Test Score Differentials and Returns to Literacy Across Race/Gender Groups

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Test Score Differentials and Returns to Literacy Across Race/Gender Groups

Kevin Hollenbeck
Senior Economist, W.E. Upjohn Institute for Employment Research
Adjunct Associate Professor, Economics, Western Michigan University

January 20, 1999

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300 S. Westnedge Avenue
Kalamazoo, Michigan 49007-4686

Prepared for

Special Colloquium in Honor of Martin Luther King Day
Western Michigan University
Kalamazoo, Michigan

W.E. Upjohn Institute
for Employment Research
Sources of Information


- MEAP Anonymous Student Data, 4th Grade, 96/97 and 97/98
  - Math
  - Reading (Info)
  - Reading (Story)

- National Adult Literacy Survey (NALS), 1992
Education is more than ever the passport to decent economic positions.

Dr. Martin Luther King, Jr.
Where Do We Go From Here?, 1967
Concepts of Social Justice

Gap Important?

- Equal Outcomes (Rawls)  No/??
- Equal Opportunity (Nozick)  Yes

- Hybrid: Equal Opportunity Plus Monitoring  Yes
Black-White Test Score Gaps, General Findings

- 0.8 s.d. - 1.2 s.d. gap on many national tests over a period of many years

\[
\text{Gap} = \frac{\text{White Mean} - \text{Black Mean}}{\text{Pop. s.d.}}
\]

- Gap is slightly wider at age 18 than at age 6
- Gap is declining slightly over time (most change over 1976-1988 period)
- Gap is wider at top of test score distribution than at bottom

Source: Jencks and Phillips
Why Gap?

- Not measurement bias
- Not genetic
- Family characteristics/parenting practices/resources
- Education/schooling

Source: Jencks and Phillips

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Trend in Gap

- School desegregation
- Smaller class sizes
- Potentially, pre-school/Head Start

Source: Jencks and Phillips
Consequences of Gap

- Higher education
- Labor market/earnings

Source: Jencks and Phillips

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for Employment Research
MEAP Datasets

• All districts
  – 96/97 (n=126,160)
  – 97/98 (n=124,751)

• 77 districts
  – 96/97 (n=25,639)
## Gaps in 4th Grade MEAP Scores

<table>
<thead>
<tr>
<th></th>
<th>96/97</th>
<th>97/98</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math</td>
<td>0.58 s.d.</td>
<td>0.61 s.d.</td>
</tr>
<tr>
<td>Reading (Story)</td>
<td>0.40 s.d.</td>
<td>0.46 s.d.</td>
</tr>
<tr>
<td>Reading (Info)</td>
<td>0.43 s.d.</td>
<td>0.53 s.d.</td>
</tr>
</tbody>
</table>

*Source: MEAP all districts*

*W.E. Upjohn Institute for Employment Research*
MEAP Math Score Frequency Distributions by Race, 96/97 and 97/98

Source: MEAP All districts

W.E. Upjohn Institute for Employment Research
MEAP Reading (Story) Score Frequency Distribution by Race, 96/97 and 97/98

W.E. Upjohn Institute for Employment Research

Source: MEAP All districts
MEAP Reading (Info) Score Frequency Distribution by Race, 96/97 and 97/98

W.E. Upjohn Institute for Employment Research

Source: MEAP All districts
### Gaps: Contrast of B/W versus Minority/White Gaps

<table>
<thead>
<tr>
<th></th>
<th>96/97 B/W</th>
<th>96/97 Minority/White</th>
<th>97/98 B/W</th>
<th>97/98 Minority/White</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math</td>
<td>0.58 s.d.</td>
<td>0.32 s.d.</td>
<td>0.61 s.d.</td>
<td>0.31 s.d.</td>
</tr>
<tr>
<td>Reading (Story)</td>
<td>0.40 s.d.</td>
<td>0.21 s.d.</td>
<td>0.46 s.d.</td>
<td>0.22 s.d.</td>
</tr>
<tr>
<td>Reading (Info)</td>
<td>0.43 s.d.</td>
<td>0.23 s.d.</td>
<td>0.53 s.d.</td>
<td>0.29 s.d.</td>
</tr>
</tbody>
</table>

Source: MEAP, All districts
Gaps in 4th Grade MEAP Scores, by Gender

<table>
<thead>
<tr>
<th></th>
<th>96/97</th>
<th>97/98</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td>Math</td>
<td>0.61 s.d.</td>
<td>0.51 s.d.</td>
</tr>
<tr>
<td>Reading (Story)</td>
<td>0.40 s.d.</td>
<td>0.40 s.d.</td>
</tr>
<tr>
<td>Reading (Info)</td>
<td>0.47 s.d.</td>
<td>0.43 s.d.</td>
</tr>
</tbody>
</table>

Source: MEAP, All districts

W.E. Upjohn Institute
for Employment Research
MEAP Reading (Info) Score Frequency Distribution by Gender, 97/98

W.E. Upjohn Institute for Employment Research

Source: MEAP, All districts
Gaps in 4th Grade MEAP Scores, by Economically Disadvantaged Status

<table>
<thead>
<tr>
<th></th>
<th>Total Population</th>
<th>96/97</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Math</td>
<td>0.64 s.d.</td>
<td></td>
<td>0.42 s.d.</td>
<td>0.54 s.d.</td>
</tr>
<tr>
<td>Reading (Story)</td>
<td>0.48 s.d.</td>
<td></td>
<td>0.28 s.d.</td>
<td>0.40 s.d.</td>
</tr>
<tr>
<td>Reading (Info)</td>
<td>0.60 s.d.</td>
<td></td>
<td>0.38 s.d.</td>
<td>0.47 s.d.</td>
</tr>
</tbody>
</table>

Source: MEAP, 77 districts

W.E. Upjohn Institute
for Employment Research
MEAP Reading (Info) Score Frequency Distribution by Economically Disadvantaged Status, 96/97

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Source: MEAP, 77 districts
Economically Disadvantaged Status "Gap" in 4th Grade MEAP Scores by Race, 96/97

<table>
<thead>
<tr>
<th></th>
<th>Total Population</th>
<th>Whites</th>
<th>Blacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math</td>
<td>0.56 s.d.</td>
<td>0.47 s.d.</td>
<td>0.37 s.d.</td>
</tr>
<tr>
<td>Reading (Story)</td>
<td>0.50 s.d.</td>
<td>0.44 s.d.</td>
<td>0.35 s.d.</td>
</tr>
<tr>
<td>Reading (Info)</td>
<td>0.56 s.d.</td>
<td>0.47 s.d.</td>
<td>0.36 s.d.</td>
</tr>
</tbody>
</table>

Source: MEAP, 77 districts
Mean 4th Grade MEAP Math Scores by Race, by Percentage White Students in Building

Source: MEAP, All districts

W.E. Upjohn Institute for Employment Research
Mean 4th Grade MEAP Reading (Story) Scores by Race, by Percentage White Students in Building

Source: MEAP, All districts

W.E. Upjohn Institute
for Employment Research
Mean 4th Grade Reading (Info) Scores by Race, by Percentage White Students in Building

Source: MEAP, All districts

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Regression Model for Estimating Gap, while Controlling for Individual, Building, and District Characteristics

- \( \text{SCORE}_{ijk} = a + b \cdot \text{INDIV}_i + c \cdot \text{BLDG}_j + d \cdot \text{DIST}_k + e_{ijk} \)

where \( \text{SCORE}_{ijk} \) = MEAP math, reading (story), or reading (info) score for individual \( i \) who attends building \( j \) in district \( k \)

- \( \text{INDIV}_i = \) characteristics of individual \( i \) (GENDER, RACE, OLDER, ECONDIS, RACE*ECONDIS)

- \( \text{BLDG}_j = \) characteristics of building \( j \) (avg. teacher salary, enrollment, avg. exp/pupil, % on FRL, pupil/teacher ratio, percent white students in 4th grade)

- \( \text{DIST}_k = \) characteristics of district \( k \) (% poverty, dropout rate, foundation grant, graduation rate, number students enrolled in PSAs, revenue/pupil, number students in schools of choice)

- \( e_{ijk} = \) error term

- "Adjusted GAP" = \( \frac{| b_{\text{BLACK}} + b_{\text{INTER}} \cdot \text{ECONDIS} |}{\text{pop s.d.}} \)

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### Adjusted Gaps in 4th Grade MEAP Test Scores, by Gender

<table>
<thead>
<tr>
<th></th>
<th>Total Population</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Math</strong></td>
<td>0.46 s.d.</td>
<td>0.48 s.d.</td>
<td>0.47 s.d.</td>
</tr>
<tr>
<td><strong>Reading (Story)</strong></td>
<td>0.28 s.d.</td>
<td>0.29 s.d.</td>
<td>0.27 s.d.</td>
</tr>
<tr>
<td><strong>Reading (Info)</strong></td>
<td>0.33 s.d.</td>
<td>0.32 s.d.</td>
<td>0.32 s.d.</td>
</tr>
</tbody>
</table>

*Source: MEAP, 77 districts*
Gaps and Adjusted Gaps in 4th Grade MEAP Test Scores

Source: MEAP, 77 districts

W.E. Upjohn Institute
for Employment Research
Underline the sentence that tells what Ms. Chanin ate during the swim.

**Swimmer completes Manhattan marathon**

*The Associated Press*

NEW YORK—University of Maryland senior Stacy Chanin on Wednesday became the first person to swim three 28-mile laps around Manhattan.

Chanin, 23, of Virginia, climbed out of the East River at 96th Street at 9:30 p.m. She began the swim at noon on Tuesday.

A spokesman for the swimmer, Roy Brunett, said Chanin had kept up her strength with “banana and honey” sandwiches, hot chocolate, lots of water and granola bars.”

Chanin has twice circled Manhattan before and trained for the new feat by swimming about 28.4 miles a week. The Yonkers native has competed as a swimmer since she was 15 and hoped to persuade Olympic authorities to add a long-distance swimming event.

The Leukemia Society of America solicited pledges for each mile she swam.

In July 1983, Julie Ridge became the first person to swim around Manhattan twice. With her three laps, Chanin came up just short of Diana Nyad’s distance record, set on a Florida-to-Cuba swim.

Reduced from original copy.

**Source:** NCES (1993)
NALS Example Prose Literacy Tasks (Cont’d)

Level 5 (Difficult)

Identify and summarize the two kinds of challenges that attorneys use while selecting members of a jury.

DO YOU HAVE A QUESTION?

Q. How was I summoned?

A. The basic source for names of eligible jurors is the Driver’s License list which is supplemented by the voter registration list. Names are chosen from these combined lists by a computer in a completely random manner.

Once in the Courthouse, jurors are selected for a trial by this same computer and random selection process.

Q. How is the Jury for a particular trial selected?

A. When a group of prospective jurors is selected, more than the number needed for a trial are called. Once this group has been seated in the courtroom, either the Judge or the attorneys ask questions. This is called voir dire. The purpose of questions asked during voir dire is to ensure that all of the jurors who are selected to hear the case will be unbiased, objective and attentive.

In most cases, prospective jurors will be asked to raise their hands when a particular question applies to them. Examples of questions often asked are: Do you know the Plaintiff, Defendant or the attorneys in this case? Have you been involved in a case similar to this one yourself? Where the answer is yes, the jurors raising hands may be asked additional questions, as the purpose is to guarantee a fair trial for all parties. When an attorney believes that there is a legal reason to excuse a juror, he or she will challenge the juror for cause. Unless both attorneys agree that the juror should be excused, the Judge must either sustain or overrule the challenge.

After all challenges for cause have been ruled upon, the attorneys will select the trial jury from those who remain by exercising peremptory challenges. Unlike challenges for cause, no reason need be given for excusing a juror by peremptory challenge. Attorneys usually exercise these challenges by taking turns striking names from a list until both are satisfied with the jurors at the top of the list or until they use up the number of challenges allowed. Challenged jurors and any extra jurors will then be excused and asked to return to the jury selection room.

Jurors should not feel rejected or insulted if they are excused for cause by the Court or peremptorily challenged by one of the attorneys. The voir dire process and challenging of jurors is simply our judicial system’s way of guaranteeing both parties to a lawsuit a fair trial.

Q. Am I guaranteed to serve on a jury?

A. Not all jurors who are summoned actually hear a case. Sometimes all the Judges are still working on trials from the previous day, and no new jurors are chosen. Normally, however, some new cases begin every day. Sometimes jurors are challenged and not selected.

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You are a marketing manager for a small manufacturing firm. This graph shows your company's sales over the last three years. Given the seasonal pattern shown on the graph, predict the sales for Spring 1985 (in thousands) by putting an "x" on the graph.
NALS Example Quantitative Literacy Tasks

Level 2 (Moderately Easy)

The price of one ticket and bus for "Sleuth" costs how much less than the price of one ticket and bus for "On the Town"?

THEATER TRIP

A charter bus will leave from the bus stop (near the Conference Center) at 4 p.m., giving you plenty of time for dinner in New York. Return trip will start from West 45th Street directly following the plays. Both theaters are on West 45th Street. Allow about 1½ hours for the return trip.

| Time:   | 4 p.m., Saturday, November 20 |
| Price:  | "On the Town" Ticket and bus $11.00 |
|         | "Sleuth" Ticket and bus $8.50 |
| Limit:  | Two tickets per person |

Source: NCES (1993)
NALS Example Quantitative Literacy Tasks (Cont.d)

Level 4 (Moderately Difficult)

Estimate the cost per ounce of the creamy peanut butter. Write your estimate on the line provided.

<table>
<thead>
<tr>
<th>Unit price</th>
<th>You pay</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.8¢ per oz.</td>
<td>1.89</td>
</tr>
<tr>
<td>rich chnky pnt bt</td>
<td></td>
</tr>
<tr>
<td>10693</td>
<td>16 oz.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit price</th>
<th>You pay</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.59 per lb.</td>
<td>1.99</td>
</tr>
<tr>
<td>creamy pnt butter</td>
<td></td>
</tr>
<tr>
<td>10732</td>
<td>20 oz.</td>
</tr>
</tbody>
</table>

Source: NCES (1993)

W.E. Upjohn Institute for Employment Research
Black/White Gap in Adult Literacy Test Scores

<table>
<thead>
<tr>
<th></th>
<th>Using % Correct</th>
<th>Using Plausible Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prose</td>
<td>0.72 s.d.</td>
<td>0.84 s.d.</td>
</tr>
<tr>
<td>Document</td>
<td>0.92 s.d.</td>
<td>0.86 s.d.</td>
</tr>
<tr>
<td>Quantitative</td>
<td>0.99 s.d.</td>
<td>0.95 s.d.</td>
</tr>
</tbody>
</table>

Source: NALS

W.E. Upjohn Institute
for Employment Research
Prose Literacy Plausible Test Score Frequency Distributions by Race

Source: NALS

W.E. Upjohn Institute
for Employment Research
Document Literacy
Plausible Test Score
Frequency Distributions by Race

W.E. Upjohn Institute
for Employment Research
Quantitative Literacy
Plausible Test Score
Frequency Distributions by Race

Quantitative

Source: NALS

W.E. Upjohn Institute
for Employment Research
Black/White Gap in Adult Literacy Test Scores by Gender

<table>
<thead>
<tr>
<th></th>
<th>Using % Correct</th>
<th>Using Plausible Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Prose</td>
<td>0.72 s.d.</td>
<td>0.71 s.d.</td>
</tr>
<tr>
<td>Document</td>
<td>0.99 s.d.</td>
<td>0.88 s.d.</td>
</tr>
<tr>
<td>Quantitative</td>
<td>1.11 s.d.</td>
<td>0.90 s.d.</td>
</tr>
</tbody>
</table>

Source: NALS

W.E. Upjohn Institute
for Employment Research
Regression Model for Estimating Gap, while Controlling for Individual Characteristics and Adjusted Gaps by Gender

- \( \text{LITSCORE}_i = a + b \times \text{INDIV}_i + e_i \)
  
  where \( \text{LITSCORE}_i \) = Percent of PROSE, DOCUMENT, or QUANTITATIVE literacy tasks performed correctly by individual \( i \)
  
  \( \text{INDIV}_i \) = characteristics of individual \( i \)
  
  (gender, race, work experience, years of education, bachelor, high school grad, currently enrolled, years since immigration)

  \( e_i \) = error term

  \[
  \text{Adjusted Gap} = \frac{\left| b_{\text{BLACK}} \right|}{\text{pop s.d.}}
  \]

<table>
<thead>
<tr>
<th></th>
<th>Total Population</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prose</td>
<td>0.54 s.d.</td>
<td>0.54 s.d.</td>
<td>0.55 s.d.</td>
</tr>
<tr>
<td>Document</td>
<td>0.75 s.d.</td>
<td>0.79 s.d.</td>
<td>0.73 s.d.</td>
</tr>
<tr>
<td>Quantitative</td>
<td>0.80 s.d.</td>
<td>0.90 s.d.</td>
<td>0.74 s.d.</td>
</tr>
</tbody>
</table>

Source: NALS

W.E. Upjohn Institute for Employment Research
Gaps and Adjusted Gaps in Literacy Scores

W.E. Upjohn Institute for Employment Research

Source: NALS
Model for Estimating Returns to Literacy and Education

- \( \text{LNWAGE}_i = a + b \cdot \text{CHAR}_i + c \cdot \text{EDUC}_i + d \cdot \text{PCTLIT}_i + e_i \)

where
- \( \text{LNWAGE}_i \) = log of individual \( i \)'s weekly wages last week (for employed individuals only)
- \( \text{CHAR}_i \) = characteristics of individual \( i \)
- \( \text{EDUC}_i \) = educational background of individual \( i \)
- \( \text{PCTLIT}_i \) = percent of prose, document, and quantitative literacy tasks performed correctly by individual \( i \)
- \( e_i \) = error term

- Estimated with and without industry and occupation dummies

- Estimated for total population and separately for blacks and whites

W.E. Upjohn Institute for Employment Research
## Returns to Education by Race

<table>
<thead>
<tr>
<th></th>
<th>Total Population</th>
<th>Blacks</th>
<th>Whites</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(1)</td>
</tr>
<tr>
<td>Years of education</td>
<td>0.06</td>
<td>0.05</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.005)</td>
<td>(0.012)</td>
</tr>
<tr>
<td>Bachelor degree</td>
<td>0.16</td>
<td>0.07</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
<td>(0.026)</td>
<td>(0.067)</td>
</tr>
<tr>
<td>High school grad.</td>
<td>0.19</td>
<td>0.13</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>(0.025)</td>
<td>(0.023)</td>
<td>(0.047)</td>
</tr>
<tr>
<td>Earned GED</td>
<td>0.10</td>
<td>0.06</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
<td>(0.038)</td>
<td>(0.082)</td>
</tr>
<tr>
<td>Currently enrolled</td>
<td>-0.26</td>
<td>-0.24</td>
<td>-0.12</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.019)</td>
<td>(0.043)</td>
</tr>
<tr>
<td>Participated in basic skills</td>
<td>0.14</td>
<td>0.08</td>
<td>0.16</td>
</tr>
<tr>
<td>training in last 12 months</td>
<td>(0.042)</td>
<td>(0.040)</td>
<td>(0.071)</td>
</tr>
<tr>
<td>Industry/occupation controls</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>$\bar{R}^2$</td>
<td>0.3489</td>
<td>0.4249</td>
<td>0.2972</td>
</tr>
</tbody>
</table>

*Source:* Author's regression results using NALS. Standard errors in parentheses.

*W.E. Upjohn Institute*  
for Employment Research
## Returns to Literacy by Race

<table>
<thead>
<tr>
<th></th>
<th>Total Population</th>
<th></th>
<th>Blacks</th>
<th></th>
<th>Whites</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(1)</td>
<td>(2)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Percentage Prose</td>
<td>0.10***</td>
<td>0.06</td>
<td>0.23***</td>
<td>0.20***</td>
<td>0.06</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>(0.043)</td>
<td>(0.041)</td>
<td>(0.077)</td>
<td>(0.073)</td>
<td>(0.051)</td>
<td>(0.048)</td>
</tr>
<tr>
<td>Percentage Document</td>
<td>0.31***</td>
<td>0.23***</td>
<td>0.11</td>
<td>0.04</td>
<td>0.35***</td>
<td>0.27***</td>
</tr>
<tr>
<td></td>
<td>(0.055)</td>
<td>(0.052)</td>
<td>(0.095)</td>
<td>(0.090)</td>
<td>(0.066)</td>
<td>(0.062)</td>
</tr>
<tr>
<td>Percentage Quantitative</td>
<td>0.23***</td>
<td>0.16***</td>
<td>0.21***</td>
<td>0.16***</td>
<td>0.23***</td>
<td>0.15***</td>
</tr>
<tr>
<td></td>
<td>(0.036)</td>
<td>(0.034)</td>
<td>(0.067)</td>
<td>(0.064)</td>
<td>(0.042)</td>
<td>(0.040)</td>
</tr>
</tbody>
</table>

**Source:** Author's regression results using NALS. Standard errors in parentheses.

*** significant at 1% level.

**W.E. Upjohn Institute**
for Employment Research
Conclusions
Conclusions about Gap

1. Gap between blacks and whites exists.

2. Gap wider in math/quantitative literacy

3. Gap (slightly) wider for males
Conclusions: Why Gap (Jencks and Phillips)

- Not testing bias
- Not genetic
- Family characteristics/parenting/resources
  - Home environment/parenting practices
  - Grandparents’ characteristics
  - Not income, single parent
- Schooling/Education
  - Lower teacher expectations that get self-fulfilled
  - Underrepresentation of black teachers
  - Courses taken
  - Stereotype threat
  - Not tracking school district or school characteristics, teacher characteristics, oppositional culture (peer pressure)
Focus on Upper End of Distribution

- Gap wider at upper end of test score distribution
- Gap wider for non-ECDIS
- ECDIS gap wider for whites

Reasons:

-- More resources
-- More time
-- More likely to exhibit parenting practices associated with high test scores
Percentage of Males, Aged 16-64, Who are White, by Years of Education

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Years of education
Percentage of Males, Aged 16-64, Who are White, by Percentiles of Annual Earnings Distribution

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