What Drives Wage Stagnation: Monopsony or Monopoly?

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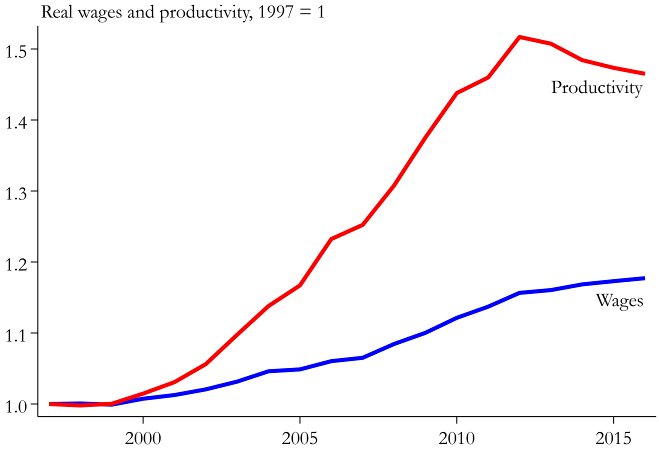
Wage Stagnation

U.S Census : Tradeable sectors



Mechanisms

- Explore two mechanisms behind wage stagnation:
  1. Monopsony: direct effect from imperfect labor market
     → Lower firm-specific wages for own workers
  2. Monopoly: output market power affects labor demand – General Equilibrium effect
     → Lowers aggregate, economy-wide wages

Mechanisms

- Explore two mechanisms behind wage stagnation:
  1. Monopsony: direct effect from imperfect labor market

     → Lower firm-specific wages for own workers
  2. Monopoly: output market power affects labor demand – General Equilibrium effect

     → Lowers aggregate, economy-wide wages

∴ Objective:
  1. Explain mechanism behind decoupling of wages and productivity
  2. Decomposition: measure contribution from Monopsony vs. Monopoly

Motivation

- Evidence on market power:
  1. Monopoly power (markups)

     De Loecker, Eeckhout, Unger (2020); Hall (2018)
  2. Monopsony power: (markdowns)

     Berger, Herkenhoff, Mongey (2020); Hershbein, Macaluso, Yeh (2018)

Motivation

- Evidence on market power:
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- Challenge for measurement: marginal cost directly not observable

- Our approach: structurally estimate Strategic Competition in GE:
  1. Jointly Measure Markups and Markdowns
  2. Estimate Market Structure

Findings

1. Competition has decreased over time:
   - Markups increase substantially
   - Markdowns are stable, increase only marginally
2. Wage stagnation: decoupling wages-productivity
3. Decomposition monopoly vs. monopsony: dominant force is monopoly

Model Setup

Markets

- Continuum of markets $j \in [0, J]$
- Finite number of establishments $i = 1, ..., I$
- Finite numbers of firms in each market $n = 1, ..., N$ (set of establishments i in firm n: $\mathcal{I}_{nj}$)

Household Preferences

- maximizes static utility

$$\max_{C_{inj}, L_{inj}} \; U\left(C - \frac{1}{\bar{\phi}^{\frac{1}{\phi}}} \frac{L^{\frac{\phi+1}{\phi}}}{\frac{\phi+1}{\phi}}\right) \quad \text{s.t. } PC = LW + \Pi$$

- CES preferences over Consumption and Labor

$$C = \left(\int_j J^{-\frac{1}{\theta}} C_j^{\frac{\theta-1}{\theta}} dj\right)^{\frac{\theta}{\theta-1}} \quad , \quad C_j = \left(\sum_i I^{-\frac{1}{\eta}} C_{inj}^{\frac{\eta-1}{\eta}}\right)^{\frac{\eta}{\eta-1}}$$

$$L = \left(\int_j J^{\frac{1}{\hat{\theta}}} L_j^{\frac{\hat{\theta}+1}{\hat{\theta}}} dj\right)^{\frac{\hat{\theta}}{\hat{\theta}+1}} \quad , \quad L_j = \left(\sum_i I^{\frac{1}{\hat{\eta}}} L_{inj}^{\frac{\hat{\eta}+1}{\hat{\eta}}}\right)^{\frac{\hat{\eta}}{\hat{\eta}+1}}$$

Model Setup

Technology

Firm $n \in \{1, \ldots, N\}$ in sector $j \in [0, J]$

$$\Pi_{nj} = \max_{\{Y_{inj}\}_{i \in \mathcal{I}_{nj}}} \sum_{i \in \mathcal{I}_{nj}} \Bigg[\underbrace{P_{inj}(Y_{inj}, Y_{-inj}) Y_{inj}}_{\text{Sales}} - \underbrace{W_{inj}(L_{inj}, L_{-inj}) L_{inj}}_{\text{Variable costs}} \Bigg]$$

subject to

$$Y_{inj} = A_{inj} L_{inj}$$

Market Structure

The same set of N firms compete in goods and labor market

Prices and Equilibrium

Cournot-Nash Competition in goods markets and labor markets

Equilibrium Solution

Producer Optimality

- The firm's first order condition for establishment i can be written as:

$$P_{inj} \underbrace{\left(1 + \varepsilon^{P}_{inj}\right)}_{\mu^{-1}_{inj}} A_{inj} = W_{inj} \underbrace{\left(1 + \varepsilon^{W}_{inj}\right)}_{\delta_{inj}}$$

Equilibrium Solution

Producer Optimality

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$$P_{inj}\underbrace{\left(1+\varepsilon^{P}_{inj}\right)}_{\mu^{-1}_{inj}}A_{inj} = W_{inj}\underbrace{\left(1+\varepsilon^{W}_{inj}\right)}_{\delta_{inj}}$$

- Markups and Markdowns

$$\mu_{inj} = \frac{P_{inj}}{MC_{inj}} = \frac{1}{1+\varepsilon^{P}_{inj}}; \qquad \varepsilon^{P}_{inj} = -\left[\frac{1}{\theta}s_{nj} + \frac{1}{\eta}(1-s_{nj})\right]$$

$$\delta_{inj} = \frac{MRPL_{inj}}{W_{inj}} = 1+\varepsilon^{W}_{inj}; \qquad \varepsilon^{W}_{inj} = \left[\frac{1}{\hat{\theta}}e_{nj} + \frac{1}{\hat{\eta}}(1-e_{nj})\right]$$

Equilibrium Solution

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- Mechanism

$$P_{inj} A_{inj} \times \mu^{-1}_{inj} = W_{inj} \times \delta_{inj} \Rightarrow \underbrace{W_{inj}}_{\text{Wage}} = \underbrace{\frac{R_{inj}}{L_{inj}}}_{\text{Rev/worker}} \times \underbrace{\mu^{-1}_{inj}}_{\text{Markup}} \times \underbrace{\delta^{-1}_{inj}}_{\text{Markdown}}$$

Quantitative Exercise

- U.S. Census Bureau Longitudinal Business Database (LBD): Tradeable Sectors
- In the data we observe
  1. Employment by establishment: L_{inj}
  2. Average Wages by establishment: $W_{inj} = \frac{\text{Wage Bill}_{inj}}{L_{inj}}$
  3. Revenue: R_{inj}
  4. Industry classification NAICS, SIC
- Market Assignment: Randomly assign I_j establishments into a market. Randomly assign I_j establishments into N subsets of size I_j/N

Exogenous Parameters

Variable	Value		Source
θ, η	1.2,5.75	Output market elasticities	DLEM (2021), Costinot e.a (2016)
ϕ	0.25	Elast. Aggregate LS	Chetty e.a. (2011)
I	32	Establishments in each market	Externally set

Quantitative Exercise

Estimation

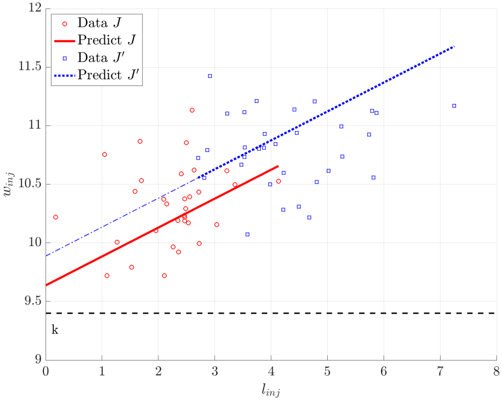
	Input/data	Output	
1. Common elasticities	W_{inj}, L_{inj}	$\hat{\theta}, \hat{\eta}$	
2. Firm-specific technology	L_{inj}	$A_{inj}, \mu_{inj}, \delta_{inj}$	system of FOCs given N
3. Market Structure	$R_{inj}/W_{inj}L_{inj}$	N	

Estimating Labor Supply Elasticities

$$w_{inj} = \underbrace{-\frac{1}{\hat{\theta}}\log\left(\frac{1}{J}\right) \quad -\frac{1}{\hat{\theta}}l + w}_{k} \ \underbrace{-\frac{1}{\hat{\eta}}\log\left(\frac{1}{I_j}\right) + \left(\frac{1}{\hat{\theta}} - \frac{1}{\hat{\eta}}\right) l_j}_{k_j} + \frac{1}{\hat{\eta}} l_{inj}$$

Estimating Labor Supply Elasticities

$$w_{inj} = \underbrace{-\frac{1}{\hat{\theta}}\log\left(\frac{1}{J}\right) \quad -\frac{1}{\hat{\theta}} l + w}_{k} \quad \underbrace{-\frac{1}{\hat{\eta}}\log\left(\frac{1}{l_j}\right) + \left(\frac{1}{\hat{\theta}} - \frac{1}{\hat{\eta}}\right) l_j}_{k_j} + \frac{1}{\hat{\eta}} l_{inj}$$



Specifications First and Second Stage

Labor Elasticities Estimates

Exogenous variation from tax differences over time

Parameter	Description	Estimate IV
$\hat{\eta}$	Within-market elasticity	3.49
$\hat{\theta}$	Between-market elasticity	1.71

Wage Distribution

Backing out $\{A_{inj}, \mu_{inj}, \delta_{inj}\}$

- For given market structure (N) and preferences $\{\eta, \theta, \hat{\eta}, \hat{\theta}\}$, using data on $\{L_{inj}\}$ we can recover $\{A_{inj}, \mu_{inj}, \delta_{inj}\}$.
- System of I equations and I unknowns for all establishments i, n in each market j

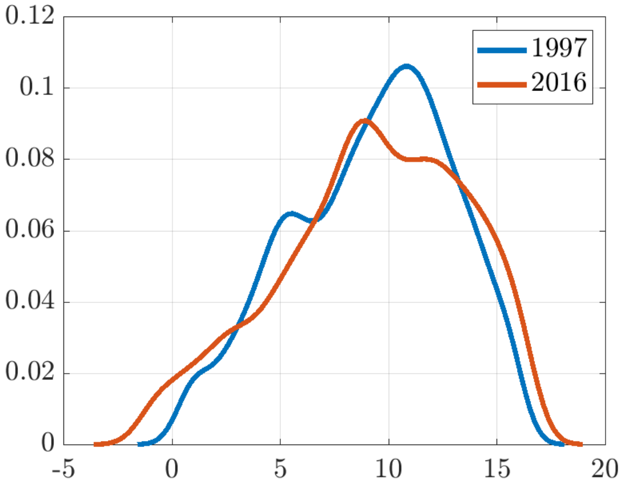
$$\frac{1}{J}^{\frac{1}{\theta}} \frac{1}{I}^{\frac{1}{\eta}} (A_{inj} L_{inj})^{\frac{1}{\eta}} \left[\left(\frac{1}{I}^{\frac{1}{\eta}} \sum_i (A_{inj} L_{inj})^{\frac{\eta-1}{\eta}} \right)^{\frac{\theta-\eta}{(\eta-1)\theta}} \right] \underbrace{\left[1 - \frac{1}{\theta} \frac{\sum_{i \in \mathcal{I}_{nj}} (A_{inj} L_{inj})^{\frac{\eta-1}{\eta}}}{\sum_i (A_{inj} L_{inj})^{\frac{\eta-1}{\hat{\eta}}}} - \frac{1}{\eta} \left[1 - \frac{\sum_{i \in \mathcal{I}_{nj}} (A_{inj} L_{inj})^{\frac{\eta-1}{\eta}}}{\sum_i (A_{inj} L_{inj})^{\frac{\eta-1}{\eta}}} \right] \right]}_{\text{Inverse Markup: } \mu_{inj}^{-1}}$$

$$= \frac{1}{Z} \frac{1}{J}^{\frac{-1}{\hat{\theta}}} \frac{1}{I}^{\frac{-1}{\hat{\eta}}} \frac{(L_{inj})^{\frac{1}{\hat{\eta}}}}{A_{inj}} \left[\left(\frac{1}{I}^{\frac{-1}{\hat{\eta}}} \sum_i (L_{inj})^{\frac{\hat{\eta}+1}{\hat{\eta}}} \right)^{\frac{\hat{\eta}-\hat{\theta}}{(\hat{\eta}+1)\hat{\theta}}} \right] \underbrace{\left[1 + \frac{1}{\hat{\theta}} \frac{\sum_{i \in \mathcal{I}_{nj}} (L_{inj})^{\frac{\hat{\eta}+1}{\hat{\eta}}}}{\sum_i (L_{inj})^{\frac{\hat{\eta}+1}{\hat{\eta}}}} + \frac{1}{\hat{\eta}} \left[1 - \frac{\sum_{i \in \mathcal{I}_{nj}} (L_{inj})^{\frac{\hat{\eta}+1}{\hat{\eta}}}}{\sum_i (L_{inj})^{\frac{\hat{\eta}+1}{\hat{\eta}}}} \right] \right]}_{\text{Markdown: } \delta_{inj}}$$

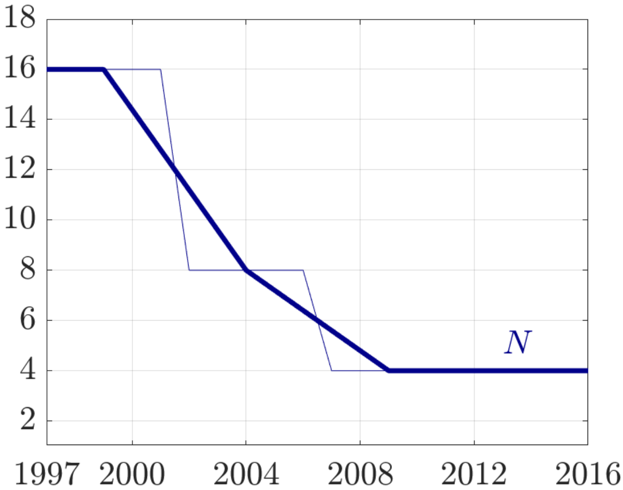
where $Z = W^{-1} L^{\frac{1}{\hat{\theta}}} Y^{\frac{1}{\theta}}$ and the aggregate price P is normalized to 1.

Estimated Technology Distribution

A_{inj}

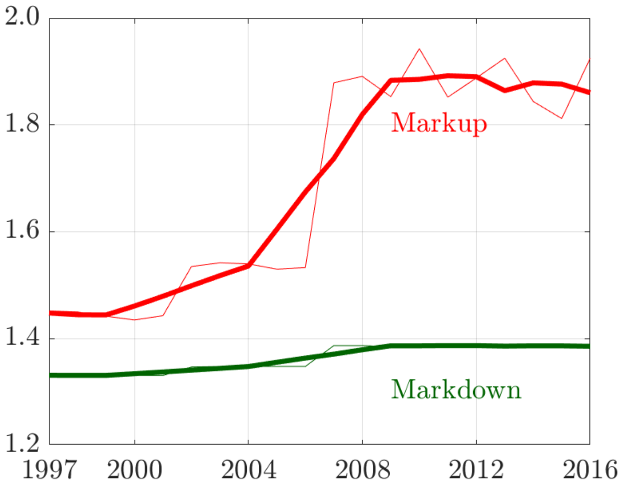


ESTIMATED N

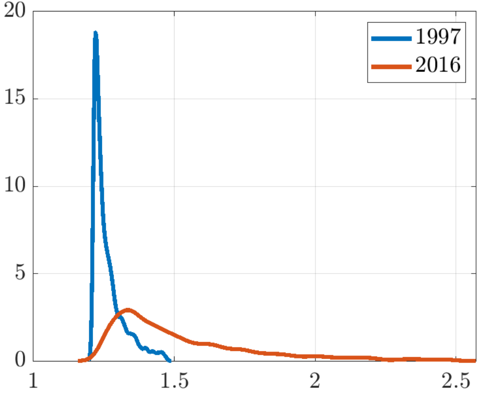


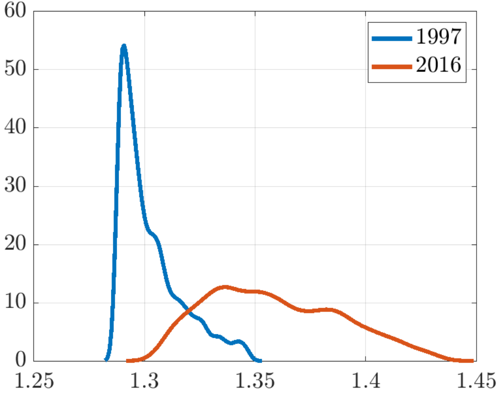
Model Fit

Average Markups and Markdowns



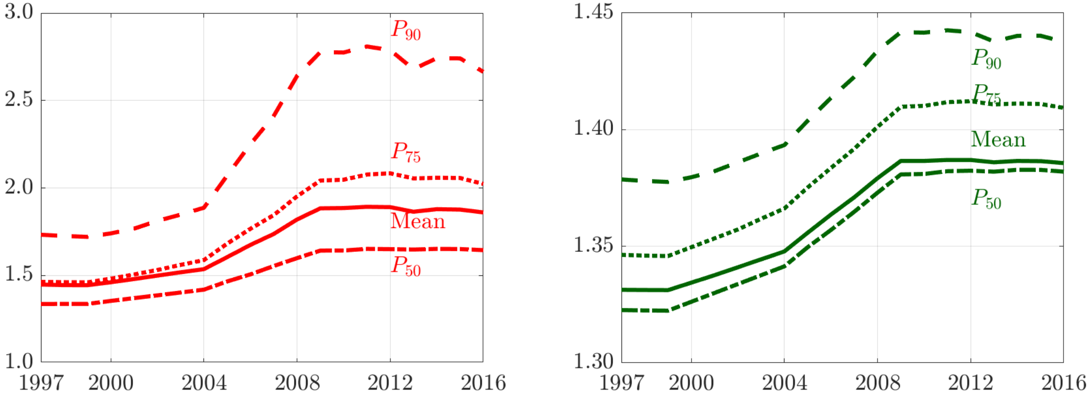
Markup and Markdown Distributions



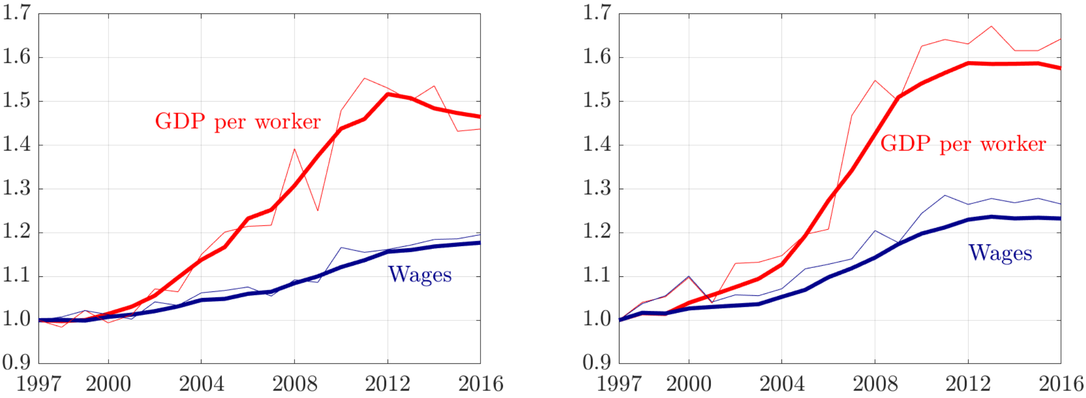


Markup and Markdown Distributions

Data vs Model

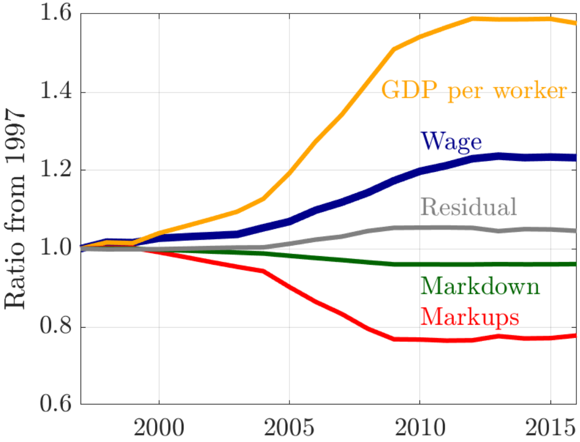


Decoupling Wages-Productivity



Decoupling Wages-Productivity

$$W = \text{GDP/Worker} \times \mu^{-1} \times \delta^{-1} \times \Omega$$



Social Planner's Problem

$$V = \max_{\{C_{inj}, L_{inj}\}} \; U\left(C - \frac{1}{\bar{\phi}^{\frac{1}{\phi}}} \frac{L^{\frac{\phi+1}{\phi}}}{\frac{\phi+1}{\phi}} \right)$$

$$\text{s.t.} \quad C_{inj} = Y_{inj} = A_{inj} L_{inj}$$

Counterfactual Economies

1. Decentralized Equilibrium: $L_{inj}^{\mu,\delta}$

$$A_{inj} P_{inj} \;\; \mu_{inj}^{-1} \; = \; W_{inj} \;\; \delta_{inj}$$

Counterfactual Economies

2. Social Planner's Solution: $L_{inj}^{1,1}$

$$A_{inj}P_{inj} = W_{inj}$$

Counterfactual Economies

3. Monopoly; No Monopsony: $L_{inj}^{\mu,1}$

$$A_{inj} P_{inj} \; \mu_{inj}^{-1} \; = \; W_{inj}$$

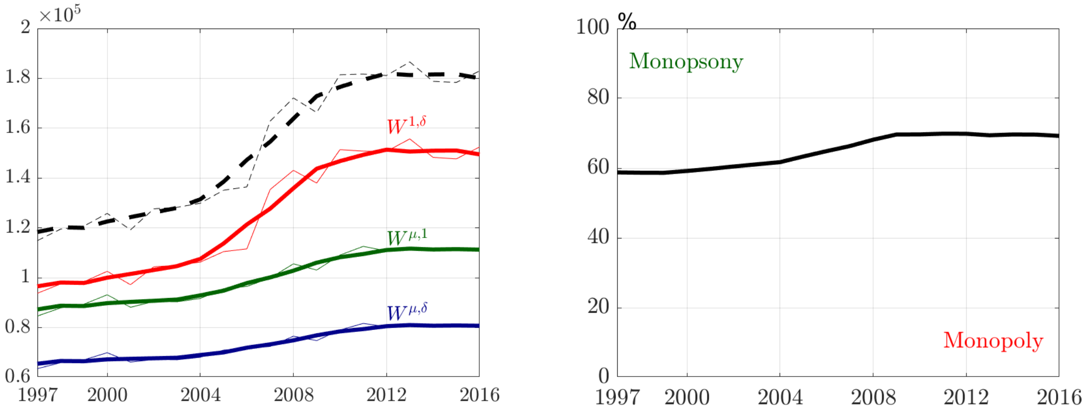
Counterfactual Economies

4. No Monopoly; Monopsony: $L_{inj}^{1,\delta}$

$$A_{inj}P_{inj} = W_{inj} \quad \delta_{inj}$$

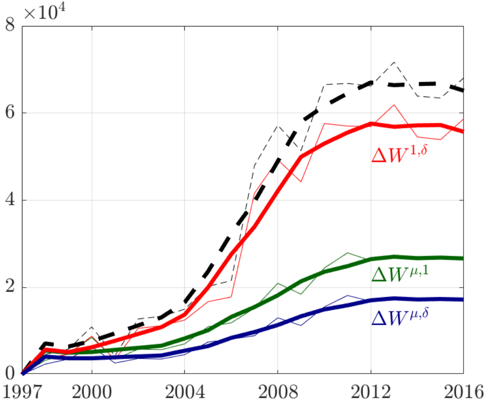
Counterfactual Economies

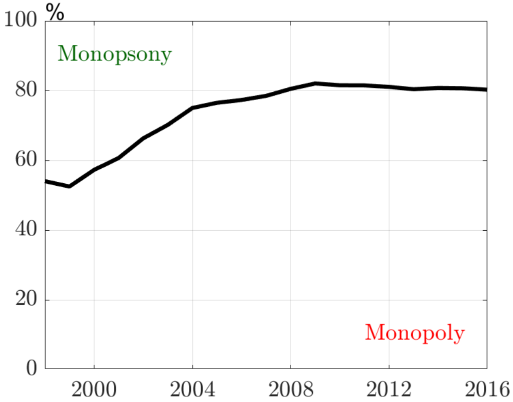
Wage Decomposition



Counterfactual Economies

Wage Growth/Stagnation





Conclusion

- We propose a novel method to:
  1. Jointly model and measure monopsony and monopoly
  2. Back out market structure

- Our Main Findings:
  1. Market Power has increased over time:
     - Markups increase from 1.45 to 1.93
     - Markdowns are stable, increase only marginally from 1.33 to 1.38
  2. Wage stagnation: decoupling wages-productivity
  3. Decomposition: indirect effect from monopoly dominates direct effect from monopsony

     69% of wage level; 80% of the wage stagnation

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Producer Optimality

$$P_{inj} + \frac{\partial P_{inj}}{\partial Y_{inj}} Y_{inj} + \sum_{i' \in \mathcal{I}_{nj}/i} \left(\frac{\partial P_{i'nj}}{\partial Y_{inj}} Y_{i'nj} \right) = \frac{1}{A_{inj}} \left[W_{inj} + \frac{\partial W_{inj}}{\partial L_{inj}} L_{inj} + \sum_{i' \in \mathcal{I}_{nj}/i} \left(\frac{\partial W_{i'nj}}{\partial L_{inj}} L_{i'nj} \right) \right]$$

$$P_{inj} \Big[1 \underbrace{- \frac{1}{\theta} s_{nj} - \frac{1}{\eta} (1 - s_{nj})}_{\epsilon^P_{inj}} \Big] A_{inj} = W_{inj} \Big[1 + \underbrace{\frac{1}{\hat{\theta}} e_{nj} + \frac{1}{\hat{\eta}} (1 - e_{nj})}_{\epsilon^W_{inj}} \Big]$$

We define our markup $\mu_{inj} = \frac{P_{inj}}{MC_{inj}}$ and markdown $\delta_{inj} = \frac{MRPL_{inj}}{W_{inj}}$

$$\mu_{inj} = \frac{1}{1 + \epsilon^P_{inj}} = \left[1 - \frac{1}{\theta} s_{nj} - \frac{1}{\eta} (1 - s_{nj}) \right]^{-1} \quad \text{and} \quad \delta_{inj} = 1 + \epsilon^W_{inj} = \left[1 + \frac{1}{\hat{\theta}} e_{nj} + \frac{1}{\hat{\eta}} (1 - e_{nj}) \right].$$

Back

Model Solution

Rearranging FOC, we get:

$$P_{inj} = \frac{\left[1 + \frac{1}{\hat{\theta}} e_{nj} + \frac{1}{\hat{\eta}}(1 - e_{nj})\right]}{\left[1 - \frac{1}{\theta} s_{nj} - \frac{1}{\eta}(1 - s_{nj})\right]} \frac{W_{inj}}{A_{inj}}.$$

$$s_{inj} = \frac{P_{inj}^{1-\eta}}{\sum_{i,n} P_{inj}^{1-\eta}} = \frac{\left[\frac{1+\frac{1}{\hat{\theta}} e_{nj} + \frac{1}{\hat{\eta}}(1-e_{nj})}{1-\frac{1}{\theta} s_{nj} - \frac{1}{\eta}(1-s_{nj})} \frac{e_{inj}^{\frac{1}{1+\hat{\eta}}}}{A_{inj}}\right]^{1-\eta}}{\sum_{i',n'} \left[\frac{1+\frac{1}{\hat{\theta}} e_{n'j} + \frac{1}{\hat{\eta}}(1-e_{n'j})}{1-\frac{1}{\theta} s_{n'j} - \frac{1}{\eta}(1-s_{n'j})} \frac{e_{i'n'j}^{\frac{1}{1+\hat{\eta}}}}{A_{i'n'j}}\right]^{1-\eta}}$$

where

$$e_{inj} = \left[\sum_{i',n'} \left(\left(\frac{s_{i'n'j}}{s_{inj}}\right)^{\frac{\eta}{\eta-1}} \frac{A_{inj}}{A_{i'n'j}}\right)^{\frac{\hat{\eta}+1}{\hat{\eta}}}\right]^{-1} = \frac{\left(s_{inj}^{\frac{-\eta}{1-\eta}} / A_{inj}\right)^{\frac{1+\hat{\eta}}{\hat{\eta}}}}{\sum_{i',n'} \left(s_{i'n'j}^{\frac{-\eta}{1-\eta}} / A_{i'n'j}\right)^{\frac{1+\hat{\eta}}{\hat{\eta}}}}.$$

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Regression Specification

We use Two-Stage Least Squares (2SLS) on the following equations to get the estimate of $\hat{\eta}$ and $\hat{\theta}$.

- $\hat{\eta}$ Estimation

$$\ln W^*_{injt} = k_{jt} + \gamma \ln L_{jt} + \beta \ln L_{injt} + \underbrace{\alpha_{inj} + \epsilon_{injt}}_{\varepsilon_{injt}} \quad (1)$$

- $\hat{\theta}$ Estimation

$$\overline{\Omega}_{Sjt} = k_{jt} + \gamma_S \ln S_{jt} + \overline{\varepsilon}_{Sjt} \quad (2)$$

where we define $\beta = \frac{1}{\hat{\eta}}$ and $\gamma = \left(\frac{1}{\hat{\theta}} - \beta\right)$.

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First and Second Stage Results

Table: Estimates of reduced-form parameters: Tradeables

A. OLS and Second-Stage IV Estimates					
	OLS	IV		OLS	IV
	(1)	(2)		(3)	(4)
$\frac{1}{\hat{\eta}}$	-0.187	0.287	$\frac{1}{\hat{\theta}} - \frac{1}{\hat{\eta}}$	0.180	0.298
	(3.8e-4)	(0.048)		(1.3e-4)	(0.001)
Sector x Year FE	Yes	Yes	Sector FE	Yes	Yes
Establishment FE	Yes	Yes	Year FE	Yes	Yes
B. First-Stage Regressions for the IV					
$\tau_{X(i)t}$	-	-0.003	$\bar{\tau}_{jt}$	-	-0.138
		(1.9e-4)			(3.8e-4)
Sector x Year FE	-	Yes	Sector FE	-	Yes
Establishment FE	-	Yes	Year FE	-	Yes
No. of obs.	3,921,000	3,921,000	No. of obs.	3,921,000	3,921,000

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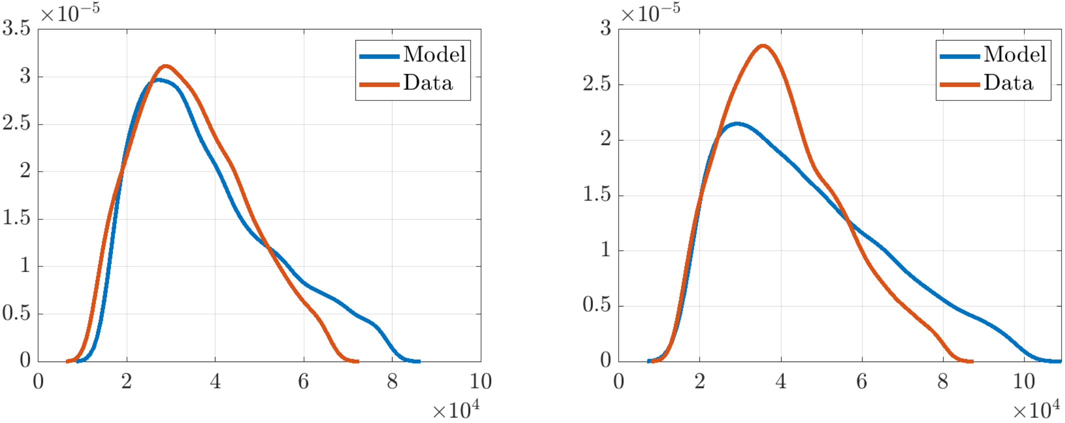
Wage Distribution

1997 and 2016



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N Estimation Fit

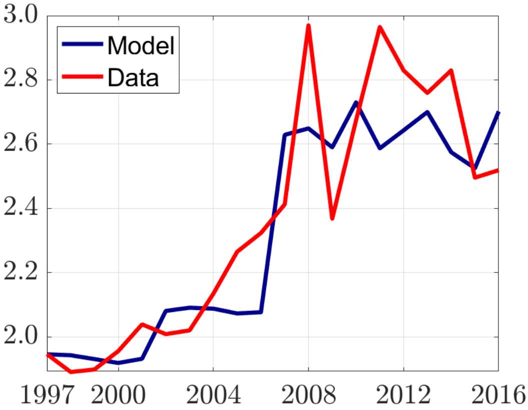

Figure: Model Fit-N estimation

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