The Allocation of Talent and U.S. Economic Growth

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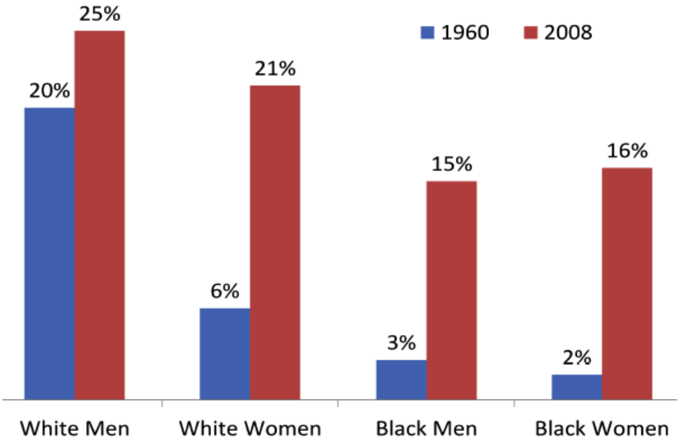
Motivation

- Are equal rights efficiency enhancing?
- Reducing wage gap - gender and race.
- Change in occupational structure in the US since 1960s.

Share of Each Group in High Skill Occupations



High-skill occupations are lawyers, doctors, engineers, scientists, architects, mathematicians and executives/managers.

Central Question

Suppose distribution of 'talent' is same for all groups (race/gender), then

- Misallocation of talent in both 1960 and 2008.
- *But* less misallocation in 2008 than in 1960.

How much productivity growth between 1960 and 2008 was due to improved allocation of talent?

Outline

1. Model
2. Evidence
3. Estimates of barriers
4. Counterfactuals

Model

- N occupations, one of which is "home".
- Individuals belong to a certain group g - gender/race
- Individuals draw talent $\{\epsilon_i\}$ in each occupation i
- Then choose occupation (i) and human capital (h)
  - Preferences
  $$U = c^{\beta}(1 - s)$$
  - Human capital (uses time s and goods e)
  $$h = \bar{h}_{ig} s^{\phi_i} e^{\eta}$$
  $$\bar{h}_{ig} = 1 \text{ (normalize)}$$

Frictions

- Frictions modeled as proportionate taxes
  - τ_{ig}^{h} : goods tax in human capital acquisition
  - τ_{ig}^{w} : wage tax in labor market

- Budget

$$c = (1 - \tau_{ig}^{w}) w_i \epsilon h(s, e) - e(1 + \tau_{ig}^{h})$$

w_i is wage per efficiency unit of human capital in occupation i

Distribution of talent

- $N-$vector $\{\epsilon_i\}$ drawn from a multivariate Frechet distribution

$$F_g(\epsilon_1, \ldots, \epsilon_N) = \exp\left\{ - \left[\sum_{i=1}^{N} \left(\tilde{T}_{ig} \epsilon_i^{-\tilde{\theta}} \right)^{\frac{1}{1-\rho}} \right]^{1-\rho} \right\}$$

  - ρ: correlation between occupational skills (absolute advantage)
  - $\tilde{\theta}$: lower with higher dispersion (comparative advantage)
  - $\tilde{T}_{ig}$: group g's average occupation specific talent

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- Relabel...

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  - ρ: correlation between occupational skills (absolute advantage)
  - θ: lower with higher dispersion (comparative advantage)
  - T_{ig}: group g's average occupation specific talent
- Baseline: $T_{ig} = 1$.

Production

Representative firm combines all occupational inputs

$$Y = \left(\sum_{i=1}^{N} (A_i H_i)^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$$

where

$$H_i = \sum_{g=1}^{G} q_g p_{ig} \mathbb{E} \left[h_{ig} \epsilon_{ig} | \text{Person chooses } i \right]$$

Individual optimization

- Conditional on choice of i,

$$s_i^* = \frac{1}{1 + \frac{1-\eta}{\beta\phi_i}}$$

$$e_{ig}^*(\epsilon) = \left(\frac{\eta(1 - \tau_{ig}^w) w_i s_i^{\phi_i} \epsilon}{1 + \tau_{ig}^h} \right)^{\frac{1}{1-\eta}}$$

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- Occupational choice:

$$\max_i U^*(\epsilon_i)$$

Talent drawn from extreme value $\implies$ $\max_i U^*(\epsilon_i)$ extreme value

Occupational distribution

Propensity of group g to work in occupation i

$$p_{ig} = \frac{\tilde{w}_{ig}^{\theta}}{\sum_{s=1}^{N} \tilde{w}_{sg}^{\theta}}$$

where

$$\tilde{w}_{ig} \equiv T_{ig}^{\frac{1}{\theta}} \times \frac{w_i}{\tau_{ig}} \times s_i^{\phi_i}(1 - s_i)^{\frac{1-\eta}{\beta}}$$

$$\tau_{ig} \equiv \frac{\left(1 + \tau_{ig}^{h}\right)^{\eta}}{1 - \tau_{ig}^{w}}$$

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- Relative, not absolute, returns matter for occupational choice.

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- Relative, not absolute, returns matter for occupational choice.
- Only τ_{ig} identified. Composite measure of frictions.

Average quality of Workers

For a given group,

$$\mathbb{E}\left[h_i\epsilon_i\right] = \gamma\left[\eta^\eta s_i^{\phi_i}\left(\frac{(1-\tau_i^w)w_i}{1+\tau_i^h}\right)^\eta\left(\frac{T_i}{p_{ig}}\right)^{\frac{1}{\theta}}\right]^{\frac{1}{1-\eta}}$$

where

$$\gamma \equiv \Gamma\left(1-\frac{1}{\theta(1-\rho)(1-\eta)}\right)$$

- Direct effect from frictions.
- Indirect selection effect - Average ability falls in p_{ig}.
- Estimation: Within occupation-group quality, therefore earnings, follow Frechet distribution with shape parameter $\theta(1-\rho)(1-\eta)$, therefore γ related to mean.

Average earning by occupation-group

$$\overline{wage}_{ig} \equiv \left(1-\tau_{ig}^{w}\right) w_i \mathbb{E}\left[h_i \epsilon_i\right] = \left(1-s_i\right)^{-1/\beta} \gamma \bar{\eta} \left(\sum_{s=1}^{N} \tilde{w}_{sg}\right)^{\frac{1}{\theta(1-\eta)}}$$

- Only schooling matters for average wage.
- Lower barriers in some occupation identically affect earnings in *all*.
  - Frechet assumption: selection effect cancels out efficiency effect.
- Prediction 1: Convergence in occupational distribution for some jobs should affect wage gap in all jobs.

Wage gap

$$\frac{\overline{wage}_{ig}}{\overline{wage}_{i,wm}} = \left(\frac{\sum_{s=1}^{N} \tilde{w}_{sg}}{\sum_{s=1}^{N} \tilde{w}_{s,wm}} \right)^{\frac{1}{\theta(1-\eta)}}$$

- For every occupation, relative earnings identical.

Occupational distribution

$$\left(\frac{p_{ig}}{p_{i,wm}}\right) = \left(\frac{T_{ig}}{T_{i,wm}}\right)\left(\frac{\tau_{ig}}{\tau_{i,wm}}\right)^{-\theta}\left(\frac{\overline{wage}_g}{\overline{wage}_{wm}}\right)^{-\theta(1-\eta)}$$

- p_i gap, not wage gap, reflects frictions in the presence of selection.

Occupational distribution

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- **Prediction 2**: Weak correlation between wage gap and relative propensity to work.

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- p_i gap, not wage gap, reflects frictions in the presence of selection.
- **Prediction 2**: Weak correlation between wage gap and relative propensity to work.
- Key equation to be taken to data to measure τ_{ig}.

Competitive Equilibrium

1. Given occupations, individuals choose c, e, s to maximize utility.
2. Each individual chooses the utility-maximizing occupation.
3. A representative firm chooses H_i to maximize profits:

$$\max_{\{H_i\}} Y - \sum_{i=1}^{N} w_i H_i$$

4. The occupational wage w_i clears each labor market:

$$H_i = \sum_{g=1}^{G} q_g p_{ig} \mathbb{E}\left[h_{ig}\epsilon_{ig} | \text{Person chooses } i\right]$$

5. Aggregate output is given by the production function.

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Data

- U.S. Census for 1960, 1970, 1980, 1990, and 2000
- American Community Survey for 2006-2008
- 67 consistent occupations, one of which is the "home" sector.
- 4 groups
- Look at full-time and part-time workers, hourly wages.
  - Home sector wage imputed from group composition and average schooling.
- Prime-age workers (age 25-55).

Convergence 1960-2008 - by schooling

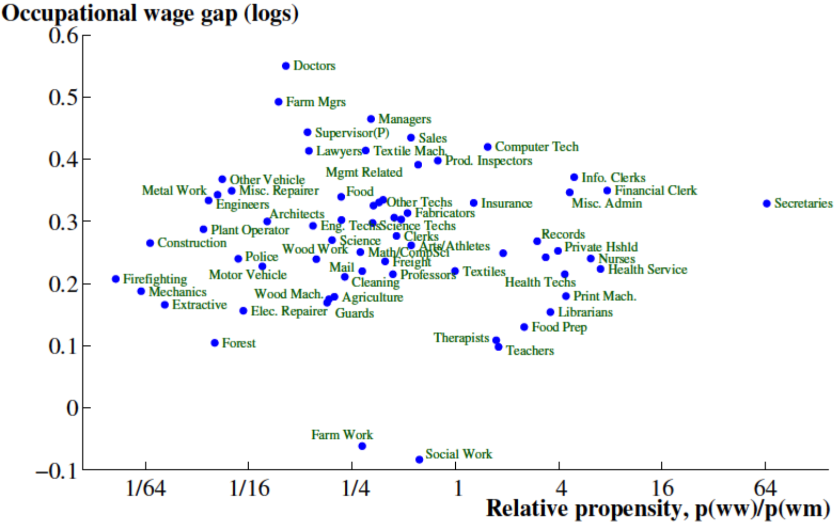
Occupational Similarity to White Men	1960	2008	1960–2008
High-Educated White Women	0.38	0.59	0.21
Low-Educated White Women	0.40	0.46	0.06

Wage Gap vs. White Men	1960	2008	1960–2008
High-Educated White Women	-0.50	-0.24	-0.26
Low-Educated White Women	-0.56	-0.27	-0.29

Prediction 1: Convergence in occupational distribution for some jobs should affect wage gap in all jobs.

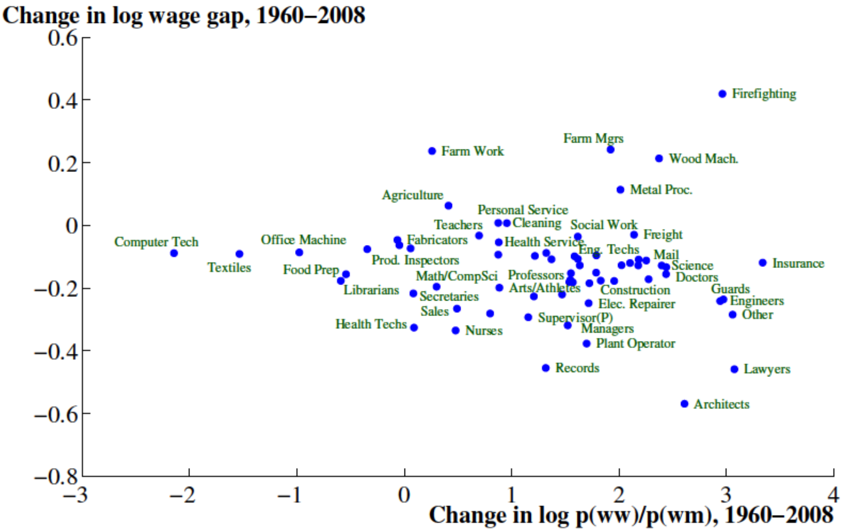
(Occupation similarity takes values between 0 and 1, 1 being identical distributions)

White Women in 1980



Prediction 2: Weak correlation between wage gap and relative propensity to work.

Change for White Women, 1960–2008



Prediction 2: Weak correlation between wage gap and relative propensity to work.

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Estimating θ and η

- Need estimates of θ and η to back out τ_{ig} from

$$\left(\frac{\tau_{ig}}{\tau_{i,wm}}\right) = \left(\frac{T_{ig}}{T_{i,wm}}\right)^{\frac{1}{\theta}} \left(\frac{p_{ig}}{p_{i,wm}}\right)^{-\frac{1}{\theta}} \left(\frac{\overline{wage}_g}{\overline{wage}_{wm}}\right)^{-(1-\eta)}$$

- Recall: Earnings distribution within occupation-group is Frechet with shape parameter $\theta(1-\rho)(1-\eta)$, therefore

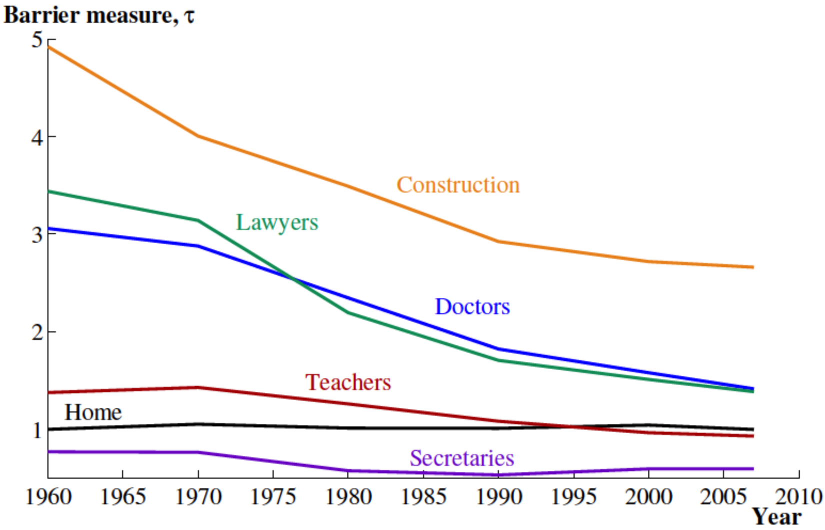
$$\frac{\text{Variance}}{\text{Mean}^2} = \frac{\Gamma\left(1 - \frac{2}{\theta(1-\rho)(1-\eta)}\right)}{\left[\Gamma\left(1 - \frac{1}{\theta(1-\rho)(1-\eta)}\right)\right]^2} - 1$$

- Match this moment.

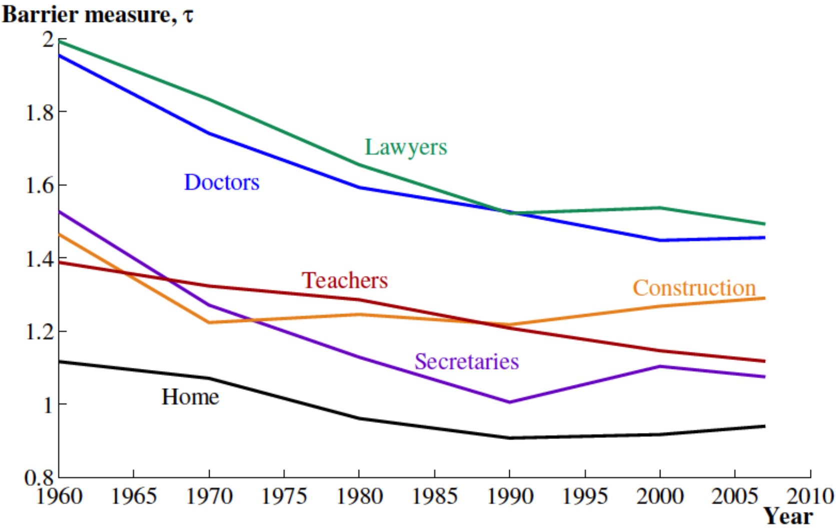
Estimating θ and η

- Using yearly cross-sections
  - Regress log worker wages on occupation-group dummies (66×4)
  - Compute mean and variance of exponent of wage residual
  - Solve for $\theta(1-\rho)(1-\eta)$.
- ρ governs absolute advantage. Adjust for
  - AFQT scores (4%)
  - individual education, hours worked, potential experience
  - transitory wage movements (14%)
- Baseline: $\theta(1-\eta) = 3.44$ and $\eta = \frac{1}{2}$
- Check sensitivity

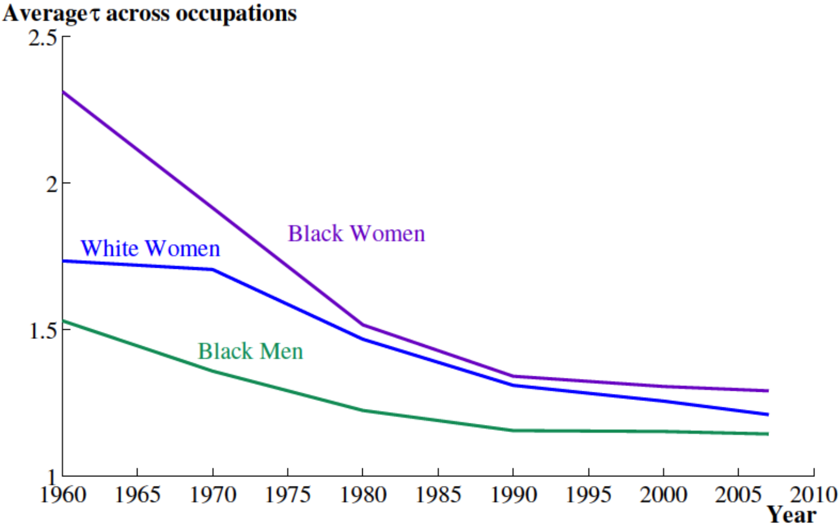
Results: Estimated barriers for white women



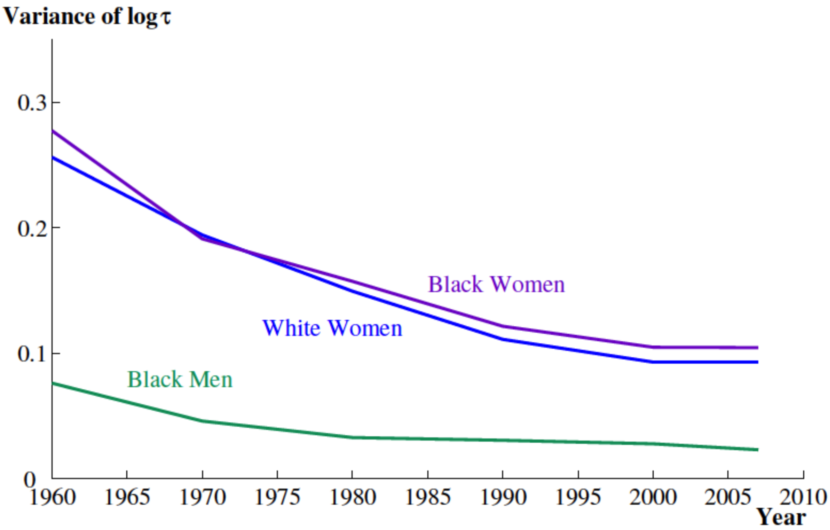
Results: Estimated barriers for black men



Results: Average of barriers across occupations



Results: Variance of barriers across occupations



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Exogenous variables

- $\beta = 0.693$ to match Mincerian return to schooling.
- $\sigma = 3$
- Fit A_i, ϕ_i, τ_{ig} separately for each year. $6N$ moments matched:
  - $\tau_{i,wm} = 1$ for all i
  - p_{ig}
  - earnings gap across groups
  - average wage in each occupation
  - average schooling in lowest-wage occupation (relative ϕ_i identified).
- Cannot distinguish between τ^h and τ^w :
  - τ^h case ($\tau^w = 0$)
  - τ^w case ($\tau^h = 0$)

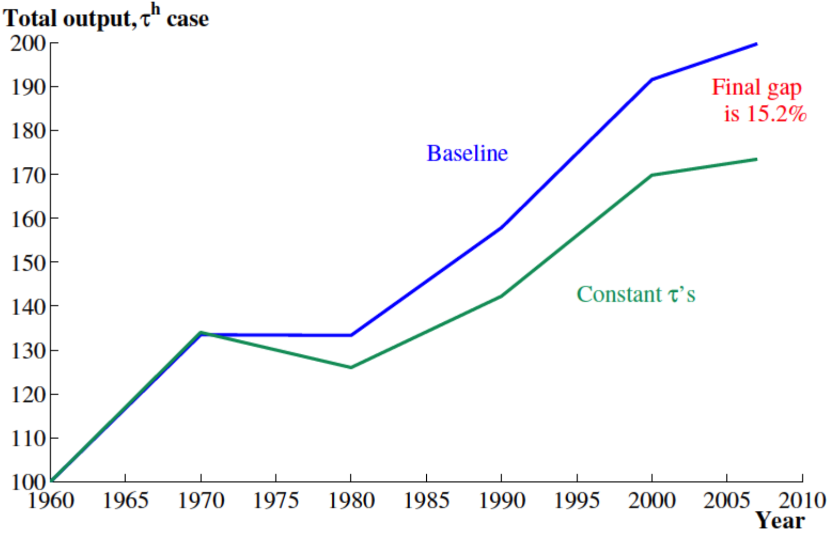
Main findings

Output (as defined by model) grew at 1.47% p.a. between 1960-1980.

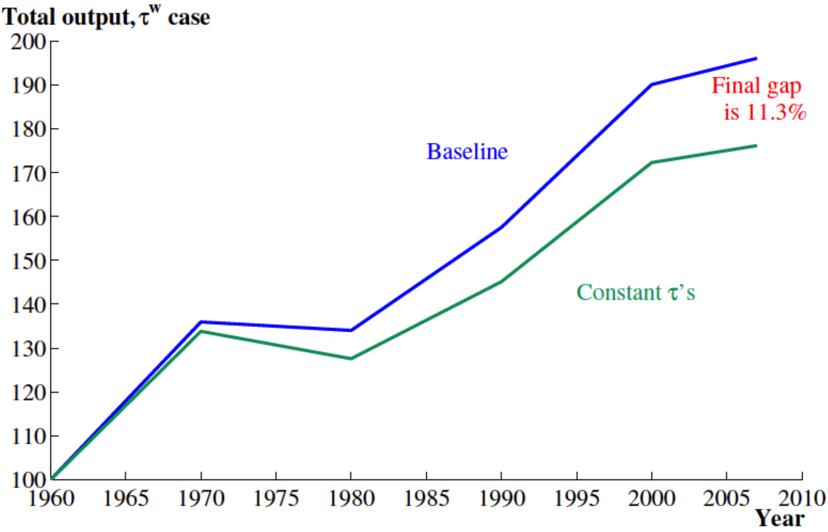
How much of this is explained by reduced frictions?

	τ^h case	τ^w case
Frictions in all occupations	20.4%	15.9%
No Frictions in “brawny occupations”	18.9%	14.1%
Ages 25-35	28.7%	23.6%
Market sector only	26.9%	23.5%

Counterfactual - τ^h case



Counterfactual - τ^w case



Potential remaining gain from frictions

	τ^h case	τ^w case
Cumulative Gain 1960-2008	15.2%	11.3%
Additional gain from removing frictions in 2008	14.3%	10.0%

Wage gap as a measure

- How does wage gap perform as measure of productivity gain?
  - Fix white male wage growth
  - Calculate how much overall growth comes from faster wage growth of others?
  - 13%
- Compare to 20% in τ^w and 16% in τ^h.
- Reasons:
  - Isolate effect of τ from A, ϕ, q
  - GE effect: impact of changing τ on wages of white men
    - 6% reduction in model.

Misallocation vs Human capital

- Two sources of productivity loss in the model
  - misallocation across occupations - dispersion of τ
  - lower average human capital investment - average τ

		τ^h case	τ^w case
1960	No variance	22%	15%
	No barriers	27%	18%
2008	No variance	17%	8%
	No barriers	14%	10%

- Misallocation appears to matter more!

More results

Changing barriers also lead to:

- 40+ percent of WW, BM, BW wage growth
- Essentially all of the narrowing of wage gaps
- 70+ percent of the rise in female LF participation
- Substantial wage convergence between North and South

Robustness: % growth explained in τ^h case

	Baseline				
	$\rho = 2/3$	$\rho = -90$	$\rho = -1$	$\rho = 1/3$	$\rho = .95$
Changing ρ	20.4%	19.7%	19.9%	20.2%	21.0%
	3.44	4.16	5.61	8.41	
Changing θ	20.4%	20.7%	21.0%	21.3%	
	$\eta = 1/4$	$\eta = 0.01$	$\eta = .05$	$\eta = .1$	$\eta = .5$
Changing η	20.4%	20.5%	20.5%	20.5%	20.3%

Robustness: % growth explained in τ^w case

	Baseline				
	$\rho = 2/3$	$\rho = -90$	$\rho = -1$	$\rho = 1/3$	$\rho = .95$
Changing ρ	15.9%	12.3%	13.3%	14.7%	18.4%
	3.44	4.16	5.61	8.41	
Changing θ	15.9%	14.6%	12.9%	11.2%	
	$\eta = 1/4$	$\eta = 0$	$\eta = .05$	$\eta = .1$	$\eta = .5$
Changing η	15.9%	13.9%	14.4%	14.8%	17.5%

Other checks

Gains not sensitive to

- varying consumption vs leisure parameter β
- more detailed set of occupations
- smaller set of occupations

Average Quality of workers

$$\frac{H_{ig}/q_{ig}p_{ig}}{H_{i,wm}/q_{i,wm}p_{i,wm}} = \frac{1-\tau^w_{i,wm}}{1-\tau^w_{ig}}\left(\frac{\overline{wage}_g}{\overline{wage}_{wm}}\right)$$

- Different predictions for τ^h and τ^w.
- τ^w case: In 1960 average woman doctor was higher quality than today!
- Data on relative quality can help identification.

Conclusion

- Preliminary investigation of important dimension of misallocation.
- Identifying τ^h and τ^w.
- Static model.
- Talent and other dimensions of inqeuality - rich vs. poor.