What Drives Wage Stagnation: Monopsony or Monopoly?

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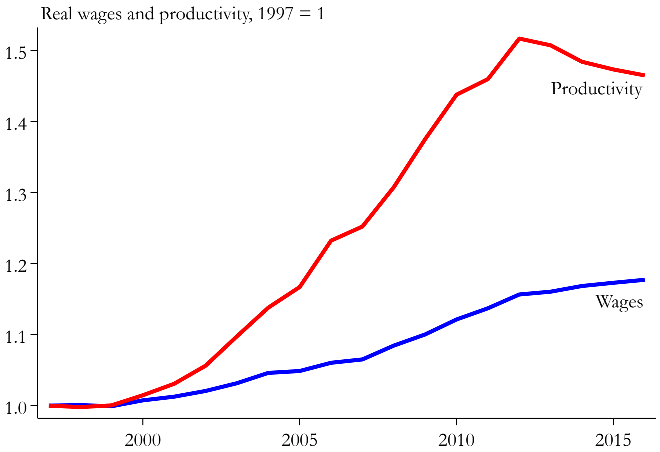
Wage Stagnation

U.S Census : Tradeable sectors



Mechanisms

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

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     $\rightarrow$ Lowers aggregate, economy-wide wages

$\therefore$ Objective:
  1. Explain mechanism behind decoupling of wages and productivity
  2. Decomposition: measure contribution from Monopsony (markdowns) vs. Monopoly (markups)

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

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- Challenge for measurement: marginal cost directly not observable
- Challenge for measurement: we don't observe who competes

- 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 $j \in [0, J]$

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

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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- Markups and Markdowns

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

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

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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 in same industry into a market. Randomly assign I_j establishments into N subsets of size I_j/N

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 Elasticities

Estimating Within and Between Market Substitutability

$$\ln W^*_{injt} = c_{jt} \; + \; \gamma \ln L_{jt} \; + \; \beta \ln L_{injt} \; + \; \underbrace{\alpha_{inj} \; + \; \epsilon_{injt}}_{\varepsilon_{injt}}$$

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

Use Two-Stage Least Squares to estimate β and γ, sequentially.

Rely on Berger, Herkenhoff and Mongey (2021) and Giroud and Rauh (2019)

- Exploit variation in state corporate taxes as instruments for employment

Preference Estimates and Parameters

Variable	Value		Source
$\hat{\theta}$	1.71	Input market: Between-market elasticity	estimated
$\hat{\eta}$	3.49	Input market: Within market elasticity	estimated
θ	1.2	Output market: Between-market elasticity	DLEM (2021)
η	5.75	Output market: Within market elasticity	DLEM (2021)
ϕ	0.25	Elast. Aggregate LS	Chetty e.a. (2011)
I	32	Establishments in each market	Externally set

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

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

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

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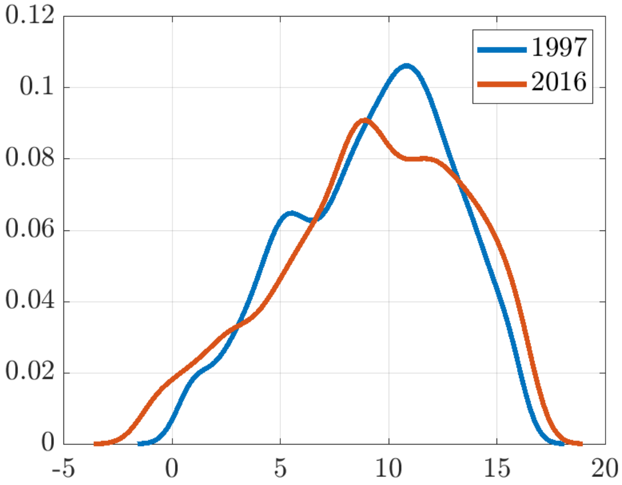
$$\frac{1}{J}^{\frac{1}{\theta}} \frac{1}{I}^{\frac{1}{\eta}} (A_{inj} L_{inj})^{\frac{1}{\eta}} \left[\left(\frac{1}{I}^{\frac{1}{\eta}} \sum_i (A_{inj} L_{inj})^{\frac{\eta-1}{\eta}} \right)^{\frac{\theta-\eta}{(\eta-1)\theta}} \right] \underbrace{\left[1 - \frac{1}{\theta} \frac{\sum_{i \in \mathcal{I}_{nj}}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

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

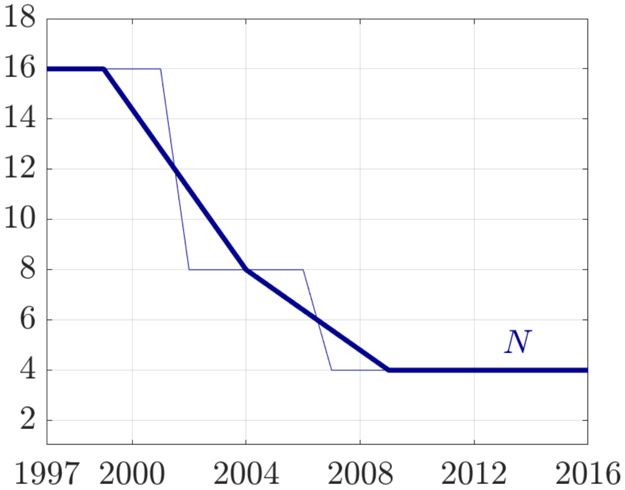
where $Z = W^{-1} L^{\frac{1}{\hat{\theta}}} Y^{\frac{1}{\theta}}$ and the aggregate price P is normalized to 1.

Estimated Technology Distribution

A_{inj}

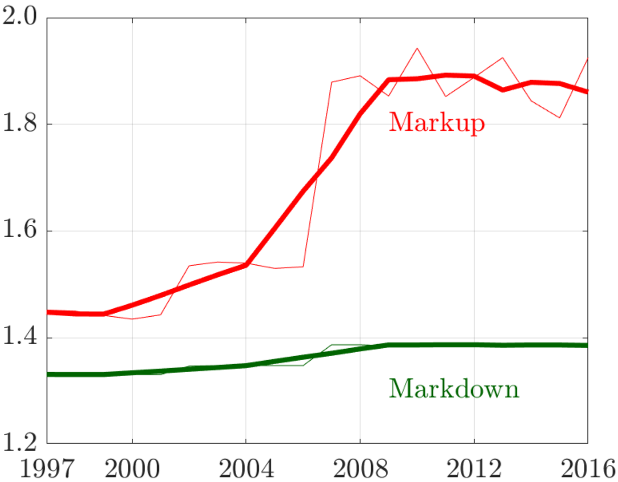


Estimated N

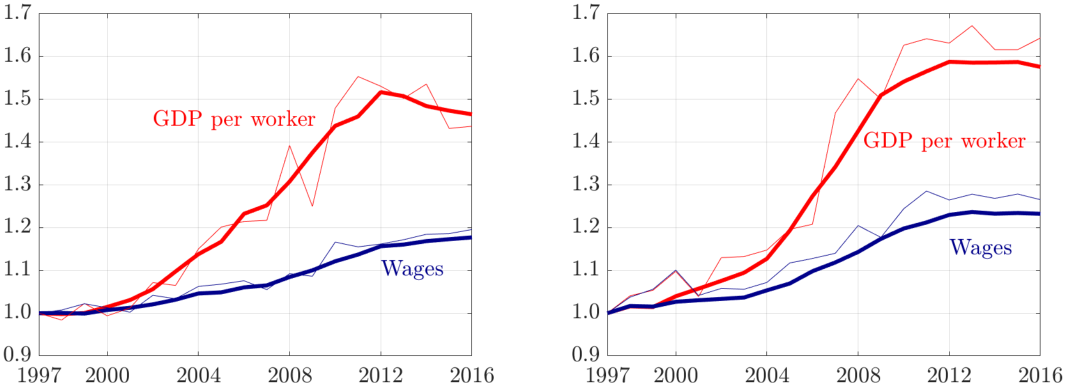


Model Fit

Average Markups and Markdowns



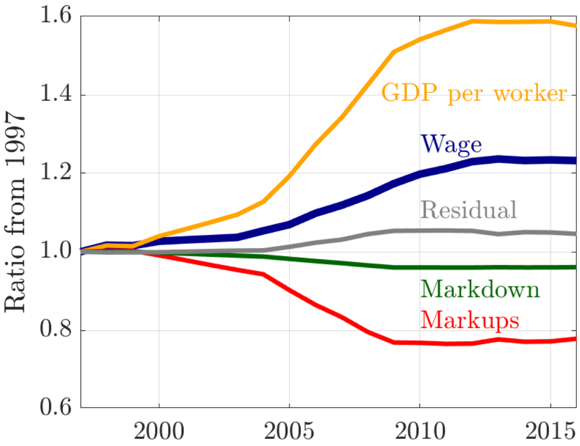
Decoupling Wages-Productivity



(a) Data (b) Model

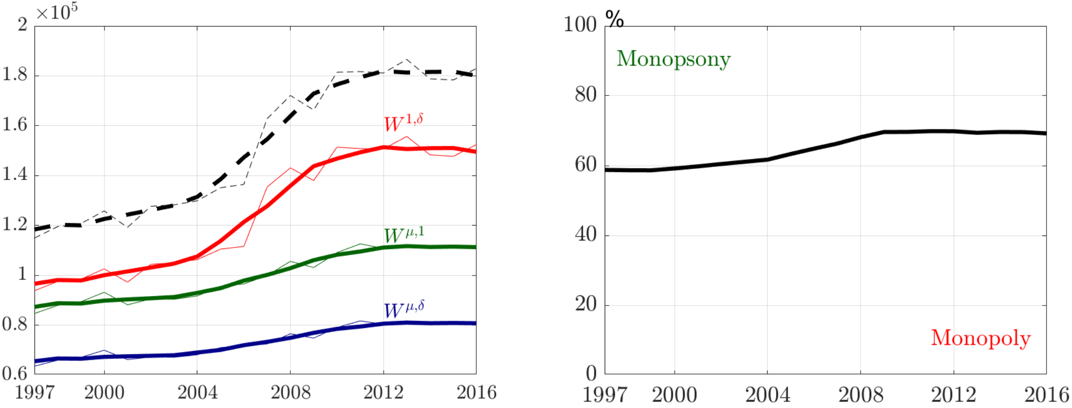
Decoupling Wages-Productivity

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



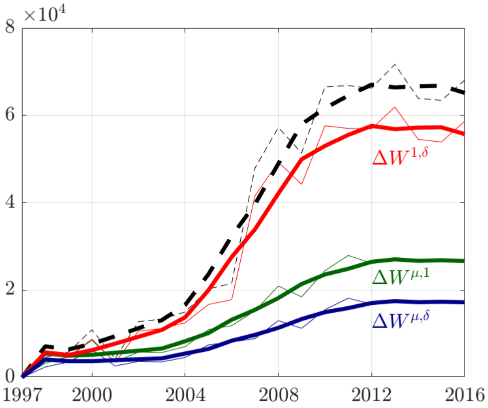
Counterfactual Economies

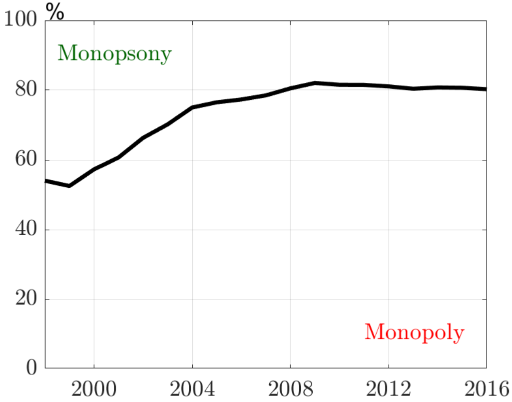
Wage Decomposition



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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Any opinions and conclusions expressed herein are those of the authors and do not represent the views of the U.S. Census Bureau. All results have been reviewed to ensure that no confidential information is disclosed. Disclosure Review Board number: CBDRB-FY22-CED006-0018.

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 $\delta_{inj} = \frac{MRPL_{inj}}{W_{inj}}$

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

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

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

- $\hat{\theta}$ Estimation

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

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

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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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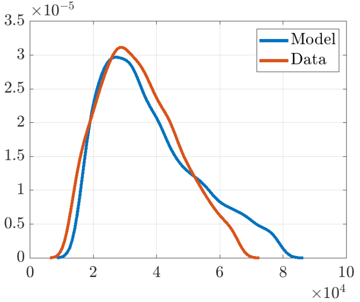
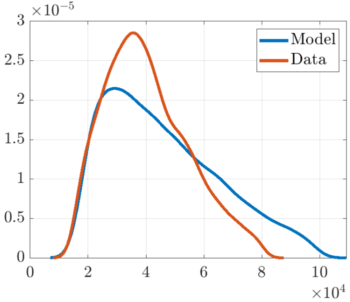
Wage Distribution



Wage Distribution 1997



Wage Distribution 2016

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N Estimation Fit

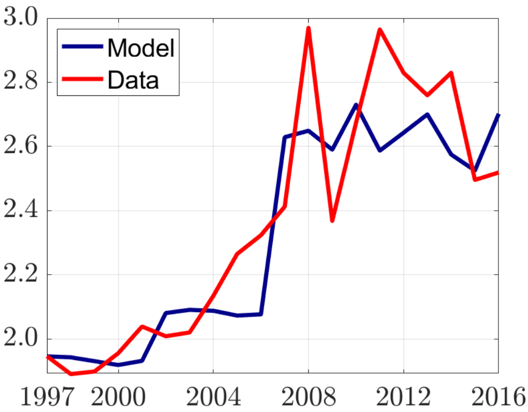

Figure: Model Fit-N estimation

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