Education and Labor Market Discrimination

Kevin Lang and Michael Manove

Boston University/NBER/IZA and Boston University

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Introduction

Theory

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- However, observable investments can signal productivity (Spence, 1973)
  - Value of the signal greater, the less reliable direct observation of productivity
  - Statistical discrimination induce blacks to do more observable investment
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Predictions

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- Results robust to controls for school quality
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Implications

- Wages higher for blacks conditional on AFQT
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  - Except at very high and low AFQT
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- Wages higher for blacks conditional on AFQT
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- Reassess Neal & Johnson (1996)
Model

Sorting Model with Productive School and Partially Observable Productivity

- Continuum of workers of different innate ability levels $a$.
- Each worker must choose a level of education $s$.
- Firms in our model simply follow the rules of a competitive labor market.
- One nonstandard assumption
  - Accuracy of direct observation of productivity increases with schooling.
  - No asymmetric information for sufficiently high schooling.
- Search for a separating equilibrium in which $s(a)$ is continuous and strictly increasing in $a$. 
Log productivity is given by

\[ \ln p^* = q(s, a) + \varepsilon \]

with

\[ q_s > 0, \quad q_{ss} < 0, \quad q_{sa} > 0 \]

Firms observe

\[ p = p^* + u \]

\( \varepsilon \) and \( u \) are independent normals

Let \( \lambda(s) \in [0, 1] \)

\[ \lambda(s) \equiv \sigma^2_\varepsilon / (\sigma^2_\varepsilon + \sigma^2_u(s)) \]

Note: No incentive to signal when \( \lambda = 1 \)
Show that there is a perfect-Bayesian separating equilibrium unique in this class.

Lowest ability type gets same education regardless of information structure.

Anyone who would choose \( s \) such that \( \lambda(s) = 1 \), gets \( s \) regardless of information structure.

All others get more education as information gets worse.
Show that there is a perfect-Bayesian separating equilibrium

- Unique in this class
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Discrimination

Assume

\[ \lambda_b(s) < \lambda_w(s) \]

for all \( s < s^* \) (i.e. \( \lambda(s) < 1 \)).

- Except at low and high ability, blacks get more education than do whites.
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- Blacks earn less than whites except at high and low levels of schooling (not conditional on ability)
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Data

- Follow Neal and Johnson
- NLSY79
- Data from 2000 (supplemented with 1998 and 1996 when missing)
- AFQT
  - Adjusted by age (linearly) and renormed to standard normal
- Education
  - Highest grade completed as of 2000 (1998 or 1996 for those with missing data)
- Use both men and women
- Weights
  - 2000 weight (imputed from 1998 and/or 1996 weights for those with missing data)
Prediction 1: Blacks get more education than whites of similar ability
Table 1
Educational Attainment of Blacks Relative to Non-Hispanic Whites

<table>
<thead>
<tr>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/W</td>
<td>N</td>
</tr>
<tr>
<td>1.17</td>
<td>4,060</td>
</tr>
<tr>
<td>(0.10)</td>
<td></td>
</tr>
<tr>
<td>1.16</td>
<td>2,302</td>
</tr>
<tr>
<td>(0.13)</td>
<td></td>
</tr>
<tr>
<td>1.11</td>
<td>2,336</td>
</tr>
<tr>
<td>(0.16)</td>
<td></td>
</tr>
<tr>
<td>1.20</td>
<td>3,323</td>
</tr>
<tr>
<td>(0.11)</td>
<td></td>
</tr>
<tr>
<td>1.16</td>
<td>1,603</td>
</tr>
<tr>
<td>(0.20)</td>
<td></td>
</tr>
<tr>
<td>0.92</td>
<td>1,719</td>
</tr>
<tr>
<td>(0.14)</td>
<td></td>
</tr>
<tr>
<td>0.94</td>
<td>1,106</td>
</tr>
<tr>
<td>(0.18)</td>
<td></td>
</tr>
<tr>
<td>0.72</td>
<td>508</td>
</tr>
<tr>
<td>(0.26)</td>
<td></td>
</tr>
<tr>
<td>0.98</td>
<td>1,737</td>
</tr>
<tr>
<td>(0.14)</td>
<td></td>
</tr>
<tr>
<td>0.99</td>
<td>1,116</td>
</tr>
<tr>
<td>(0.18)</td>
<td></td>
</tr>
<tr>
<td>0.78</td>
<td>514</td>
</tr>
<tr>
<td>(0.26)</td>
<td></td>
</tr>
<tr>
<td>0.87</td>
<td>913</td>
</tr>
<tr>
<td>(0.21)</td>
<td></td>
</tr>
<tr>
<td>1.04</td>
<td>914</td>
</tr>
<tr>
<td>(0.25)</td>
<td></td>
</tr>
<tr>
<td>1.01</td>
<td>1,385</td>
</tr>
<tr>
<td>(0.17)</td>
<td></td>
</tr>
<tr>
<td>1.05</td>
<td>630</td>
</tr>
<tr>
<td>(0.31)</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Standard errors in parentheses. All estimates control for age.

School inputs: log enrollment, log no. of teacher, log no. of guidance counselors, log library books, % teachers with MA/PhD, % teachers left during the year, average teacher salary.

School composition: % disadvantaged, daily attendance rate, dropout rate, % students Asian, % students black, % students Hispanic.

Family background: mother's education, father's education, no. of sibling, born in U.S., lived in U.S. at age 14, lived in urban area at age 14, mother born in U.S., father born in U.S.

Table 1
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Lang/Manove
Econometric Society Presentation
Prediction 1: Blacks get more education than whites of similar ability

*Prediction 2: Except at high and low levels of ability*
Education and AFQT by Race: Men

![Graph showing the relationship between mean education and standardized AFQT by race for men, with lines for white and black races.](graph.png)

Legend:
- **white**
- **black**
Education and AFQT by Race: Women

Mean Education

Standardized AFQT

white  black

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Prediction 1: Blacks get more education than whites of similar ability
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*Prediction 3: Blacks earn less than whites except at high and low levels of education*
Prediction 1: Blacks get more education than whites of similar ability
Prediction 2: Except at high and low levels of ability
Prediction 3: Blacks earn less than whites except at high and low levels of education

*Prediction 4: Blacks earn more than whites except at high and low levels of ability*
### Table 5
**Black-White Wage Differentials**

<table>
<thead>
<tr>
<th>Young Cohorts</th>
<th>All Regression</th>
<th>Median Regression</th>
<th>AFQT</th>
<th>Education</th>
<th>Family Background, School Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.36</td>
<td>-0.36</td>
<td>-0.42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.04)</td>
<td>(0.03)</td>
<td>(0.03)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1637</td>
<td>3841</td>
<td>4055</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.13</td>
<td>-0.09</td>
<td>-0.10</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.03)</td>
<td>(0.02)</td>
<td>(0.03)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1637</td>
<td>3841</td>
<td>4055</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.17</td>
<td>-0.15</td>
<td>-0.18</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>(0.03)</td>
<td>(0.02)</td>
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<td>1637</td>
<td>3841</td>
<td>4055</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>-0.06</td>
<td>-0.06</td>
<td>-0.05</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td>(0.06)</td>
<td>(0.04)</td>
<td>(0.03)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>732</td>
<td>1876</td>
<td>1955</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>-0.10</td>
<td>-0.11</td>
<td>-0.11</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
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<td>1955</td>
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Other Controls
Table 5
Black-White Wage Differentials
### Table 6

**Determinants of Log Wages**

*Using Controls for School Quality: N&J Wages*

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Student Composition/Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Black</strong></td>
<td>Black</td>
</tr>
<tr>
<td>0.14 (0.03)</td>
<td>-0.14 (0.04)</td>
</tr>
<tr>
<td><strong>Hispanic</strong></td>
<td>Hispanic</td>
</tr>
<tr>
<td>-0.02 (0.05)</td>
<td>-0.01 (0.06)</td>
</tr>
<tr>
<td><strong>Age/10</strong></td>
<td>Age/10</td>
</tr>
<tr>
<td>0.13 (0.04)</td>
<td>0.14 (0.04)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td>Education</td>
</tr>
<tr>
<td>0.06 (0.01)</td>
<td>0.06 (0.01)</td>
</tr>
<tr>
<td><strong>AFQT</strong></td>
<td>AFQT</td>
</tr>
<tr>
<td>0.14 (0.01)</td>
<td>0.15 (0.01)</td>
</tr>
<tr>
<td><strong>log of enrollment</strong></td>
<td>Proportion disadvantaged</td>
</tr>
<tr>
<td>-0.08 (0.04)</td>
<td>-0.08 (0.06)</td>
</tr>
<tr>
<td><strong>log no. of teachers</strong></td>
<td>Proportion daily attendance</td>
</tr>
<tr>
<td>0.02 (0.05)</td>
<td>-0.05 (0.07)</td>
</tr>
<tr>
<td><strong>log no. of counselors</strong></td>
<td>Proportion dropout</td>
</tr>
<tr>
<td>0.10 (0.04)</td>
<td>-0.10 (0.05)</td>
</tr>
<tr>
<td><strong>log. no. of library books</strong></td>
<td>Proportion students black</td>
</tr>
<tr>
<td>0.01 (0.01)</td>
<td>0.08 (0.06)</td>
</tr>
<tr>
<td><strong>Proportion of teachers MA/PhD</strong></td>
<td>Proportion students Hispanic</td>
</tr>
<tr>
<td>0.17 (0.05)</td>
<td>-0.07 (0.10)</td>
</tr>
<tr>
<td><strong>Teacher Salary $0,000s</strong></td>
<td>Proportion students Asian</td>
</tr>
<tr>
<td>0.18 (0.09)</td>
<td>0.82 (0.43)</td>
</tr>
<tr>
<td><strong>Teacher who left/100</strong></td>
<td></td>
</tr>
<tr>
<td>-0.30 (0.13)</td>
<td></td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>N</td>
</tr>
<tr>
<td>2,194</td>
<td>2,223</td>
</tr>
</tbody>
</table>

Notes: Standard errors in parentheses. Weights were the same as the education results in Table 3 and 4.
Some of the principal predictions of theory consistent with data
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Statistical discrimination + educational sorting cannot fully explain data.
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Model implies that conditional on AFQT blacks earn more than whites.
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- Another: reduced unobservable investment
Some of the principal predictions of theory consistent with data:

- Statistical discrimination + educational sorting cannot fully explain data.
  - Model implies that conditional on AFQT blacks earn more than whites.
  - One explanation: education is a pure signal at the margin.
  - Another: reduced unobservable investment.

- Results paper cast doubt on an emerging consensus that the origins of the black-white wage differential lie in premarket rather than labor market factors.