Beliefs and Affirmative Action in Employment

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 $^{^{3}\}mbox{The}$ views expressed do not necessarily reflect the Cleveland Fed or the Federal Reserve System

Motivation

US labor market outcomes differ for Black and White workers

Employment outcomes:

- Emp. (Prime Age, Male): White: 91%, Black: 83%
- Inc. (Prime Age, Male): White: \$48k, Black: \$36k
- "Prestigious" Occupations (2010 ACS, share of race):
 - Management: White workers: 10.7%; Black workers: 4.7%
 - Engineers: 3.2% vs. 1.7%
 - Lawyers: 0.9% vs. 0.25%

Occ. choice explains 58% of race income gap (CPS).

Occupations and Beliefs

What drives occupational choice?

- Wage (benefits, etc.)
- and (beliefs about) probability of employment.

تەندىكەندىكەنلەت 'We Belong in These Spaces': Jackson's Successors Reflect on Her Nomination

Judge Ketanji Brown Jackson, who was confirmed to the Supreme Court on Thursday, will be the first Black woman to serve as a justice. Here's what that means to Black women at her alma mater.

Mariah Watson (Law student): Judge Jackson has carved out a path for Black women in law, Ms. Watson said, and made ... "... the path a little clearer for those who seek to come after her."

Beliefs about Employment Probabilities

- What affects beliefs about probability of employment for Black workers:
 - ► Knowledge that some firms are taste-based discriminators → less likely to invest in skills for those occupations;
 - ► Over time: occupational underrepresentation → pessimism about employment prospects.
- Beliefs that affect hiring probability for firms:
 - Screen workers based on observables, may be biased.
 - ► Fewer Black applicants → difficult to update beliefs, implies signal about capabilities.
- Can policies that change information acquisition alter occupational choice?

Affirmative Action

Why are we going to think about Affirmative Action?

- "Intangible benefits" of seeing Black workers in an occupation.
- Affirmative Action increases information acquisition:
 - ▶ Observe big change in Black employment → less discrim.;
 - Hiring more Black workers \rightarrow firms update views.
- Not necessarily costless:



firms could revise down their beliefs.

This Paper

How do firm beliefs about Black worker productivity

and Black worker beliefs about discrimination affect

Black human capital investment?

income inequality between Black and White workers?

aggregate output?

Can Affirmative Action in employment reduce inequality?

What We Do

- Develop a model with two-sided beliefs and learning:
 - workers have beliefs over the degree of discrimination in the labor market;
 - firms have beliefs over worker productivity by race;
 - Both sides update beliefs after observing labor market outcomes.
- Use model to assess impact of Affirmative Action on
 - Black human capital investment
 - by changing beliefs.

Preview of Findings

- How do firm beliefs about Black worker productivity
- and Black worker beliefs about discrimination affect
 - Black human capital investment?
 - Black workers observe few Black workers in high prestige jobs.
 - \blacktriangleright \rightarrow do not invest.
 - \blacktriangleright \rightarrow firms infer that Black workers are less capable.
 - income inequality between Black and White workers?
 - Reduces Black human capital investment;
 - \blacktriangleright \rightarrow amplifies inequality.
 - aggregate output?
 - Under investment by Black workers;
 - Less competition \rightarrow less investment by White workers.
- Can Affirmative Action in employment reduce inequality?
 - Initially, AA leads to underqualified Black hires.
 - Belief changes: \rightarrow permanent \uparrow in Black human capital inv.

Evidence about Beliefs and Occupational Choice

- Do beliefs about discrimination change occupational choice?
- NLSY79 contains Qs about
 - Aspired occupation (ages 12-16);
 - Occupational prestige index;
 - Belief that discrimination will affect career.
- Empirical Specification:

 $\begin{aligned} \textit{PrestigeIndex}_{i} &= \beta_{0} + \beta_{1} \times \mathbb{1}_{i}^{\textit{Black}} + \beta_{2} \times \mathbb{1}_{i}^{\textit{Belief}} + \beta_{3} \times \mathbb{1}_{i}^{\textit{Black}} \times \mathbb{1}_{i}^{\textit{Belief}} \\ &+ \beta_{4}\textit{AFQT}_{i} + \delta X_{i} + \epsilon_{i} \end{aligned}$

β₁ + β₃ < 0: Beliefs about discrimination leads to less prestigious career aspirations.

Discrimination and Aspirations

Black youths who believe they face discrimination

aspire to less prestigious occupations.

	Prestige Score of Career Aspiration in 1979
Black	6.8900** (1.4183)
Believes Discrimination will Affect Career=1	7.6232** (2.0462)
Black \times Believes Discrimination will Affect Career=1	-8.9059*** (1.4701)

	Coef.	Robust SE	$P \! > \! t $
$\beta_1 + \beta_3 = 0$	-2.016	0.823	0.092

These careers have higher than average Black representation.
Shows up in actual occupations at age 35.

Model Environment

- Static optimization over
 - workers: human capital investment and applying for jobs
 - firms: hiring
- Dynamic belief updating over
 - workers: discrimination (taste and statistical)
 - firms: worker productivity by race.
- Discrete time, period length is cohort.

Static Model Environment

- Static optimization:
- Agents:
 - Black and White wrkrs: innate ability $q \sim Q$, live for 1 period.
 - acquire human capital z at cost C(z,q)
 - ▶ μ discrim. and $(1-\mu)$ non-taste "high prestige" firms, inf. live
 - Non-discrim. "humble" jobs, all produce *z*_L.
- Technology:
 - Random search: average of H_A workers show up at each firm.
 - Choose whether or not to apply at cost $\nu \sim \text{ Gumbel}$;
 - Firms: get noisy signals & "score" applicants;
 - Hire highest score & learn true z, produce z, pay z.
- Priors:
 - Workers: $\hat{\eta}$ frac. of firms are discriminatory.
 - Firms: beliefs $f(z|r) \sim Beta$ over human cap. by race.

Static Optimization: Workers

Three stages:

- 1. Invest in human capital;
- 2. If apply for job at high prestige firm, pay $\nu \sim \textit{ Gumbel};$
- 3. If not hired, apply for humble job.

• Investment decision $(C(z,q) = \frac{z^2}{2q})$:

$$V_{I}(z, r, \hat{P}; \hat{\eta}) = \max_{z} \{ E[V_{A}(z, r, \hat{P}; \hat{\eta})] - \frac{z^{2}}{2q} \}$$
(1)

High-prestige application decision:

$$V_{A}(z,r,\nu,\hat{P};\hat{\eta}) = \max\left\{\hat{P}\left(e|z,r;\hat{\eta}\right)z + (1-\hat{P}\left(e|z,r;\hat{\eta}\right))V_{L} + \nu, V_{L}\right\}$$
(2)

P̂: P(emp. | other worker decisions, beliefs) (fixed pt)
 *V*_L = *P*_L*z*_L + (1 − *P*_L)*b* (think service sector)

Static Optimization: Workers

• Investment decision
$$(C(z,q) = \frac{z^2}{2q})$$
:

$$V_{I}(z, r, \hat{P}; \hat{\eta}) = \max_{z} \{ E[V_{A}(z, r, \hat{P}; \hat{\eta})] - \frac{z^{2}}{2q} \}$$
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(2)

- P̂: P(emp. | other worker decisions, beliefs) (fixed pt)
 P̂ (e|z, r; η̂) depends on beliefs about discrimination
 - ▶ Discrim. beliefs $\hat{\eta} \uparrow \rightarrow \hat{P}(e|z, B; \hat{\eta})$ beliefs \downarrow

$$\blacktriangleright \rightarrow \hat{\eta} \uparrow \rightarrow z^* \downarrow$$

Static Optimization: Firms

• *H* workers show up and consider applying (avg. H_A)

Receive application, get signal of worker productivity:

$$y = z + \epsilon, \epsilon \sim N(0, \sigma_{\epsilon}) \tag{3}$$

Each applicant receives a score hires highest:

$$s(y,r) = E\left[\tilde{z}|y,r\right] - \mathbb{1}_D\gamma r + \mathbb{1}_{AA}r\zeta.$$
 (4)

- 1_D: taste-based discriminator (reduces Black score by γ);
- ▶ $\mathbb{1}_{AA}$: affirmative action policy (increases Black score by ζ);
- $E[\tilde{z}|y, r]$: Beliefs (may be biased) about the worker prod.

Static Optimization: Firms

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 (4)

• Each firm hires
$$\max\{s_1, ..., s_H\}$$
.

Learns true productivity z of hired worker.

•
$$E[\tilde{z}|y,r]$$
 depends on history of hires and observed signals:

$$E[\tilde{z}|y,r] = \int zf(z|y,r)dz = \int z \frac{f(y|z,r)f(z|r)}{f(y|r)}dz \quad (5)$$

Dynamic Updating

- Workers:
 - believe fraction $\hat{\eta}$ of firms discriminate
 - $\hat{\eta}$ is reduced-form estimate of either taste or stat. discrim.
 - Use this to form $\hat{P}(e|z, r)$.

Firms:

- beliefs $f(z|y, r) \sim Beta$ over $z \mid signal y$, race r.
- Information:
 - Workers observe aggregate employment outcomes by race.
 - Firms observe signals of applicants and true prod. of hire.
 - Next gen. updates beliefs using this information, but
 - don't have enough info to solve other side's decision rules
 - (Adaptive expectations).

Dynamic Updating: Workers

Knowledge of decision rules and predicted worker outcomes:

- Know Q dist. and z(q, r).
- Predict hiring decisions of both types of firms.
- Can't distinguish stat and taste → assume E [z|y, r] unbiased.
 Discriminator:

$$s(y,r) = E[z|y,r] - \mathbb{1}_D \gamma r + \mathbb{1}_{AA} r \zeta.$$
(6)

Non-discriminator:

$$s(y,r) = E[z|y,r] + \mathbb{1}_{AA}r\zeta.$$
(7)

Find P̃(e|r; η) = p(s_i(z_i, r) = max{s₁, ..., s_H}) for both types.
 Predicted hiring given η̂:

$$\tilde{P}(e|B;\hat{\eta}) = \hat{\eta}\tilde{P}(e|B,D) + (1-\hat{\eta})\tilde{P}(e|B,N)$$
(8)

Dynamic Updating: Workers II

Next cohort knows history of:

• hiring by race $\{(e_0^B, e_0^w), ..., (e_{t-1}^B, e_{t-1}^w)\}$

▶ predicted outcomes: $\{\tilde{P}_0(e|r; \hat{\eta}_0), ..., \tilde{P}_{t-1}(e|r; \hat{\eta}_{t-1})\}$

• Updates $\hat{\eta}$ to minimize difference between this history:

$$\min_{\hat{\eta}} \sum_{j=0}^{t-1} \left(\frac{\tilde{P}_{j}(e|B;\hat{\eta})}{\tilde{P}_{j}(e|B;\hat{\eta}) + \tilde{P}_{j}(e|W;\hat{\eta})} - \frac{e_{j}^{B}}{e_{j}^{B} + e_{j}^{W}} \right)^{2}$$
(9)

where

$$ilde{P}(e|B;\hat{\eta}) = \hat{\eta} ilde{P}(e|B,D) + (1-\hat{\eta}) ilde{P}(e|B,N)$$
 (10)

• Use new $\hat{\eta}$ to find $\hat{P}(e|z, r; \hat{\eta}) = p(s_i(z_i) = \max\{s_1, ..., s_H\})$

Dynamic Updating: Firms

Firms enter period with beliefs over worker z by race:

• $f(z|r) \sim Beta(\alpha, \beta)$

Formed/updated from previous hiring and interviewing.

• Have prior, $p(\alpha, \beta)$ over *Beta*(.) parameters.

Firms observe from own applicants

Sample $\{y_i, r_i\}_{i=2}^H$ of non-hired applicants and

•
$$(y, z, r)$$
 of hired applicant.

▶ P(X), $X = \{\{y, r\}, (y, z, r)\}$ when $f(z|r) \sim Beta(\alpha, \beta)$:

$$p(X|\alpha,\beta) = \prod_{i=1}^{H_A} \underbrace{\left(\int \frac{e^{-\frac{1}{2}\left(\frac{y_i - \ln(z)}{\sigma}\right)^2}}{2\sqrt{\pi\sigma}} f(z|r) dz\right)^{1-\mathbb{I}_{s_i=\hat{s}}}}_{\text{observed}} \underbrace{f(z|r)^{\mathbb{I}_{s_i=\hat{s}}}}_{\text{observed}} (11)$$

Dynamic Updating: Firms II

$$\mathsf{P}(\mathsf{X}), \ \mathsf{X} = \{\{y, r\}, (y, z, r)\} \text{ when } f(z|r) \sim Beta(\alpha, \beta):$$

$$p(\mathsf{X}|\alpha, \beta) = \prod_{i=1}^{H_{\mathsf{A}}} \underbrace{\left(\int \frac{e^{-\frac{1}{2}} (\frac{y_i - \ln(z)}{\sigma})^2}{2\sqrt{\pi\sigma}} f(z|r) dz\right)^{1-1} \underbrace{f(z|r)^{1}}_{observed}}_{f(z|r) dz} \underbrace{f(z|r)^{1}}_{observed} (12)$$

Then posterior is

$$p(\alpha,\beta|X) = \underbrace{p(X|\alpha,\beta)}_{Likelihood} \times \underbrace{p(\alpha,\beta)}_{Prior}$$
(13)

• Each firm uses $p(\alpha, \beta | X)$ to form f(z|y, r):

$$f(z|y,r) = \int_{\alpha} \int_{\beta} f(z|y,r;\alpha,\beta) p(\alpha,\beta|X) d\alpha d\beta \qquad (14)$$

Dynamic Feedback

- How do beliefs interact?
- Black Workers:

 \blacktriangleright Believe large share of labor market is discriminatory, ightarrow high $\hat{\eta}$

• Causes $\hat{P}(e|z, B)$ to be low for all z

• Investment is costly ightarrow invest less, $z^*\downarrow$

Firms:

- Get signals that are increasing in z.
- Lower $z^* \rightarrow$ Black Workers get lower signals on average.
- Firms place more weight on low prod., less on high prod.
- Simultaneously, few hires to increase information from true z.
- Combined effect of statistical and taste discrim. leads to

worse employment outcomes than predicted,

workers to revise down employment probabilities.

Calibration

External calibration:

 $\hat{\eta}$ (Discrim. Beliefs), Black discrimin. beliefs in 1985: 0.784

 \blacktriangleright μ (Taste), Share supervisors: Blacks lower ability (1977): 0.221

• App. Cost.: $\nu \sim Gumbel(\sigma_{\nu})$

line Ability: $q \sim LN(\mu, \sigma)$

Targets:

B-W: earn., high prest. emp., unemp., 25th/75th AFQT emp.

Pooled: 95/5 earnings.

Calibration results (fit , non-targeted):

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Parameter	Comment	Value
σ_Q	SD of Innate Ability Dist.	1.38
σ_{ϵ}	SD of Signal Noise	0.82
$\sigma_{ u}$	SD of Application Taste Shock	1.38
γ	Taste-Based Discrimination Score Penalty	50
$Pr(e_L)$	Low Prestige Employment Probability	0.79

Findings

Set-up:

Explore time series of 20 cohorts.

▶ Initial conditions: fix $\hat{\eta}$ and let $z_r^0(q)$ and $\hat{P}(e|z, r; \hat{\eta})$ converge.

Explore the mechanisms:

How do observed outcomes affect worker and firm beliefs?

How do those beliefs affect subsequent decisions?

What happens when imposing affirmative action policies?

Understanding the Mechanism: Worker Decisions (1st Cohort)



Figure: Beliefs about employment probabilities given z by race.



Figure: Human capital investment decisions (z) by innate ability (q) and race.

- Lower employment probability \rightarrow
- Less investment over key range (98th pctile).

Understanding the Mechanism: Firm Hiring (1st Cohort)





Figure: Average firm beliefs over human capital (z) by race.



Lower beliefs for Black workers.

Biased downward.

Understanding the Mechanism: Worker Updating (1st Cohort)



Figure: Average firm beliefs over human capital (z) by race.



- $\hat{\eta}$ varies with hiring outcomes.
- Translates in higher emp. prob.

Changes in Worker Beliefs Over Time





• But change in $\hat{\eta}$ correlated with emp. outcomes.

Human Capital Investment



Higher levels of investment for White workers.

Both vary over time, inversely related.

Updated Firm Beliefs





Mean posterior shifts up.

Statistical discrimination Falls.

Policy Experiment

- Affirmative Action policy
 - For one cohort, Black worker scores are adjusted ↑ by ζ = γ (ad-hoc).
 - Implemented after investment decisions by cohort.
- Two Affirmative Action stories to explore:
 - 1. Forces firm hiring decisions:
 - Black workers less qualified $\rightarrow z$ beliefs revised down?
 - White workers displaced?
 - 2. Changes in hiring representation:
 - More Black workers hired, revise beliefs? → more investment?
 - ► More competition → more White investment?

Initial Costs





Figure: White workers displaced Black workers newly hired

Figure: Difference in firm Z beliefs (Black)

A number of more qualified White workers are displaced.

Beliefs decline on average.

Long-Run Benefits



Figure: Diff. in $P(e|B, \hat{\eta})$.



Figure: Human capital investment decisions (z) by innate ability (q) and race.

However, workers revise beliefs up

And invest like White workers.

Long-Run Benefits



Over time, improvement in beliefs persist.

Reflected in employment probability.

Long-Run Benefits



Large improvements in Black Z.

Negligible effects on White Z.

Overall Effects

Value	Base	$t_{AA} = 1$
Ave. $\hat{\eta}$	0.5240	0.1610
Employed Z (Post AA)	18.627	18.913
Black Z Invest	2.359	2.865
White Z Invest	3.162	3.139
Black Employed Z (Post AA)	19.565	19.646
White Employed Z (Post AA)	18.536	18.819
Black High Prestige Emp. Rate	0.0530	0.0840
White High Prestige Emp. Rate	0.0910	0.0860
Average Black Income	1.857	2.127
Average White Income	2.480	2.387

Racial income inequality:

Baseline: Black-White income ratio 75% (same as data).

After Affirmative Action Policy: 89%.

Emp. *z*: up for both Black and White.

Conclusion

- Constructed a model with
 - Endogenous worker beliefs about discrimination and employment;
 - Endogenous firm beliefs about worker productivity.
- Used this model to consider effects of Affirmative Action policies.
- Findings:
 - Affirmative Action may displace more qualified White workers, but little or positive effect on firm beliefs.
 - Has dynamic benefits by increasing Black human capital investment by changing beliefs about employment prospects.
- Brianna Banks (26, Harvard Law): "...[W]e have a lot of Supreme Court justices from Harvard Law School ... I knew that could never be me ... because there had never been one that looked like me before... Now ... the sky is the limit."

Thank You!

Thank you!

Calibration Fit

Moment		Model
Black-to-White Earnings Ratio		0.6591
95/5 Earnings Ratio (Pooled)		5.8454
Black Unemployment Rate	0.0597	0.0401
White Unemployment Rate	0.0285	0.0390
Black Employment Rate (25th AFQT Pctile)		0.9533
Black Employment Rate (75th AFQT Pctile)	0.9600	0.9591
White Employment Rate (25th AFQT Pctile)	0.9600	0.9622
White Employment Rate (75th AFQT Pctile)		0.9595
Ratio of Black-to-White High Prestige Employment Rates		0.5149

→ back

Non-Targeted Fit



Figure: Comparison between $\hat{\eta}$ and discrimination beliefs.

0.82 0.8 0.78 0.76 0.76 Earning Ratio 0.72 0.68 0.66 +-1985 1990 2000 2005 2010 2015 2025 Cohort

Figure: Earnings ratio (Black-to-White)

▶ back