Affirmative Action in a Competitive Economy
and
Effect of Statistical Discrimination...

Moro and Norman (2003) and Moro (2003)

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1 Coate and Loury (1993)

- Statistical Discrimination model: multiple equilibria cause discrimination as a Coordination Failure.
- Policy Question: Can Minorities obtain permanent labor-market gains?
  - Under sufficient condition, Self Confirming Discriminatory beliefs may be removed by Affirmative Action.
  - Affirmative Action (AA) may also correctly fail to eliminate stereotypes (Patronizing Equilibria).
- Limitation: Exogenous Wages Assumption (EWA).

2 Moro and Norman (2003)

- Competitive Markets Assumption differs from (EWA) in the implications of a policy intervention.
- General Equilibrium model with complementary production factors: $[y(C, S)]$
  1. AA affects human capital investment decisions through equilibrium wages.
  2. Cross-group investment externalities.
  3. Investment and *Welfare* implications of Affirmative Action.

3 The model

- Two groups $\{B, W\}$ represent fractions $\left\{\lambda^B, \lambda^W\right\}$ of the population.
- Two tasks $\{C, S\}$. Both are necessary for production.
- Competitive labor market.

$$y(C, S) \text{ homogeneous of degree 1}$$
$$\frac{\partial^2 y}{(\partial C)^2} < 0; \frac{\partial^2 y}{(\partial S)^2} < 0; \frac{\partial^2 y}{\partial C \partial S} > 0$$

- $\theta \in [0, 1]$ Qualification Signal: distribution of "qualified" signal 1st-order dominates "non-qualified" ($\approx MLRP$).

$$F_q(\theta) \leq F_u(\theta) \ \forall \theta$$

- $\left\{\pi^B, \pi^W\right\}$ are firms' priors on the fraction of qualified workers in each group. Posterior distribution:

$$\begin{aligned}
\Pr\left(q \mid \theta, \pi^J\right) &= p\left(\theta, \pi^J\right) = \frac{\pi^J f_q(\theta)}{\pi^J f_q(\theta) + (1 - \pi^J) f_u(\theta)} \\
MLRP &\Rightarrow \frac{\partial p}{\partial \theta} > 0
\end{aligned}$$

4 Timing

1. Workers Invest [$G(c)$ cost distribution]
2. Test is performed [θ realized]
3. Firms simultaneously assign task and competitive wage

5 Equilibrium

Both firms assign tasks using threshold $\theta^J(\pi)$ that solve:

$$\max_{\theta^B, \theta^W} y(C(\theta), S(\theta))$$

where

$$\begin{aligned}
C &= \sum_J \lambda^J \pi^J \left(1 - F_q\left(\theta^J\right)\right) \\
S &= \sum_J \lambda^J \left(\pi^J F_q\left(\theta^J\right) + (1 - \pi^J) F_u\left(\theta^J\right)\right)
\end{aligned}$$

and post wages equal to *expected marginal productivity* (EMP):

$$\begin{aligned} w^J(\theta;\pi) &= \frac{\partial y}{\partial S}(C^*,S^*) \text{ for } \theta < \theta^J(\pi) \\ w^J(\theta;\pi) &= p\left(\theta,\pi^J\right)\frac{\partial y}{\partial C}(C^*,S^*) \text{ for } \theta \geq \theta^J(\pi) \end{aligned}$$

- Note that, by CRTS,

$$\begin{aligned} \nabla y(C^*,S^*) &= \nabla y(r(\pi),1) \\ r(\pi) &= C^*/S^* \end{aligned}$$

- Expected Investment benefits are uniquely determined given firm's prior beliefs (π):

$$I^J\left(\pi^B;\pi^W\right) = \int_0^1 w^J(\theta;\pi)\left(f_q(\theta) - f_u(\theta)\right)d\theta$$

- Any equilibrium must satisfy

$$\pi^J = \Pr\left(c \leq I^J(\pi)\right) = G\left(I^J(\pi)\right) \qquad \text{(EQ)}$$

- **Discriminatory Equilibrium:** a solution to (EQ) where $\pi^B \neq \pi^W$.

6 Cross-Group Externality:

An increase in the fraction of W investors reduces the incentives for Bs.

- When more workers become qualified, the overall ratio of complex to simple labor increases $\left(\partial r(\pi)/\partial \pi^W > 0\right)$.
- Expected productivity of the "cutoff" type must be the same in either task:

$$p\left(\theta^J(\pi),\pi^J\right)\frac{\partial y}{\partial C}(r(\pi),1) = \frac{\partial y}{\partial S}(r(\pi),1)$$

  Since $\frac{\partial y}{\partial C}\downarrow$ and $\frac{\partial y}{\partial S}\uparrow$ (and $MLRP \Rightarrow \partial p/\partial\theta > 0$), it is necessary that:

$$\partial\theta^B(\pi)/\partial\pi^W > 0$$

- Wage in the simple task has increased
- Threshold θ^B has increased too

  $\Rightarrow$ Incentives for B's to invest are reduced $\left(\partial I^B\left(\pi^B,\pi^W\right)/\partial\pi^W \leq 0\right)$.
- (Probably) positive effect of π^W on $I^W\left(\pi^B,\pi^W\right)$.
- Certainly, positive welfare effect of π^W on W's.
- That's why a white majority will want to keep an equilibrium where $\left(\pi^W > \pi^B\right)$.

7 2-Task Affirmative Action

- AA constraint in a symmetric equilibrium: *the proportion of workers below the threshold must be the same in each group.*
- Just add this constraint to firms' maximization problem? The Solution $\hat{\theta}^J(\pi)$ would then be characterized by

$$\frac{\partial y}{\partial S} = \frac{\partial y}{\partial C}\left[\lambda^W p\left(\hat{\theta}^W(\pi), \pi^W\right) + \lambda^B p\left(\hat{\theta}^B(\pi), \pi^B\right)\right]$$

- If $\pi^B < \pi^W$, then $p\left(\hat{\theta}^W(\pi), \pi^W\right) > p\left(\hat{\theta}^B(\pi), \pi^B\right)$ and each group's EMP has jumps $[W\uparrow; B\downarrow]$ at the threshold. Thus, each firm has profitable deviations.
- The *true* equilibrium wage schedules display *Average Payment=Marginal Product.*

$$\begin{aligned}
\hat{w}^J(\theta;\pi) &= p\left(\hat{\theta}^J(\pi), \pi^J\right)\frac{\partial y(\hat{r}(\pi), 1)}{\partial C} \quad \theta < \hat{\theta}^J(\pi) \\
\hat{w}^J(\theta;\pi) &= p\left(\theta, \pi^J\right)\frac{\partial y(\hat{r}(\pi), 1)}{\partial C} \quad \theta \geq \hat{\theta}^J(\pi)
\end{aligned}$$

- This implies that AA policy may reduce Bs' expected earnings.

8 Results and Conclusions

- There always exists a discriminatory equilibrium (for any $\left\{y, f_q, f_u, \lambda^B, \lambda^W\right\}$ there exists $G(c) : \pi^{*B} \neq \pi^{*W}$)
- AA improves incentives to invest for discriminated group

$$\left(w_S^B \downarrow; \hat{\theta}^B \downarrow; \hat{I}^B\left(\pi^B, \pi^W\right)\uparrow\right)$$

- AA reduces stereotypes in the *most discriminatory equilibrium* when λ_B is small... [As $\lambda_B \to 0$, the shadow-cost of AA becomes small and its effects on $\hat{w}^W(\theta;\pi)$ and on $\hat{r}(\pi)$ are negligible. The constraint is met by lowering $\hat{\theta}^B$, which reduces inequality].
- **However:**
  - The changes in human capital investment due to AA may not be large enough to reverse the initial effect.
  - Worry more about the possibility of harming the discriminated group then about the perverse incentive effects (C&L'93).

9 Moro (2003)

- Each worker has an investment cost distribution $g(c)$ and an efficiency endowment $e^j(c)$.
- Production Function is $y\left(\left(\rho^b C^b + \rho^w C^w\right); \left(S^b + S^w\right)\right)$
  - Parameters of g, e, y are Fundamentals vector ϕ.
- Equilibrium vector: $\xi \approx (\theta^*, \pi^*)$

10 Estimation Problem

$$DGP: \text{Fundamentals}(\phi) \to \text{Equilibria}(\xi) \to \text{Data}(\omega)$$

- Multiple Equilibria: $\phi \to \xi$ can be a correspondence.
  - However, $\phi = r(\xi)$, a function.
  - Model is non-stochastic $\Rightarrow$ data ω deterministic given equilibrium ξ.
- Separate estimation problem:
  1. Estimate equilibrium vector (ξ) from wage dtb (ω)
  2. Impose equilibrium restrictions to obtain fundamentals (ϕ)

11 Step 1: Equilibrium

- Goal: to go from wage dtb to a "testable" form $w(\theta \mid \xi)$
- Need an assumption on testing technology:

$$\left[f_q^j(\theta) = \gamma^j \theta^{\left(\gamma^j - 1\right)}\right]; \left[f_u^j(\theta) = \gamma^j (1-\theta)^{\gamma^j - 1}\right] \qquad \text{(Tech)}$$

- Efficiency endowments $e(c)$ and (Tech) allow to invert wage function

$$w^{-1}: \omega \in \mathbb{R}_+ \to \theta \in [0,1]$$

- Since $\theta \sim f(\theta \mid \pi, \gamma)$, can use MLE to solve for equilibrium, where Likelihood function is:

$$L(\omega \mid \theta, \pi, \gamma)$$

12 Step 2: Fundamentals

- Once π is known, so is $I^j(\pi)$ (investment incentive)
- Identifying assumptions:
  - $G(c)$ Uniform; $e^j(c)$ linear;
  - $y(C,S)$ Cobb-Douglas; $\rho^w = 1$
- Apply fix point restrictions $\pi^j = G\left(I^j(\pi)\right)$ and solve for parameters ϕ.

13 Data

- Model is separately estimated at years: 1965; '80; '95.
- Weekly Wage data from Current Population Surveys ('82-'84 CPI standard)

14 Results

- The economy always chose the equilibrium with the lowest wage differentials (though multiple equilibria only in '80).

  $\Rightarrow$ Anti-discrimination policies '65-'95 changed the fundamentals' values.

15 Limitations

- Need uniform dtb assumption of investment costs and productivity across individuals.
- Need non-stochastic model to grant separability (and identification).
- Model is consistent only with a narrow definition of *complex task* (5-15% of all workers)
- Model assumes ρ factor: this may alone explain some of the results.

16 Alternative Interpretation

$Year \downarrow$	π^W	π^B	$\Delta\pi$	ρ^B	$ST(B)$	$ST(W)$	Δw^B_{CB}	Δw^W_{CB}
1965	24	15	9	101	95	86	32	-3
1980	30	24	6	99	94	87	24	-2
1995	27	19	8	96	96	81	25	-2

- Paper: $\Delta\pi \downarrow$, specialization due to ρ, no change of equilibrium $\Rightarrow$ less racist fundamentals.. (but look at Color-Blind).
- An alternative explanation: $\rho \equiv 1$; increase of racist animus (at least in '90s); specialization and investment by blacks are combined effect of discrimination in job allocation and AA policies (a narrow definition of complex task may explain).