\right)}_{\text{Mechanical revenue benefit}} = \underbrace{\tau_1^* \left(\frac{\varphi}{\varphi + 1}\right)\left(\frac{1}{1 - \tau_1^*}\right)}_{\text{Hours: } -\tau_1^* \partial \log h\left(\tau_1^*\right)/\partial\tau} + \underbrace{\tau_1^* \left(\eta \sigma_z^2\right)}_{\text{Sorting: } -\tau_1^* d\mathbb{E}_\rho\left[\log z_j\right]/d\tau_1^*} + \underbrace{\frac{(1 - \tau_\pi)\,\eta}{\left[\tau_\pi + \eta(1 - \tau_1^*)\right]\left[1 + \eta(1 - \tau_1^*)\right]}}_{\text{Leakage: } \omega(\tau_1^*)\partial \log \mu\left(\tau_1^*\right)/\partial\tau_1^*}$$

What are implications for tax policy? **Theory**



What are implications for tax policy? **Positive**

Are these distortions large?

1. Yes. They reduce TFP substantially
2. Yes. They are necessary for large ↓Earnings in response to ↑Taxes, consistent with data.

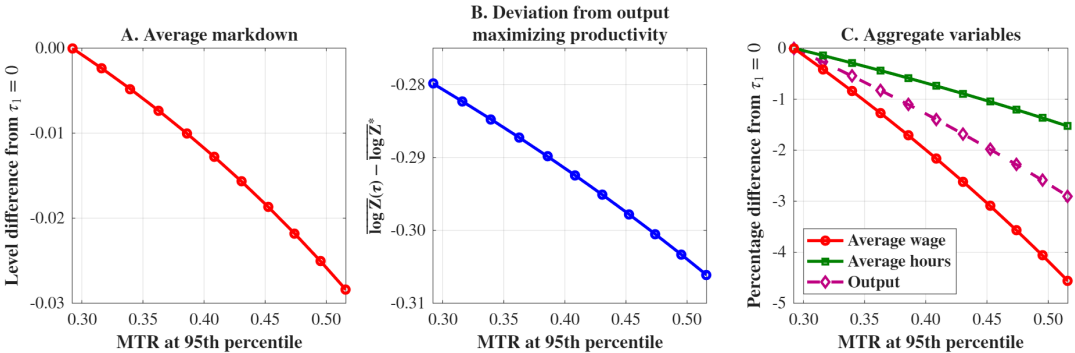
Exercise

- Vary $\tau_1 \in [0, 0.02, ..., 0.20]$
- Choose τ_0 to keep total taxes constant

$$c_{jm}^i = \Big(1 - \tau_0\Big)\Big(w_{jm}^i h_{jm}^i\Big)^{1-\tau_1} + T + a^i$$

- Plot outcomes against *Marginal tax rate (MTR) at p95 of income*

What are implications for tax policy? **Positive**



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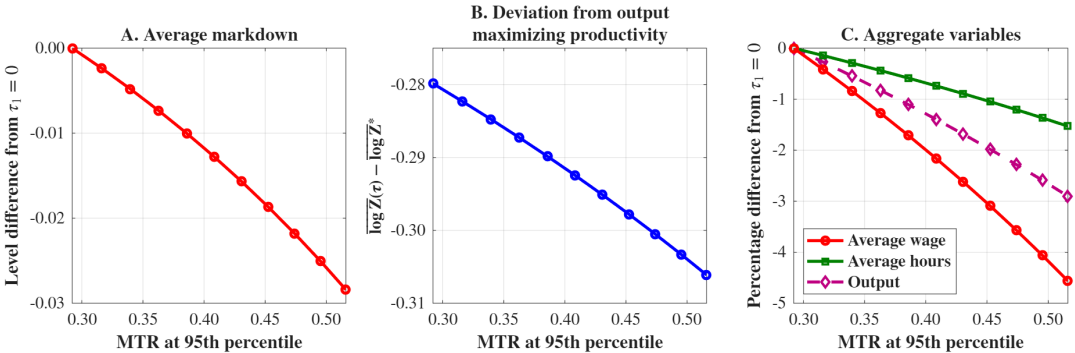

A. **Markdowns** - Exacerbates labor market power, widening ↓Markdowns 3 ppt

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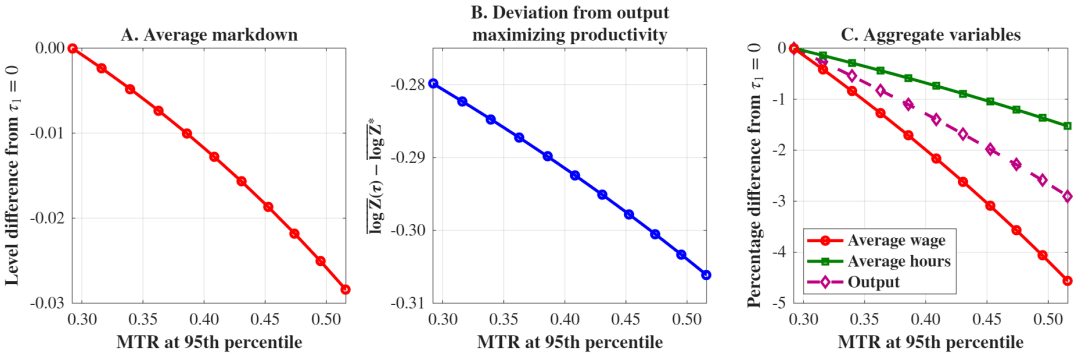

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B. **Sorting** - Moves economy further from output maximizing allocation $A(z^*(e), e)$

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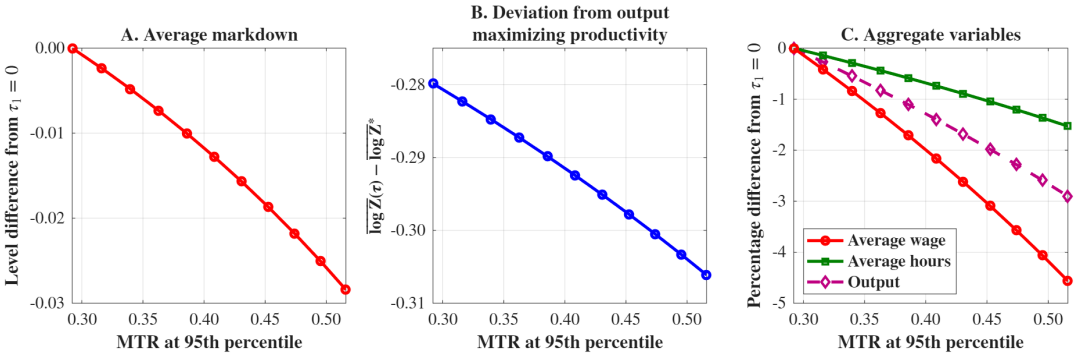

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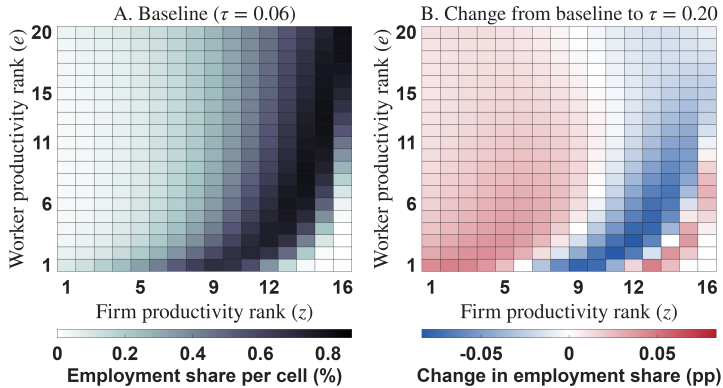

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Applied literature - *Elasticity of Taxable Income* (ETI) to marginal tax rate $\in \left[0.12\,,\ 0.40\right]$

Standard models - Can't generate large ETI with hours changes seen in data

	Homogenous firms	Heterogeneous firms		
		Hours only	+ Sorting	+ Markdown
	(1)	(2)	(3)	(4)
Elasticity of Taxable Income				
	0.07	0.05	0.16	0.24
Decomposition				
Hours	0.07	0.05	0.05	0.05
Sorting	—	—	0.10	0.07
Markdowns	—	—	—	0.12

What are implications for tax policy? **Quantitative**

	Hours only	+ **Sorting**	+ **Common markdown**	+ **Variable markdown**
	h_j^i, $\overline{\rho}_j^i$, $\overline{w}_j^i$	h_j^i, ρ_j^i, $\overline{w}_j^i$	$(1-\tau_1)u'(\overline{c}^i)\overline{y}^i$	$(1-\tau_1)u'(c^i)y^i$
	(1)	(2)	(3)	(4)
A. Optimal progressivity τ_1^*				
$\varphi = 0.09$				
$\varphi = 0.40$				
$\varphi = 0.80$				
B. Marginal tax rate at P95 income (%)				
$\varphi = 0.09$				
$\varphi = 0.40$				
$\varphi = 0.80$				
C. Consumption equivalent welfare gains (%)				
$\varphi = 0.09$				
$\varphi = 0.40$				
$\varphi = 0.80$				

Notes: For rows with alternative φ, shifter parameters $\overline{Z}$, $\overline{\varphi}$ and τ_0 are recalibrated under baseline $\tau_1 = 0.06$ to match mean hours, earnings and taxes, with all other parameters as in the baseline.

What are implications for tax policy? **Quantitative**

	Hours only	+ **Sorting**	+ **Common markdown**	+ **Variable markdown**
	h_j^i, $\overline{\rho}_j^i$, $\overline{w}_j^i$	h_j^i, ρ_j^i, $\overline{w}_j^i$	$(1-\tau_1)u'(\overline{c}^i)\overline{y}^i$	$(1-\tau_1)u'(c^i)y^i$
	(1)	(2)	(3)	(4)
A. Optimal progressivity τ_1^*				
$\varphi = 0.09$	0.71			
$\varphi = 0.40$	0.49			
$\varphi = 0.80$	0.37			
B. Marginal tax rate at P95 income (%)				
$\varphi = 0.09$	**88**			
$\varphi = 0.40$	74			
$\varphi = 0.80$	62			
C. Consumption equivalent welfare gains (%)				
$\varphi = 0.09$	**24.4**			
$\varphi = 0.40$	8.9			
$\varphi = 0.80$	3.8			

Notes: For rows with alternative φ, shifter parameters $\overline{Z}$, $\overline{\varphi}$ and τ_0 are recalibrated under baseline $\tau_1 = 0.06$ to match mean hours, earnings and taxes, with all other parameters as in the baseline.

What are implications for tax policy? **Quantitative**

	Hours only	+ **Sorting**	+ **Common markdown**	+ **Variable markdown**
	h_j^i, $\overline{\rho}_j^i$, $\overline{w}_j^i$	h_j^i, ρ_j^i, $\overline{w}_j^i$	$(1-\tau_1)u'(\overline{c}^i)\overline{y}^i$	$(1-\tau_1)u'(c^i)y^i$
	(1)	(2)	(3)	(4)
A. Optimal progressivity τ_1^*				
$\varphi = 0.09$	0.71	0.56		
$\varphi = 0.40$	0.49	0.41		
$\varphi = 0.80$	0.37	0.31		
B. Marginal tax rate at P95 income (%)				
$\varphi = 0.09$	**88**	78		
$\varphi = 0.40$	74	68		
$\varphi = 0.80$	62	60		
C. Consumption equivalent welfare gains (%)				
$\varphi = 0.09$	**24.4**	15.7		
$\varphi = 0.40$	8.9	6.1		
$\varphi = 0.80$	3.8	2.5		

Notes: For rows with alternative φ, shifter parameters $\overline{Z}$, $\overline{\varphi}$ and τ_0 are recalibrated under baseline $\tau_1 = 0.06$ to match mean hours, earnings and taxes, with all other parameters as in the baseline.

What are implications for tax policy? **Quantitative**

	Hours only	+ **Sorting**	+ **Common markdown**	+ **Variable markdown**
	h_j^i, $\overline{\rho}_j^i$, $\overline{w}_j^i$	h_j^i, ρ_j^i, $\overline{w}_j^i$	$(1-\tau_1)u'(\overline{c}^i)\overline{y}^i$	$(1-\tau_1)u'(c^i)y^i$
	(1)	(2)	(3)	(4)
A. Optimal progressivity τ_1^*				
$\varphi = 0.09$	0.71	0.56	0.35	
$\varphi = 0.40$	0.49	0.41	0.24	
$\varphi = 0.80$	0.37	0.31	0.16	
B. Marginal tax rate at P95 income (%)				
$\varphi = 0.09$	**88**	78	57	
$\varphi = 0.40$	74	68	46	
$\varphi = 0.80$	62	60	38	
C. Consumption equivalent welfare gains (%)				
$\varphi = 0.09$	**24.4**	15.7	7.0	
$\varphi = 0.40$	8.9	6.1	2.1	
$\varphi = 0.80$	3.8	2.5	0.5	

Notes: For rows with alternative φ, shifter parameters $\overline{Z}$, $\overline{\varphi}$ and τ_0 are recalibrated under baseline $\tau_1 = 0.06$ to match mean hours, earnings and taxes, with all other parameters as in the baseline.

What are implications for tax policy? **Quantitative**

	Hours only	+ **Sorting**	+ **Common markdown**	+ **Variable markdown**
	h_j^i, $\overline{\rho}_j^i$, $\overline{w}_j^i$	h_j^i, ρ_j^i, $\overline{w}_j^i$	$(1-\tau_1)u'(\overline{c}^i)\overline{y}^i$	$(1-\tau_1)u'(c^i)y^i$
	(1)	(2)	(3)	(4)
A. Optimal progressivity τ_1^*				
$\varphi = 0.09$	0.71	0.56	0.35	0.43
$\varphi = 0.40$	0.49	0.41	0.24	0.24
$\varphi = 0.80$	0.37	0.31	0.16	0.08
B. Marginal tax rate at P95 income (%)				
$\varphi = 0.09$	**88**	78	57	**68**
$\varphi = 0.40$	74	68	46	49
$\varphi = 0.80$	62	60	38	34
C. Consumption equivalent welfare gains (%)				
$\varphi = 0.09$	**24.4**	15.7	7.0	**7.9**
$\varphi = 0.40$	8.9	6.1	2.1	1.3
$\varphi = 0.80$	3.8	2.5	0.5	0.0

Notes: For rows with alternative φ, shifter parameters $\overline{Z}$, $\overline{\varphi}$ and τ_0 are recalibrated under baseline $\tau_1 = 0.06$ to match mean hours, earnings and taxes, with all other parameters as in the baseline.

What are implications for tax policy? **No transfer,** $\tau_1 = 0.18$

	Hours only	+ **Sorting**	+ **Common markdown**	+ **Variable markdown**
	h_j^i, $\overline{\rho}_j^i$, $\overline{w}_j^i$	h_j^i, ρ_j^i, $\overline{w}_j^i$	$(1-\tau_1)u'(\overline{c}^i)\overline{y}^i$	$(1-\tau_1)u'(c^i)y^i$
	(1)	(2)	(3)	(4)
A. Optimal progressivity τ_1^*				
$\varphi = 0.15$	0.70	0.59		0.46
$\varphi = 0.40$	0.56	0.49		0.33
$\varphi = 0.80$	0.45	0.40		0.18
B. Marginal tax rate at P95 income (%)				
$\varphi = 0.15$	**87**	81		**69**
$\varphi = 0.40$	76	72		55
$\varphi = 0.80$	66	66		41
C. Consumption equivalent welfare gains (%)				
$\varphi = 0.15$	**21.1**	13.9		**6.0**
$\varphi = 0.40$	9.7	6.7		1.3
$\varphi = 0.80$	4.2	2.8		0.0

Notes: Table C3 (No transfer calibation, $\tau_1 = 0.18$)

What are implications for tax policy? **Zero profit tax**

	Hours only	+ Sorting	+ Common markdown	+ Variable markdown
	h_j^i, $\overline{\rho}_j^i$, $\overline{w}_j^i$	h_j^i, ρ_j^i, $\overline{w}_j^i$	$(1-\tau_1)u'(\overline{c}^i)\overline{y}^i$	$(1-\tau_1)u'(c^i)y^i$
	(1)	(2)	(3)	(4)
A. Optimal progressivity τ_1^*				
$\varphi = 0.09$	0.71	0.56	0.18	0.38
$\varphi = 0.40$	0.49	0.41	0.07	0.27
$\varphi = 0.80$	0.37	0.31	0.00	0.17
B. Marginal tax rate at P95 income (%)				
$\varphi = 0.09$	**88**	78	46	**65**
$\varphi = 0.40$	74	68	29	53
$\varphi = 0.80$	62	60	29	41
C. Consumption equivalent welfare gains (%)				
$\varphi = 0.09$	**24.4**	15.7	1.4	**5.9**
$\varphi = 0.40$	8.9	6.1	0.0	1.8
$\varphi = 0.80$	3.8	2.5	0.4	0.4

Notes: Baseline results with zero corporate profit tax

What are implications for tax policy? **Log model**

	Hours only	+ Sorting	+ Common markdown	+ Variable markdown
	h_j^i, $\overline{\rho}_j^i$, $\overline{w}_j^i$	h_j^i, ρ_j^i, $\overline{w}_j^i$	$(1-\tau_1)u'(\overline{c}^i)\overline{y}^i$	$(1-\tau_1)u'(c^i)y^i$
	(1)	(2)	(3)	(4)
A. Optimal progressivity τ_1^*				
$\varphi = 0.09$	0.46	0.26	0.07	0.07
$\varphi = 0.40$	0.18	0.10	0.00	0.00
$\varphi = 0.80$	0.08	0.02	0.00	0.00
B. Marginal tax rate at P95 income (%)				
$\varphi = 0.09$	**69**	50	29	**30**
$\varphi = 0.40$	44	39	29	29
$\varphi = 0.80$	32	23	28	28
C. Consumption equivalent welfare gains (%)				
$\varphi = 0.09$	**4.4**	1.4	0.0	**0.0**
$\varphi = 0.40$	0.6	0.1	1.0	1.0
$\varphi = 0.80$	0.0	0.1	1.9	1.9

Notes: Log utility + zero non-labor income

Conclusion

New framework

- Heterogeneous workers with neoclassic labor supply in workhorse monopsony model
- Generates empirical patterns of worker sorting based on marginal value of job
- Big picture point: Treats $\uparrow \tau$ as a *rotation* instead of *shift*, yields $\downarrow w$, $\downarrow n$

Quantitative results

1. Tax progressivity amplifies monopsony power & reduces productivity via sorting
2. These two effects reduce optimal tax progressivity by a third
3. Heterogeneity accounts for 78% of overall markdown, 89% of markdown dispersion
4. Firms are an important determinant of wage inequality, compressing it by 20%

Additional questions

1. What drives markdowns?

2. What is the role of firms' wage setting power in wage inequality?

1. What drives markdowns?

- **State of literature**
  - Data: Reduced form dependence of μ_j^i on limited firm / worker traits
  - Models: Markdowns all from oligopsony or worker heterogeneity
- **Our model** - Nest oligopsony and heterogeneity channels
- **Counterfactual** - Remove one by one from both elasticities

$$\varepsilon_j^{\rho,i} = \underbrace{\left(1-\tau_1\right)}_{\text{(1) Tax progressivity}} \underbrace{\left[1-\rho_j^i\left(\frac{\eta-\theta}{\eta}\right)\right]}_{\text{(2) Oligopsony}} \underbrace{u'\left(c_j^i\right)\tilde{y}_j^i}_{\text{(3) Heterogeneity}} \underbrace{\eta}_{\text{(4) Monopsony}}$$

1. What drives markdowns? - In the aggregate

$$\varepsilon_j^{\rho,i} = \underbrace{\left(1-\tau_1\right)}_{\text{(1) Tax progressivity}} \underbrace{\left[1-\rho_j^i\left(\frac{\eta-\theta}{\eta}\right)\right]}_{\text{(2) Oligopsony}} \underbrace{u'\left(c_j^i\right)\widetilde{y}_j^i}_{\text{(3) Heterogeneity}} \underbrace{\eta}_{\text{(4) Monopsony}}$$

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Source of markdowns removed	**Markdown** $(1-\mu)$ (1)	**Share (%)** (2)
Baseline	0.35	—
1. No tax progressivity - $\tau_1 = 0$	0.34	3.6
2. No oligopsony power - $\theta = \eta$	0.32	6.7
3. No within-worker across-firm differences - $u'(c_j^i)\widetilde{y}_j^i = \mathbb{E}\left[u'(c_k^i)\widetilde{y}_k^i \middle| i\right]$	0.30	6.0
4. No across-worker differences - $u'(c_j^i)\widetilde{y}_j^i = \mathbb{E}\left[u'(c_k^i)\widetilde{y}_k^i\right]$	0.18	31.5
5. No monopsony $\eta = \infty$	0.00	52.2

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4. No across-worker differences - $u'(c_j^i)\widetilde{y}_j^i = \mathbb{E}\left[u'(c_k^i)\widetilde{y}_k^i\right]$	0.18	31.5
5. No monopsony $\eta = \infty$	0.00	52.2

- **Result 1** - 50% of markdowns variable & respond to policy. Worker traits matter most.

1. What drives markdowns? - Across firms

- Aggregate $\varepsilon_j^{\rho,i}$ to firm
- Decompose across firm productivity

$$\varepsilon_j^{\rho,i} = \eta\left(1-\tau_1\right) \underbrace{\left[1-\rho_j^i\left(\frac{\eta-\theta}{\eta}\right)\right]}_{\text{Oligopsony}} \underbrace{u'\left(c_j^i\right)\widetilde{y}_j^i}_{\text{Heterogeneity}}$$

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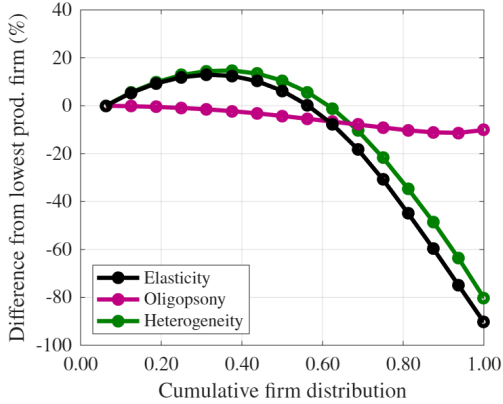

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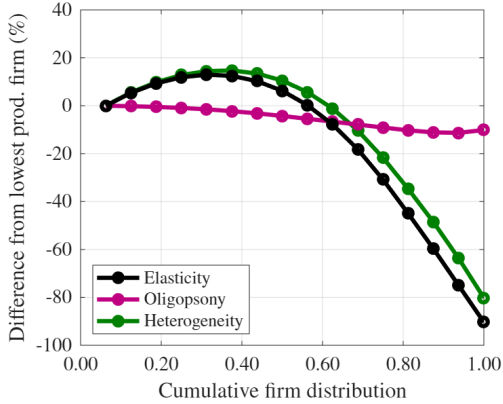
- **Result 2** - 89% of gap across large v. small firms driven by worker traits



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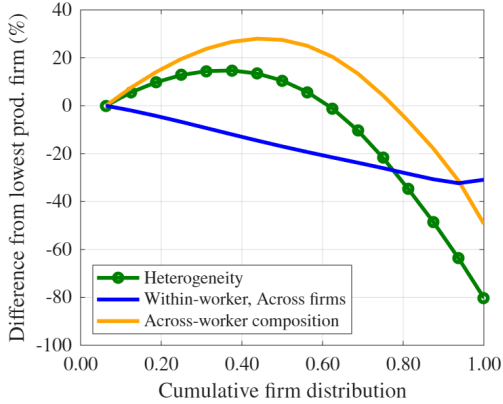

2. What is the role of firms in wage inequality?

2. What is the role of firms in wage inequality?

- **State of literature** - Based on reduced form evidence, firms are not that important
  - Small role for firms in AKM-style decompositions (which model matches)
- **Our model** - Wider markdowns at high wage firms compress high wages.
  - Removing their role in wage setting will increase inequality
- **Counterfactual** - Remove firms from wage setting, compute competitive equilibrium

$$w_{jm}^e = \mu_{jm}^e A_{jm}^e \quad , \quad \mu_{jm}^e = 1$$

2. What is the role of firms in wage inequality?

	Baseline (1)	**Competitive** (2)
Inequality [std. dev. of log]		
Hourly wage	0.60	0.77
Earnings	0.60	0.77
Consumption	0.51	0.65
Variance of log wages		
Overall	0.36	0.59
Across firms	0.13	0.20
Within firms	0.23	0.40
Other measures		
$2 \times$ Covariance (Sorting)	0.059	**0.083**

- **Result 3** - Firm wage setting compresses wage inequality 22%, x-firm difference 35%

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Other measures		
$2 \times$ Covariance (Sorting)	0.059	**0.083**

- **Result 3** - Firm wage setting compresses wage inequality 22%, x-firm difference 35%
- Competitive allocation is much **more assortative**. Tax progressivity will do the *opposite*

APPENDIX SLIDES

Full model - Non-labor income, transfers and taxes

- Budget - add non-labor income a^i and transfers T; distribution becomes $\Gamma(a, e)$

$$c^i_{jm} = \underbrace{\left(1-\tau_0\right)\left(w^e_{jm}h^i_{jm}\right)^{1-\tau_1}}_{\widetilde{y}^i_{jm}} + T + a^i$$

- Firm - sets w^e_{jm} by skill e, averages over a within e

$$H^e_{jm} = \int_A \rho^i_{jm} h^i_{jm}\, d\Gamma(a^i|e) \quad , \quad \varepsilon^e_{jm} = \int_A \frac{\rho^i_{jm} h^i_{jm}}{H^e_{jm}} \left[\varepsilon^{\rho,i}_{jm} + \varepsilon^{h,i}_{jm}\right] d\Gamma(a^i|e)$$

- Extensive margin

$$\varepsilon^{\rho,i}_{jm} = \left[\eta\left(1-\rho^i_{j|m}\right) + \theta\rho^i_{j|m}\right] u'\left(\widetilde{y}^i_{jm} + a^i + T\right)\widetilde{y}^i_{jm}\left(1-\tau_1\right)$$

- Intensive margin

$$\varepsilon^{h,i}_{jm} = \frac{\left(1-\sigma MPC^i_{jm}\right)\left(1-\tau_1\right)}{\left(1+1/\varphi\right) - \left(1-\sigma MPC^i_{jm}\right)\left(1-\tau_1\right)} \quad , \quad MPC^i_{jm} = \frac{\widetilde{y}^i_{jm}}{\widetilde{y}^i_{jm} + a^i + T}$$

- Setting $a^i = T = 0$ (so $MPC^i_{jm} = 1$) returns the model in the main slides Back

Tax progressivity in simplified BHM economy (BHMM, AEA P&P, 2024)

- Household

$$\max_{C,\{n_j\}} \quad \log\left(C - \frac{\mathcal{N}^{1+1/\varphi}}{1+1/\varphi}\right) \quad , \quad \mathcal{N} = \left[\int n_j^{\frac{\eta+1}{\eta}} dj\right]^{\frac{\eta}{\eta+1}}$$

$$\text{subject to} \quad C = \sum_j \left(1-\tau_0\right)\left(w_j\right)^{1-\tau_1} n_j + \Pi$$

Tax progressivity in simplified BHM economy (BHMM, AEA P&P, 2024)

- Household

$$\max_{C,\{n_j\}} \quad \log\left(C - \frac{\mathcal{N}^{1+1/\varphi}}{1+1/\varphi}\right) \quad , \quad \mathcal{N} = \left[\int n_j^{\frac{\eta+1}{\eta}} dj\right]^{\frac{\eta}{\eta+1}}$$

$$\text{subject to} \quad C = \sum_j \Big(1-\tau_0\Big)\Big(w_j\Big)^{1-\tau_1} n_j + \Pi$$

- Firm

$$\pi_j = Z n_j - w_j n(w_j) \quad , \quad n_j = \left(\frac{w_j}{\mathcal{W}}\right)^{\varepsilon} \mathcal{N} \quad , \quad w_j = \frac{\varepsilon}{\varepsilon+1} Z \quad , \quad \varepsilon = \Big(1-\tau_1\Big)\eta$$

Tax progressivity in simplified BHM economy (BHMM, AEA P&P, 2024)

- Household

$$\max_{C,\{n_j\}} \quad \log\left(C - \frac{\mathcal{N}^{1+1/\varphi}}{1+1/\varphi}\right) \quad , \quad \mathcal{N} = \left[\int n_j^{\frac{\eta+1}{\eta}} dj\right]^{\frac{\eta}{\eta+1}}$$

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- Firm

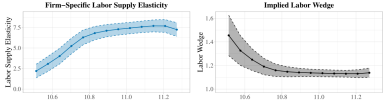
$$\pi_j = Z n_j - w_j n(w_j) \quad , \quad n_j = \left(\frac{w_j}{\mathcal{W}}\right)^{\varepsilon} \mathcal{N} \quad , \quad w_j = \frac{\varepsilon}{\varepsilon+1} Z \quad , \quad \varepsilon = \left(1-\tau_1\right)\eta$$

∗ Additional distortion of progressive taxes

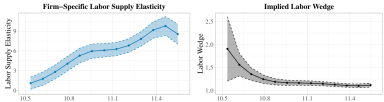
$$\mu = \frac{\left(1-\tau_1\right)\eta}{\left(1-\tau_1\right)\eta+1} \quad , \quad Y = \underbrace{\left[\frac{(1-\tau_1)\,\eta}{(1-\tau_1)\,\eta+1}\right]^{\varphi(1-\tau_1)}}_{\text{Monopsony term}} \times \underbrace{\left[\left(1-\tau_0\right)^{\varphi} Z^{1+\varphi(1-\tau_1)}\right]}_{\text{Competitive distortion, } W=Z}$$

Volpe 2024

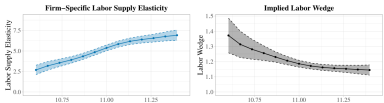
Figure 4: IV Estimates of Labor Supply Elasticities and Labor Wedges



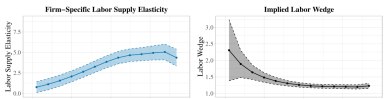
(a) No College Degree, < 10 Years Experience



(b) College Graduate, < 10 Years Experience



(c) No College Degree, ≥ 10 Years Experience



(d) College Graduate, ≥ 10 Years Experience

Validation - Firm labor supply elasticities by worker-firm

	A. Data - Seegmiller (2025)		**B. Model**	
	Low z	High z	Low z	High z
Low skill workers	8.44	5.72	8.96	6.38
High skill workers	1.72	1.07	2.19	1.36

- Elasticities falling within-worker-type, across-firms
  1. Less elastic at higher wages, higher consumption
  2. Larger firms have more 'size-based' market power
     - Contra Volpe (2024): Within-type, elasticities higher at higher productivity firms
- Elasticities falling within-firm, across-worker-types
  - Higher consumption workers, less elastic Back to elasticity dist

Calibration - Kline et al (2020)

Data

- Log earnings variance decomposition

$$\log y_j^i = \alpha^i + \psi_j + \varepsilon_j^i$$

- We're not interested in whether the assumptions of AKM are met, all we want is to replicate the empirical setting and estimate reduced form
- Shares - Variance α (0.61), Variance ψ (0.13), Covariance α , ψ (0.16), Variance ε (0.10)

Model

- 100 periods, 100,000 workers, drawn from $\Gamma(a, e)$
- Reallocate workers each period across firms according to ρ_j^i
- Use KSS Matlab code on log earnings panel

Back to calibration

1. What Drives Markdowns?

$$\varepsilon_j^{\rho,i} = \underbrace{\left(1-\tau_1\right)}_{\text{(1) Tax progressivity}} \underbrace{\left[1-\rho_j^i\left(\frac{\eta-\theta}{\eta}\right)\right]}_{\text{(2) Oligopsony}} \underbrace{u'\left(c_j^i\right)\widetilde{y}_j^i}_{\text{(3) Heterogeneity}} \underbrace{\eta}_{\text{(4) Monopsony}} \tag{2}$$

$$\varepsilon_j^{h,i} = \frac{\overbrace{\left(1-\tau_1\right)}^{\text{(1) Tax progressivity}} \overbrace{\left(1-\sigma MPC_j^i\right)}^{\text{(3) Heterogeneity}}}{\left(1+\frac{1}{\varphi}\right) - \underbrace{\left(1-\tau_1\right)}_{\text{(1) Tax progressivity}} \underbrace{\left(1-\sigma MPC_j^i\right)}_{\text{(3) Heterogeneity}}}. \tag{3}$$

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Back

Cardinality of preferences:

- The relative scale of $u'(c)$ and η is not identified from elasticities $(u'(c)\eta)$
- Resolve with quasi-linear outside good c_0^i at price p_0

$$V_{jm}^i + \zeta_{jm}^i = \frac{c_{jm}^{i\,1-\sigma}}{1-\sigma} + c_0^i - \frac{1}{\overline{\varphi}^{1/\varphi}} \frac{h_{jm}^{i\,1+1/\varphi}}{1+1/\varphi} + \zeta_{jm}^i.$$

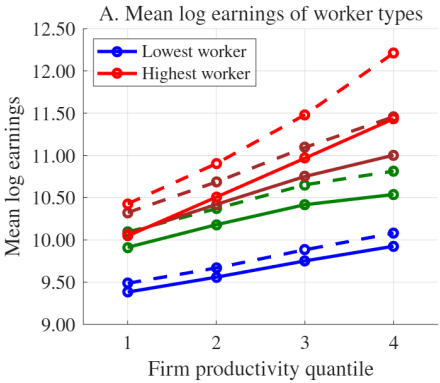
Cross-worker and cross-firm:

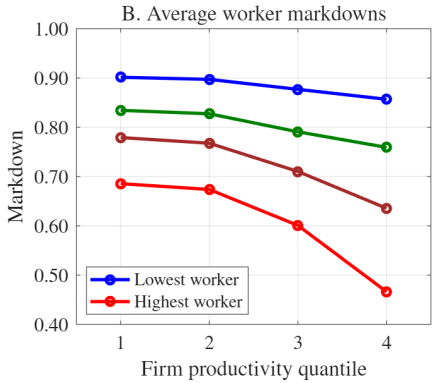
- The most variable markdowns are driven by worker heterogeneity is a *cross-worker variation* in $\log \varepsilon^\rho$, not of its level.
- Under $u \mapsto au,\ \eta \mapsto \eta/a$,

$$\log \varepsilon^\rho = \log(1-\tau_1) + \log\left[1 - \rho\tfrac{\eta-\theta}{\eta}\right] + \log\left(a\,u'(c)\widetilde{y}\right) + \log(\eta/a),$$

- and the two $\log a$ terms cancel

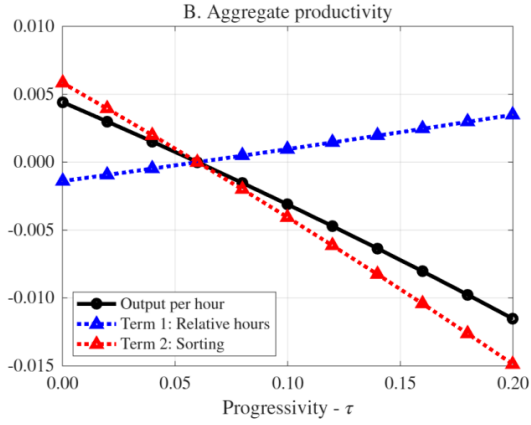
1. Why do markdowns vary across firms?





- Most variation in markdowns is across workers, especially at the top
- Sorting implies that more High wage workers are at top firms Back

What are implications for tax policy?



- **Result 4** - TFP losses are due to distorting incentives *across* firms

Worker problem - Preferences

- Standard preferences in labor economics

$$V_{jm}^{i} + \zeta_{jm}^{i} = \frac{{c_{jm}^{i}}^{1-\sigma}}{1-\sigma} - \frac{1}{\overline{\varphi}^{1/\varphi}} \frac{{h_{jm}^{i}}^{1+1/\varphi}}{1+1/\varphi} + \zeta_{jm}^{i}.$$

Worker problem - Preferences

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- Lamadon, Mogstad, Setzler (AER, 2022) $\approx$
  - Log utility $(\sigma = 1)$, No hours margin $h_{jmt}^i = 1$, Monopsony $J_m \to \infty$
- Volpe (2024) $\approx$
  - Adds exogenous variation in wage sensitivities $\beta^i \log w_{jm}^i$
- Berger, Herkenhoff, Mongey (AER, 2022) $\approx$
  - No worker heterogeneity, Log utility $(\sigma = 1)$, No hours margin $h_{jmt}^i = 1$ Back

Labor supply elasticity - Extensive margin

$$\rho^i_{jm} = \underbrace{\left(\frac{v^i_{jm}}{\widetilde{v}^i_m}\right)^{\eta}}_{\text{Cond'l choice: } \rho^i_{j|m}} \left(\frac{\widetilde{v}^i_m}{\overline{v}^i}\right)^{\theta}, \quad \widetilde{v}^i_m = \left[\sum_{j\in m}\left(v^i_{jm}\right)^{\eta}\right]^{1/\eta}, \quad \overline{v}^i = \left[\sum_m \left(\widetilde{v}^i_m\right)^{\theta} dm\right]^{1/\theta}, \quad v^i_{jm} = e^{V^i_{jm}}.$$

$$\varepsilon^{\rho,i}_{jm} = \frac{\partial \log \rho^i_{jm}}{\partial \log v^i_{jm}} \frac{\partial \log v^i_{jm}}{\partial \log w^i_{jm}}$$

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$$\varepsilon^{\rho,i}_{jm} = \underbrace{\left(\eta\left(1-\rho^i_{j|m}\right)+\theta\rho^i_{j|m}\right)}_{\text{Oligopsony}} \underbrace{\lambda^i_{jm}\widetilde{y}^i_{jm}}_{\text{Wealth}} \underbrace{\left(1-\tau_1\right)}_{\text{Progressive tax}}$$

Labor supply elasticity - Extensive margin

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1. Preferences more dispersed $\downarrow \eta$, Less elastic

Labor supply elasticity - Extensive margin

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2. Larger firm in the market $\uparrow \rho^i_{j|m}$, $\downarrow \theta$, Less elastic

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1. Preferences more dispersed $\downarrow \eta$, Less elastic
2. Larger firm in the market $\uparrow \rho^i_{j|m}$, $\downarrow \theta$, Less elastic
3. Richer households $\downarrow \lambda^i_{jm}$, Higher marginal value of a dollar, Less elastic

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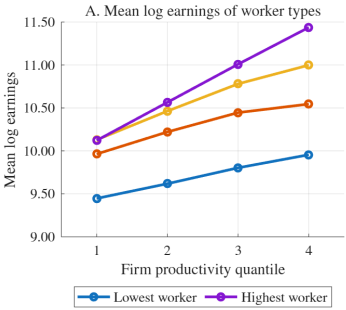
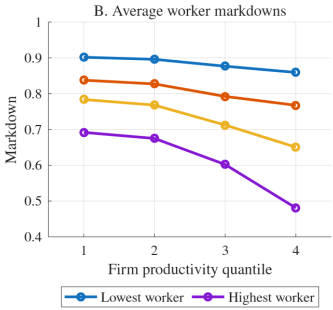
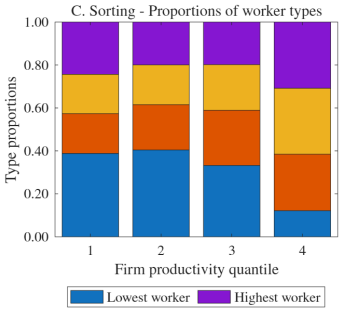
4. Higher earning $\uparrow \widetilde{y}^i_j$, More at stake, More elastic
5. Higher progressivity $\uparrow \tau_1$, Competitor's higher offer is taxed away, Less elastic

Sorting







- Comparative advantage generates right sorting patterns despite wealth effects
- Log additivity of wages comes via the market power at high-wage firms

Back ID Back elast dist

Sorting

- Worker skill: $e^H > e^L$
- Firm productivity: $z_1 > z_2$
- Budget constraint: $c_j^i = y_j^i = w_j^i h_j^i$.
- Extensive margin elasticity

$$\varepsilon_j^{\rho,e} = \left(\eta(1-\rho_j^e) + \theta\rho_j^e\right) y_j^{e\,-(\sigma-1)}$$

- Complementarities in production

$$y_j = A_j^H \rho_j^H h_j^H + A_j^L \rho_j^L h_j^L \quad , \quad \underbrace{A_j^e = z_j e \exp\left\{-\frac{\psi}{2}\left(\widetilde{z}_j - \widetilde{e}\right)^2\right\}}_{\psi=0 \;\Leftrightarrow\; A_j^e = z_j e}$$

Back

Sorting

- Definition: x is *log super-modular* if σ_x is positive, where σ_x is

$$\sigma_x = \underbrace{\left[\log x_1^H + \log x_2^L\right]}_{\text{Pair likes}} - \underbrace{\left[\log x_2^H + \log x_1^L\right]}_{\text{Pair \textbf{dis}likes}}$$

- Applied to production technology A_j^i

$$\sigma_A = \psi\left(\widetilde{z}_1 - \widetilde{z}_2\right)\left(\widetilde{e}^H - \widetilde{e}^L\right)$$

Sorting

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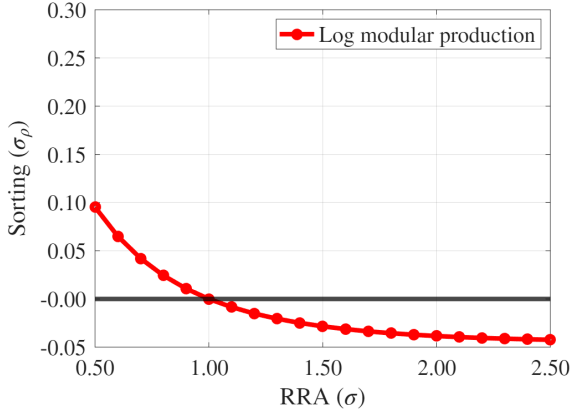
$$\sigma_A = \psi\left(\widetilde{z}_1 - \widetilde{z}_2\right)\left(\widetilde{e}^H - \widetilde{e}^L\right)$$

- Applied to choice probability ρ_j^e

$$\sigma_\rho = \eta\left[\left(V_1^H - V_1^L\right) - \left(V_2^H - V_2^L\right)\right]$$

$$\frac{\sigma_\rho}{\eta} \approx \underbrace{\sigma_A\, u'\left(c_2^L\right) c_2^L}_{\text{Technological comp.}} + \underbrace{-\left(\sigma - 1\right) u'\left(c_1^L\right)\left(y_1^L - y_2^L\right) \Delta\log y_1}_{\text{Wealth effects}} \quad , \quad \Delta\log y_1 = \frac{y_1^H - y_2^H}{y_2^H}.$$

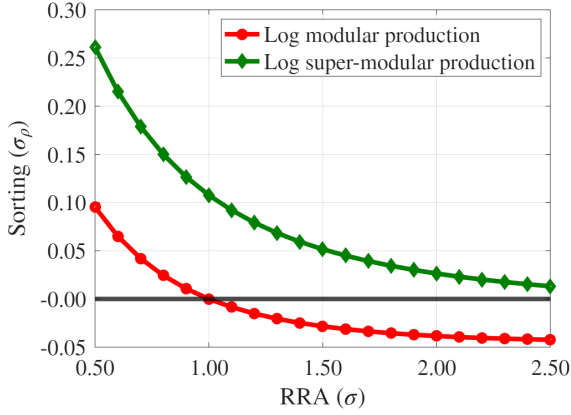
Sorting



- With no complementarities $(\psi = 0)$, sorting is negative if $\sigma > 1$

Back

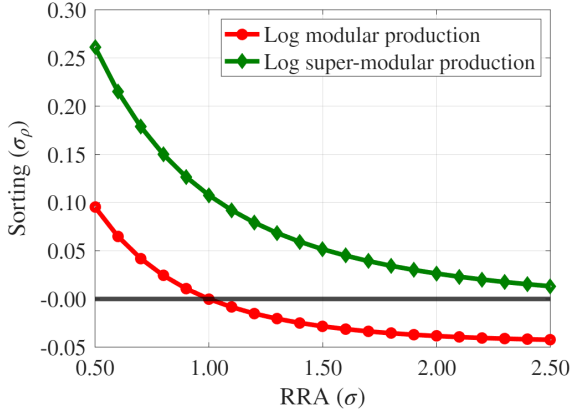
Sorting



- With complementarities $(\psi > 0)$, sorting can be positive if $\sigma > 1$

Back

Sorting



- **Data** - Lower elasticities of high wage workers $(\sigma > 1)$ plus positive sorting $(\sigma_\rho > 0)$ will point to complementarities $(\psi > 0)$

Back

Calibration - Seegmiller (2024)

Data

- Links U.S. Census LEHD to idiosyncratic stock returns / patenting
- Estimates the impact on VAPW, average earnings and employment
- Uses these to compute total reduced form labor supply elasticity by:
  - Worker quintile (AKM FEs) - Falls by 5.7 from low to high earning
  - Firm quintile (VAPW) - Falls by 1.7 from low to high paying
  - Average implies average elasticity of 5.34

Model

- Shock z_j to match first-stage impact on wages
- Identifies risk aversion σ, within-market elasticity η, across-market elasticity θ

Kline et al Replication | Back to calibration

Validation - Responses to unearned income

- Golosov et al (2023) measure earnings and job switching response to windfall earnings

	A. MPE (*=targeted)			B. Δ Pr(down | move)		
Earnings quartile	All	Low	High	All	Low	High
Data	-0.52*	-0.31	-0.67	7.0	6.0	3.2
Model	-0.52*	-0.26	-0.78	9.1	8.7	6.8

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- Intensive margin elasticities are small due to the low Frisch elasticity

  $\Rightarrow$ the level and gradient of MPEs delivered by job switching

- High earners have lower probability of move to lower wage firm

  ... but larger earnings drops when they move (larger MPE) Back

Labor supply elasticity - Intensive margin

$$\varepsilon_{jm}^{h,i} = \frac{\partial \log h_{jm}^{i}}{\partial \log w_{jm}^{i}} = \frac{\left(1-\sigma\right)\left(1-\tau_1\right)}{\left(1+1/\varphi\right)-\left(1-\sigma\right)\left(1-\tau_1\right)}$$

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- Progressivity - More progressivity $\uparrow \tau_1$, Additional hour taxed more, Less elastic

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- Progressivity - More progressivity $\uparrow \tau_1$, Additional hour taxed more, Less elastic
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We estimate intensive margin to be small (focus on extensive) Back

What are implications for tax policy?

- Output

$$Y = \sum_k \rho(k) h(k) A(k) \Gamma(k)$$

- Labor productivity (TFP)

$$\widehat{\left(\frac{Y}{H}\right)} = \underbrace{\sum_k \omega(k)\left[\widehat{h}(k) - \widehat{H}\right]}_{\text{1. Relative hours (intensive margin)}} + \underbrace{\sum_k \omega(k)\widehat{\rho}(k)}_{\text{2. Sorting (extensive margin)}} + \underbrace{\sum_k \omega(k)\widehat{h}(k)\widehat{\rho}(k)}_{\text{3. Interaction}} \quad , \quad \underbrace{\omega(k) = \frac{y(k)}{Y}}_{\text{Output share}}$$

- **Standard theory** - Higher progressivity distorts incentives of high skill workers
- **Our theory** - Labor shifts away from high output matches, **1.5** TFP loss

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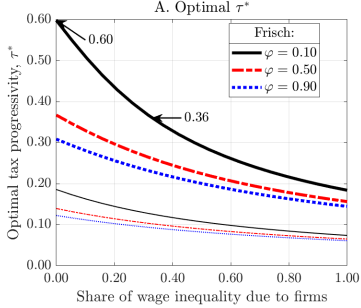
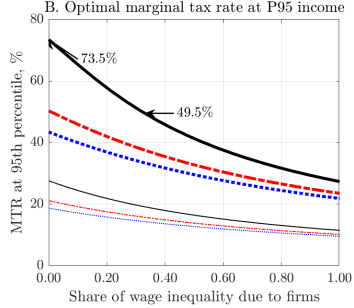
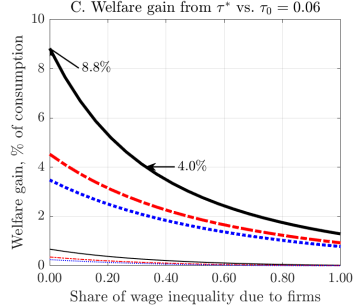
- **Standard theory** - Higher progressivity distorts incentives of high skill workers
- **Our theory** - Labor shifts away from high output matches, **1.5** TFP loss
- **Result 4** - Worse **sorting** explains >100% of TFP losses Back

Quantitative Tax Exercise

Recalibrate to $var(log(c))$ same, raise τ_1 while keeping τ_0 s.t. G is identical







$$\log z | \text{Sorting} \sim N\left(\mu_z + \eta\left(1-\tau\right)\sigma_z^2, \sigma_z^2\right)$$

$$\log z^{1-\tau} | \text{Sorting} \sim N\left(\left(1-\tau\right)\mu_z + \eta\left(1-\tau\right)^2\sigma_z^2, \left(1-\tau\right)^2\sigma_z^2\right)$$