Firms' Choices of Wage-Setting Protocols

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Will make four points today

(1) When firms can choose between:

R: Posting non-negotiable wage offers

N: Bargaining and renegotiating wages

equilibrium fraction p_R depends on:

Average no. of offers on job vs Worker power in negotiation

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(4) In estimated model, differences in rate of bargaining explain:
  1. $\approx$ 10 % of residual wage inequality
  2. $\approx$ 7% of gender wage gap

5 Motivating Facts

(1) Workers report setting wages differently (Babcock & Leschever 2009, Hall & Krueger 2012)
   - Men bargain more than women
   - Highly educated bargain more than less educated

(2) Wage-setting strategies are not policy invariant (Lucas 1976, Marschak 1953)

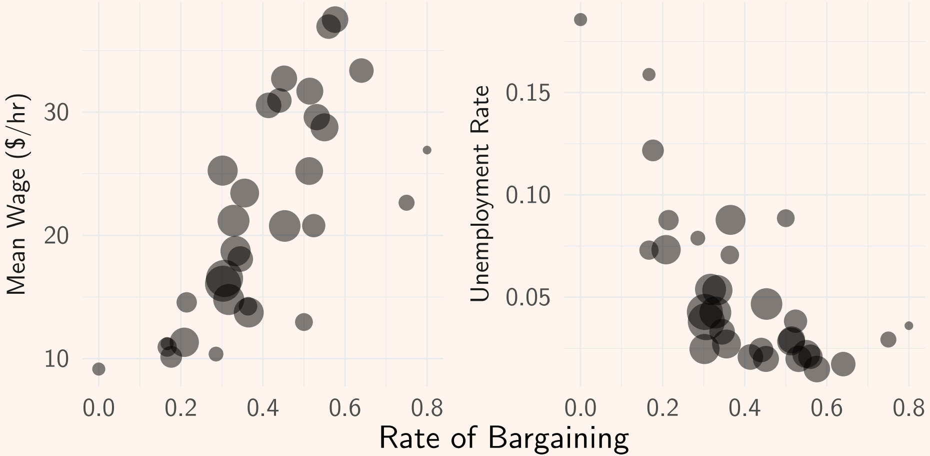
(3) Bargaining matters for gender wage gaps (Flinn, Todd & Zhang 2020, Biasi & Sarsons 2021)

(4) Increasing efforts to regulate wage-setting (salary history bans in 19 states)

(5) Need suitable empirical framework for heterogenous wage-setting within and across markets.

   Postel-Vinay & Robin (2004), Michelacci & Suarez (2006), Doniger (2015), Cheremukhin & Restrepo-Echavarria (2021)

Setting the Scene



Source: Hall & Krueger + CPS, matched by Age×Sex×Education. Question: “did your employer make a “take-it-or-leave-it” offer or was there some bargaining that took place over the pay?” more on data

Let's work through a simple model

- Continuous time. Risk-neutral. Discount $\rho \approx 0$.
- All worker-firm pairs produce z.
- Undirected search $\lambda_U, \lambda_E, p_R$
- Firms post vacancy type:
  - R: Bargain/renegotiate wage, given outside option (p_R)
  - N: Take-it-or-leave-it wage offer with no info ($1 - p_R$)
- Utility b in unemployment $b \mapsto w^*$
- Free entry determines equilibrium $\lambda_U, \lambda_E, p_R$
- **Segmented markets**

Wage-Setting: bargaining and renegotiation

Type R:

- Bargain wages according to surplus-splitting rule (Cahuc et al 2006, Binmore et al 1986)
- Worker's bargained value:

$$\nu + \alpha S$$

  where S is surplus, ν is outside option
- Renegotiate offer when outside option improves
- Bertrand competition between R firms

Wage-Setting: non-negotiation

Type N:

- Post "take it or leave it" offer w under asymmetric information (Albrecht & Axell 1984, Burdett & Mortensen 1998)
- Can allow wage to be a function productivity
- Do not renegotiate
- Value $V_N(w)$ to worker
- **Tradeoff**: N-firms have all bargaining power, less retention, less information.

Mobility rules and equilibrium definition

Four kinds of encounters:

1. U vs either firm: accept if $w > w^*$,
2. N vs N: go to firm with higher wage offer w.
3. N vs R: R wins and N's offer is outside option.
4. R vs R: wage bid up to z and either can win.

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Equilibrium is:

- w^* determined by reservation wage equation ($V_N(w^*) = V_U$).
- Offer distribution Φ such that N firms are indifferent in support.
- Equal profits ($\Pi_N = \Pi_R$) if $p_R \in (0, 1)$.
- Contact rates can be endogenous free entry conditions

Equilibrium Wages

Define $\kappa = \lambda/\delta$. In equilibrium:

$$\Phi(w) = \frac{1+\kappa}{\kappa(1-p_R)}\left(1-\sqrt{\frac{z-w}{z-w^*}}\right)$$

- Note nesting of Burdett & Mortensen (1998)
- Solve analytically for profits Π_N, Π_R.

Wage-Setting in Equilibrium

Equilibrium with $p_R \in (0,1)$, must have:

$$(1-\alpha)\left[\frac{1+\kappa p_R}{1+\kappa\alpha p_R} + 2\log\left(\frac{1+\kappa-\kappa p_R(1-\alpha)}{1+\kappa p_R \alpha}\right)\right] = 1$$

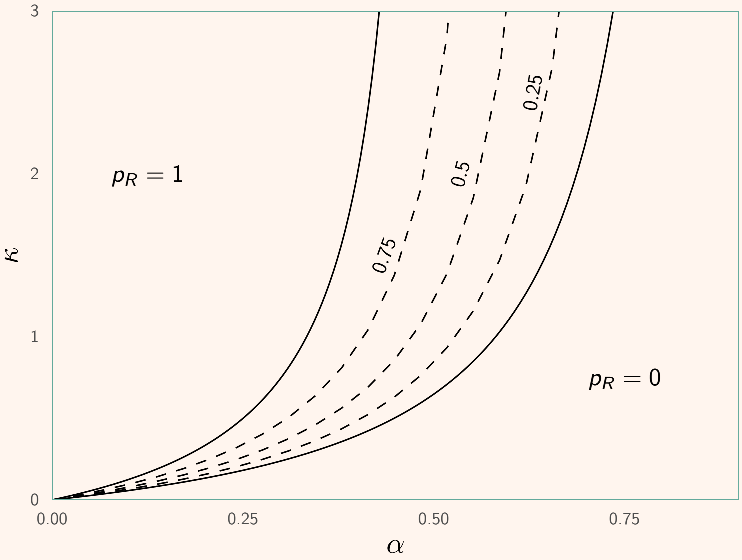
Unique. Corners when $\alpha \uparrow\downarrow$. Comp stats:

1. $\frac{\partial p_R}{\partial \kappa} > 0$
2. $\frac{\partial p_R}{\partial \alpha} < 0$

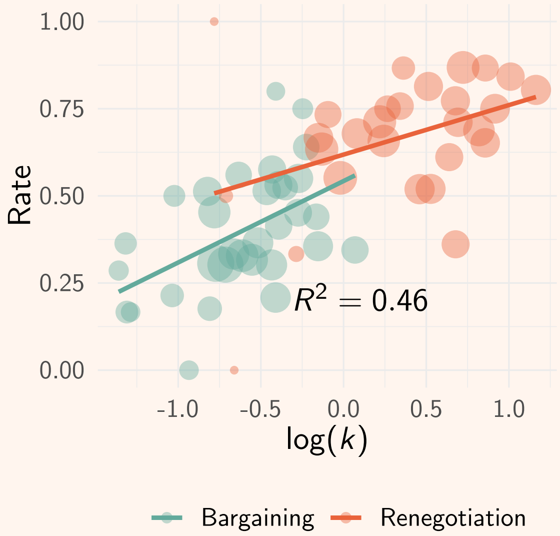
Prediction

In markets where the ratio of job-to-job transitions to separations is higher, should see more bargaining and renegotiation.

Picturing Equilibrium



Bargaining and Renegotiation in Cross-Section



- Let $x = \{AGE, SEX, ED\}$
- CPS: $\hat{k}(x) = EE(x)/EU(x)$
- Using HK data, calculate rate of bargaining.
- For robustness, get rate of renegotiation using SCE
- Consistent with other evidence (Chen et al 2021, Brenzel et al 2014)

Adding Heterogeneity to the Model

- The simple model clarifies the mechanism (κ vs α)
- We want to extend to interpret wage and employment dynamics
- Output $a\theta$ where a is ability and θ is idiosyncratic job productivity
- Sufficient statistic for mobility and wages: max attainanable wage details

Wages

Nests Cahuc et al (2006) and Burdett & Mortensen (1998) details:

$$\varphi_R(\theta, q) = \alpha\theta + (1-\alpha)q - \lambda_E p_R (1-\alpha)^2 \int_q^x \frac{\tilde{F}_\theta(y|R)}{\rho + \delta + \lambda_E p_R \alpha \tilde{F}_\theta(y|R) + \lambda_E (1 - p_R)\tilde{\Phi}(y)} dy$$

$$\log(W_{it}) = \log(a_i) + R_{j(t)} \log(\varphi_R(\theta_{j(t)}, q_{it})) + (1 - R_{j(t)}) \log(\varphi_N(\theta_{j(t)}))$$

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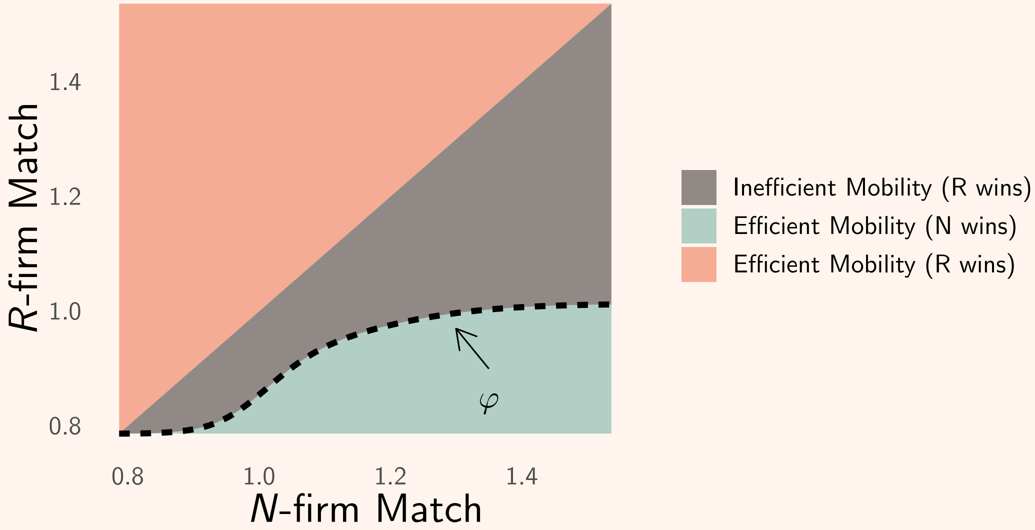
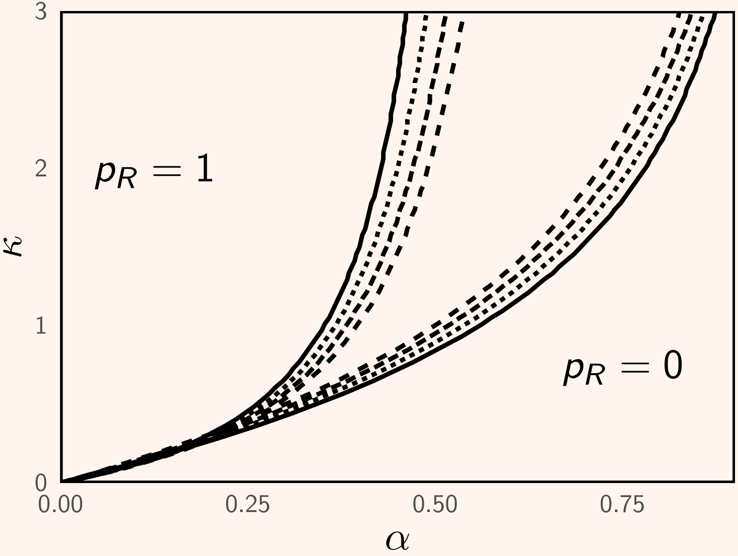
- Evidence: heterogeneous effect of outside options (Caldwell 2019, Di Addario et al 2020)
- New model is key to fit this evidence
- Can derive AKM style formula

Inefficient Mobility



Equilibrium with Match Heterogeneity



Estimation

Assume $\log(\theta) \sim \mathcal{N}(0, \sigma^2)$.

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Assume $\log(\theta) \sim \mathcal{N}(0, \sigma^2)$. For $x \in \{Cohort, Sex, Educ\}$ estimate

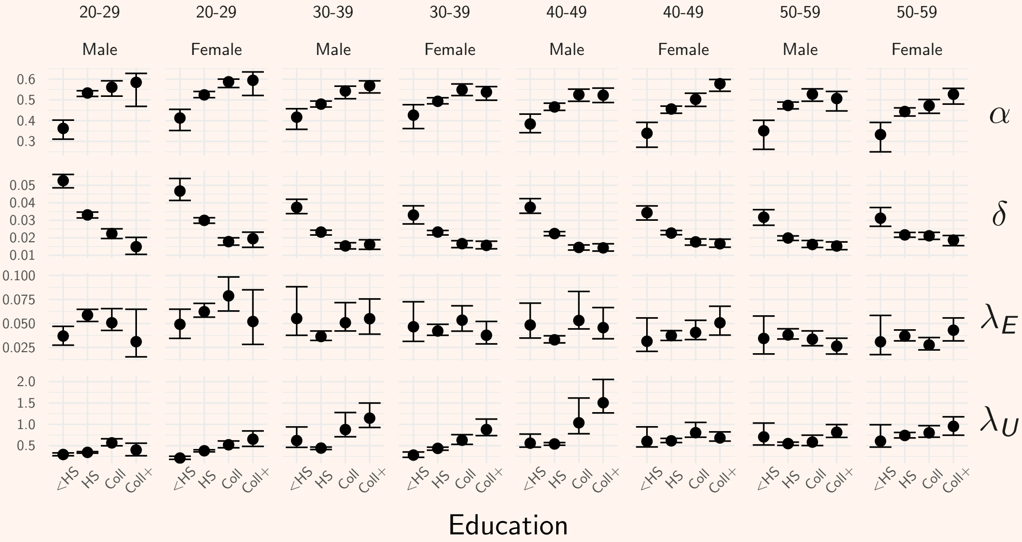
$$\beta(x) = \{\sigma(x), b(x), \delta(x), \lambda_U(x), \lambda_E(x), \alpha(x)\}$$

by matching:

1. $EE, EU, U \;\mapsto\; \delta, \lambda_E, \lambda_U$
2. Reported bargaining in HK $\mapsto p_R$
3. $\Pi_R = \Pi_N \mapsto \alpha$
4. $\mathbb{E}[\log(W)] - \mathbb{E}[\log(W)|UE], \; \mathbb{V}[\log(W)] - \mathbb{V}[\log(W)|UE] \;\mapsto\; w^*, \sigma$
   - "Difference out" ability

more on data

Estimates



20-29 Male
20-29 Female
30-39 Male
30-39 Female
40-49 Male
40-49 Female
50-59 Male
50-59 Female
α
δ
λ_E
λ_U
<HS
HS
Coll
Coll+
Education

Wage Densities

Residual Wage Dispersion

Table: Baseline Statistics from the Estimated Model

	Baseline	% of Population Value
$\mathbb{E}[\mathbb{V}[\log(W)\|X]]$	0.03	10.43
	(0.001)	(0.51)
$\mathbb{V}[\mathbb{E}[\log(W)\|X]]$	0.006	6.29
	(0.002)	(1.54)
Gender Wage Gap	0.002	0.82
	(0.009)	(4.5)
Education Wage Gap	0.082	15.7
	(0.022)	(4.32)
Inefficient Mobility (%)	14.87	-
	(0.26)	-

Residual Wage Gaps

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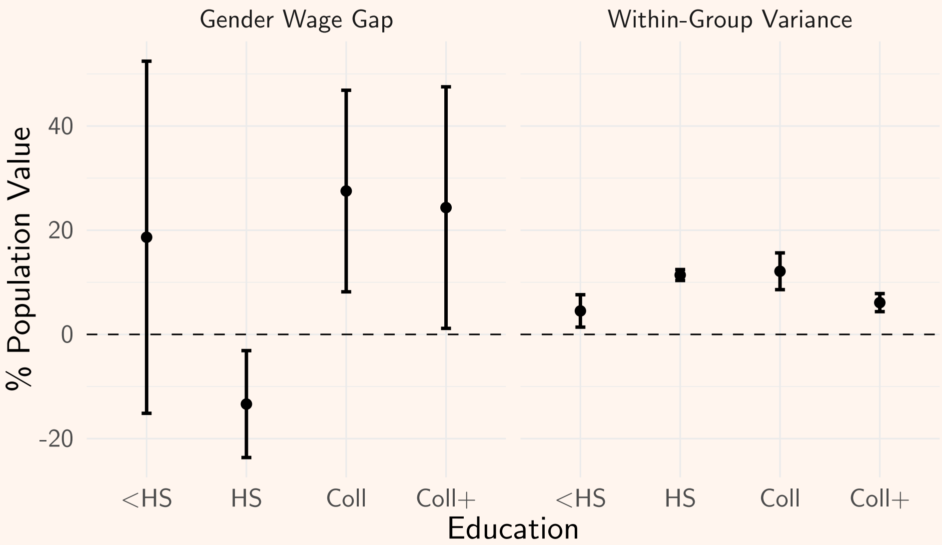
Figure: Wage Inequality by Education Group



Counterfactual Analysis

We consider two counterfactuals:

1. Wage-posting mandate ($p_R = 0$)
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Objectives:

1. Understand contribution of heterogeneity in wage-setting to wage inequality
2. Quantify extent of inefficient mobility
3. Evaluate potential welfare and output effects of wage-setting regulation

Baseline Statistics

Table: The Impacts of Wage-Setting Mandates on Inequality

	% of Data Value		% of Model Baseline	
	$p_R = 0$	$p_R = 1$	$p_R = 0$	$p_R = 1$
$\mathbb{E}[\mathbb{V}[\log(W)\|X]]$	-1.21	-1.3	-11.64	-12.47
	(0.06)	(0.16)	(0.49)	(1.23)
$\mathbb{V}[\mathbb{E}[\log(W)\|X]]$	-0.58	-4.56	-9.19	-72.48
	(0.36)	(0.83)	(4.2)	(6.38)
Gender Wage Gap	-6.78	-2.39	-823.12	-290.14
	(1.27)	(1.96)	(3122.2)	(870.69)
Education Wage Gap	-3.09	-11.13	-19.72	-70.89
	(0.65)	(2.02)	(6.12)	(17.26)
Inefficient Mobility (%)			-100.0	-100.0
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endogenous contact rates

Bargaining and Wage Inequality

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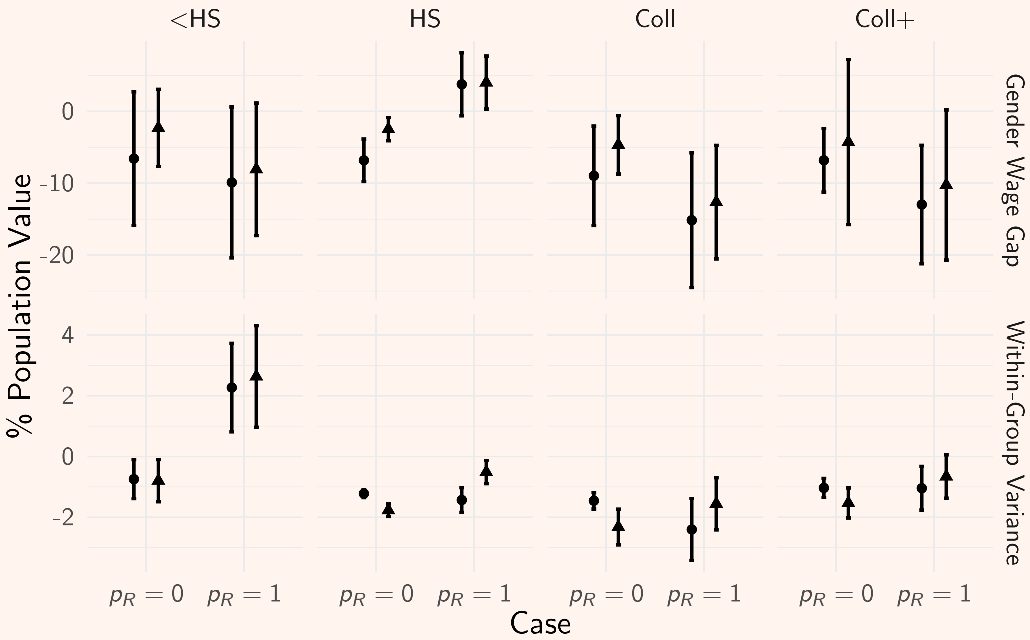
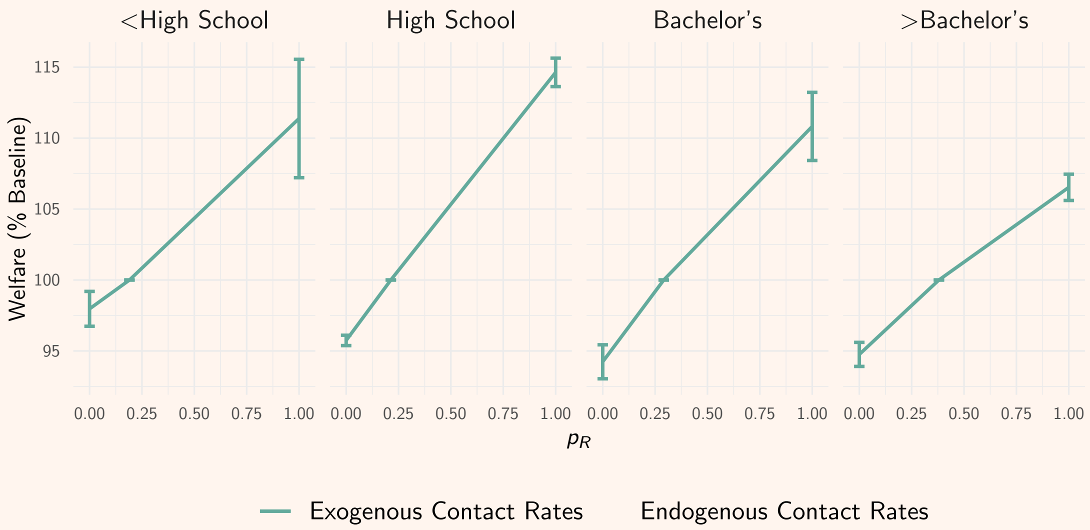
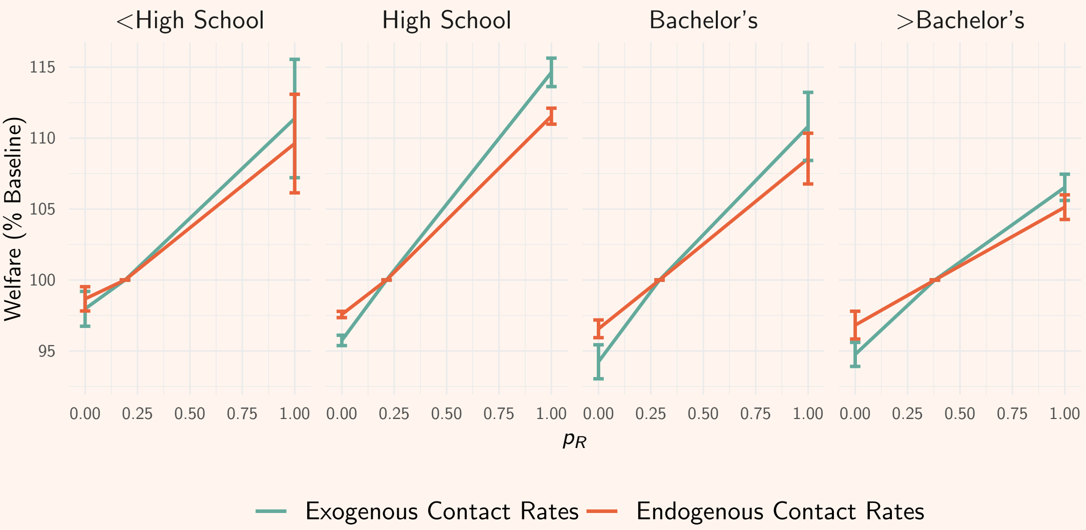


<HS
HS
Coll
Coll+
Gender Wage Gap
Within-Group Variance
% Population Value
0
-10
-20
4
2
0
-2
$p_R = 0$
$p_R = 1$
Case

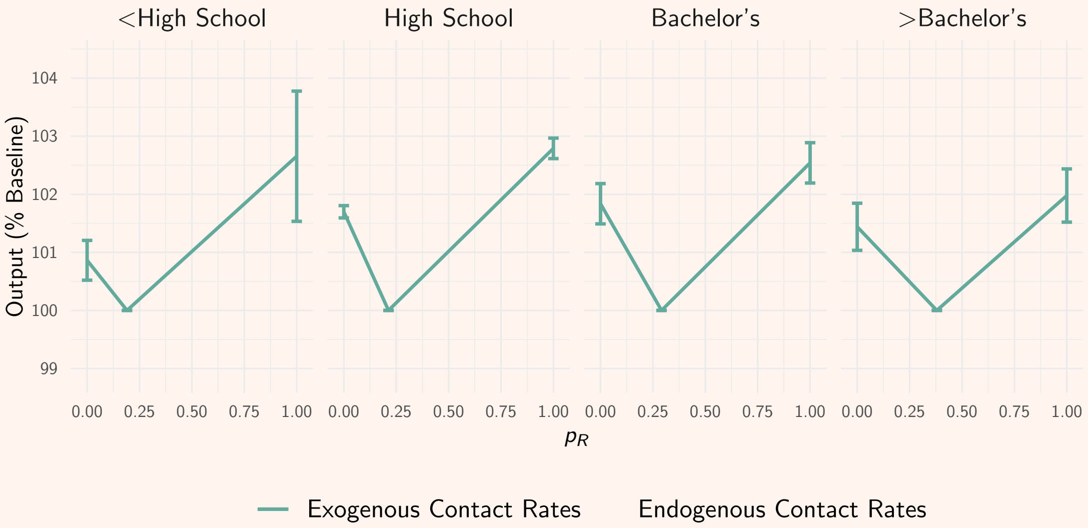
Welfare Impacts



Welfare Impacts



Efficiency Gains



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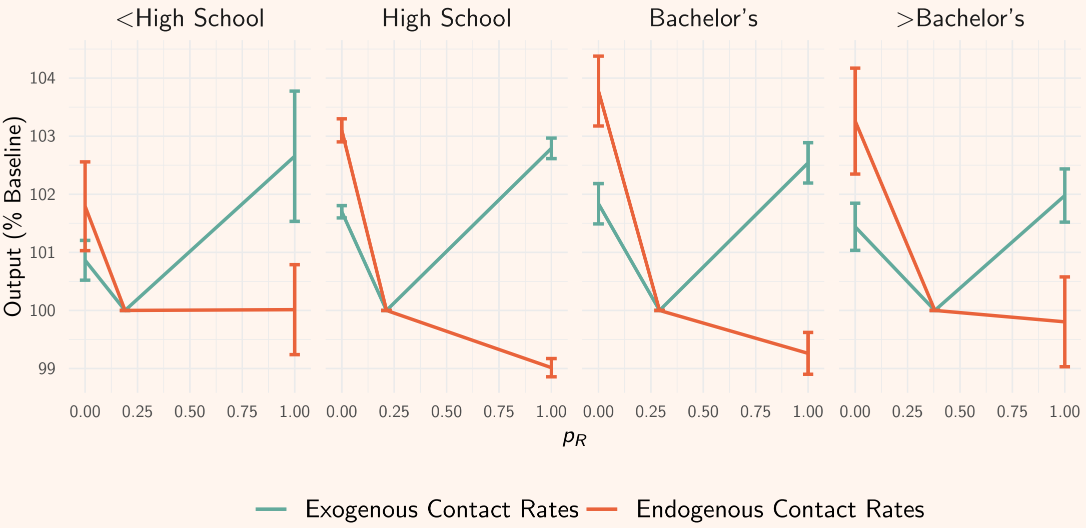

Conclusion

- We play Frankenstein with two classic labor market models (posting vs bargaining and renegotiation)
- We show that the model can explain variation in reported wage-setting across markets
- Differences in bargaining can explain 5-15% of gender wage gap, 12% of residual wage dispersion
- Eliminating bargaining/renegotiation leads to welfare losses, gains in output
- Eliminating posting leads to welfare gains, losses in output
- Caveat: cannot measure congestion externalities

Table: The Impacts of Wage-Setting Mandates on Inequality: Endogenous Contact Rates

	% of Data Value		% of Model Baseline	
	$p_R = 0$	$p_R = 1$	$p_R = 0$	$p_R = 1$
$\mathbb{E}[\mathbb{V}[\log(W)\|X]]$	-1.79	-0.5	-17.11	-4.78
	(0.1)	(0.14)	(0.55)	(1.3)
$\mathbb{V}[\mathbb{E}[\log(W)\|X]]$	-0.6	-4.24	-9.57	-67.38
	(0.43)	(0.78)	(3.78)	(5.93)
Gender Wage Gap	-2.95	-1.29	-358.46	-156.08
	(0.95)	(1.67)	(1468.63)	(304.85)
Education Wage Gap	-1.72	-9.77	-10.93	-62.27
	(0.46)	(1.63)	(3.25)	(14.52)
Inefficient Mobility (%)			-100.0	-100.0
			(0.0)	(0.)
Contact Rates (λ_U)			10.29	-16.1
			(2.35)	(1.6)

exogenous contact rates

Figure: Inefficient Mobility vs Output Gains

Data

- Hall & Krueger (2012):
  + Worker indicates whether bargaining or take-it-or-leave-it offer
  + Demographics, X_{HK}.
- Survey of Consumer Expectations (2015):
  + Worker evaluates probability that firm would match wage offer.
  + Demographics, X_{SCE}
- CPS:
  + Employment rates, wages, employment transitions (EE,EU)
  + Demographics, X_{CPS}.
- General strategy: link averages in $x \in X_{HK} \cap X_{SCE} \cap X_{CPS}$, treat as **market segment**.

back to intro back to identification

Endogenizing contact rates:

- $\lambda_E = \mu_E \lambda_U$, $\lambda_U = f(\nu)$.
- $\nu = \frac{V_R + V_N}{U + \mu_E (1-U)}$
- $q(\nu)\Pi_N(p_R, \kappa, \alpha) \leq c$, $q(\nu)\Pi_R(p_R, \kappa, \alpha) \leq c$, $p_R = \frac{V_R}{V_R + V_N}$.

back to slides

Worker Mobility: “Finding the state is an art”

Fix endog. objects $\langle p_R, \Phi, F_\theta(\cdot|R)\rangle$. Compare:

$$
\begin{aligned}
(\rho+\delta)V_N(w) = w + \lambda_E p_R \int \alpha[T_R(x) - V_N(w)]^+ dF_\theta(x|R) \\
+ \lambda_E(1-p_R)\int [V_N(x) - V_N(w)]^+ d\Phi(x) + \delta V_U
\end{aligned}
$$

$$
\begin{aligned}
(\rho+\delta)T_R(\theta) = \theta + \lambda_E p_R \int \alpha[T_R(x) - T_R(\theta)]^+ dF_\theta(x|R) \\
+ \lambda_E(1-p_R)\int [V_N(x) - T_R(\theta)]^+ d\Phi(x) + \delta V_U
\end{aligned}
$$

One state: max attainable wage. Simple mobility rules. back

Equilibrium Wage-Setting

Assume: firms choose wage-setting ex ante, then draw $\theta \sim F_\theta$. Then:

- $F_\theta(\cdot|R) = F_\theta$.
- Equilibrium wage function φ_N is increasing in θ.
- $\Phi(w) = F_\theta(\varphi_N^{-1}(w))$.
- Defined almost everywhere by ODE.
- Flat at bottom ($\lim_{w \to w^*} \varphi_N'(w) = 0$).

back