Trends in racial achievement gaps in the NCLB era

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Demetra Kalogrides
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(supported by IES grant R305D110018,
Andrew Ho, co-Investigator )
Issues

• How have black-white and Hispanic-white achievement gaps changed in the NCLB era?
  ○ We know gaps narrowed substantially in the 1970s and 1980s, but what are more recent trends?

• How do these trends and patterns vary across states?
  ○ And why do they vary across states (not the topic of this paper, but for future work)?

• Has NCLB accountability policy led to a narrowing of achievement gaps?
  ○ Some evidence that NCLB led to some increase in average achievement, especially in math (see Dee & Jacob 2009; Wong, Cook, & Steiner, nd)
  ○ Less evidence (but some, see Gaddis & Lauen, 2011; Lauen & Gaddis, forthcoming) of effects of NCLB on achievement gaps.
Data

State NAEP

- 4th and 8th grade
- Math and Reading
- \( n \approx 1,500 - 2,000 \) per state/year/grade/subject
- Same test across states and over time

State Accountability Test Data

- 2nd-8th grades
- Math and ELA/Reading
- Late 1990s/early 2000s-2010 (K cohorts from \(~1990-2006\) )
- Full state population (large \( n \)'s)
- Tests vary across states and time
Data Structure

Number of Years Exposed to NCLB, by K Cohort and Grade

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Number of Available State-x-Subject Black-White Achievement Gap Estimates, NAEP Math and Reading Test Data, by K Cohort and Grade

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Note: Shading Indicates Years Exposed to NCLB
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Note: Shading Indicates Years Exposed to NCLB
Measuring Gaps

We use the gap measure $V$ (Ho & Reardon, 2012), which is similar to Cohen’s $d$, but with some advantages:

- When the test score distributions of the 2 groups are both normal, $V = d$
- If the test metric is transformed monotonically, so that the 2 distributions are respectively normal, $V$ is unchanged (but $d$ is sensitive to the test metric)
- If the distributions are respectively normal (or even approximately so), $V$ can be computed from group-specific proficiency counts (as are typically available post-NCLB), while $d$ cannot.
- Even if the distributions are not respectively normal, $\hat{V}$ contains very little bias across a wide range of conditions.
Example of Alternative Gap Estimation Methods

White-Black Achievement Gap in NAEP Across Cohort, Math and Reading Pooled

Year of Kindergarten Enry

Cohen's D (W/in State Pooled SD)  V- Full Data  V- Censored Data
Descriptive Models

- Pool the data from a given source (NAEP or state data)
- Model the gap in cohort $c$ in grade $g$ in state $s$ in subject $t$ as a function of
  - a state-specific intercept $(\Gamma + \gamma_s)$,
  - a state-specific linear cohort trend $(\Delta + \delta_s)$,
  - a state-specific linear grade trend $(\Lambda + \lambda_s)$,
  - a subject difference,
- Fit as random-coefficient models, estimating the variance-covariance matrix of $\gamma_s, \delta_s, \lambda_s$
- Weight by the precision of the gap estimate $(1/\sigma_{cgst}^2)$
- $\delta_s$ is the key parameter of interest

$$V_{cgst} = (\Gamma + \gamma_s) + (\Delta + \delta_s)C_c + (\Lambda + \lambda_s)G_g + \beta M_t + e_{scgst}$$
White-Black Achievement Gap Across Cohort, Math and Reading Pooled (HLM Models)
White-Hispanic Achievement Gap Across Cohort, Math and Reading Pooled (HLM Models)

Year of Kindergarten Entry

State Test Data

State NAEP
White-Hispanic Achievement Gap Across Grade, Math and Reading Pooled (HLM Models)
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**Random Effects Parameters**

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Relationship Between State Cohort Slopes and Intercepts
White-Black Gaps, Math and Reading Combined

State Data

NAEP Data
Has NCLB led to reductions in achievement gaps?

First approach:

- Does gap narrow within a cohort, net of grade trends common to all cohorts, the more years the cohort was exposed to NCLB?
- or, equivalently, do gaps in a given grade narrow across cohorts, net of cohort trends common to all grades, the more years a cohort has been exposed to NCLB by that grade?

\[ V_{cgst} = (\Gamma + \gamma_s) + (\Delta + \delta_s)C_c + (\Lambda + \lambda_s)G_g + \beta M_t + \alpha (YRSNCLB_{cg}) + e_{scgt} \]
Has NCLB led to reductions in achievement gaps?

Second approach:

- Do cohort trend in gaps begin to narrow faster after 2002 in states where we expect NCLB would have had the largest effects?

- We expect faster gap narrowing in states with
  - No consequential accountability policy prior to NCLB (as in Dee & Jacob, 2009)
  - No subgroup accountability policy prior to NCLB
  - More minority students in schools meeting minimum subgroup size threshold
  - Lower/higher (?) proficiency thresholds (direction of expected effect is unclear here)
Has NCLB led to reductions in achievement gaps?

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NCLB Effect Models

Model 1 (exposure model with state “treatment” interaction):

\[ V_{cgst} = (\Gamma + \gamma_s) + (\Delta + \delta_s)C_c + (\Lambda + \lambda_s)G_g + \beta M_t \]
\[ + \alpha(YRSNCLB_{cg}) + \eta(YRSNCLB_{cg} \cdot TX_s) + e_{scgt} \]

Model 2 (comparative interrupted time-series model, as in Dee & Jacob, 2009):

\[ V_{cgst} = f_s(TIME_{cg}, G_g, M_t) + \beta(TIME_{cg} \cdot TX_s) \]
\[ + \eta(TIME_{cg} \cdot POSTTIME_{cg} \cdot TX_s) + e_{cgst} \]
### Black-White Gap

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<td>-0.004 -0.002</td>
<td>0.002 -0.004 -0.015 ** -0.001</td>
<td>(0.003) (0.003) (0.003) (0.005) (0.003)</td>
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<td>(0.014) (0.004) (0.017) (0.004) (0.026) (0.006)</td>
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<td>Years Exposed to NCLB</td>
<td>-0.007 -0.010 *** -0.019 *** -0.011 *** 0.011 + -0.007 +</td>
<td>(0.004) (0.003) (0.005) (0.002) (0.006) (0.004)</td>
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<td>0.865 *** 0.742 *** 1.003 *** 0.793 *** 0.717 *** 0.692 ***</td>
<td>(0.032) (0.024) (0.035) (0.024) (0.033) (0.027)</td>
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**Random Effects Parameters**

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**Random Effects Parameters**

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Estimated NCLB Effects on Achievement Gaps (Exposure Models)

Annual Rate of Gap Change (SDs)

B/W (NAEP)  B/W (State) Gap (Data Source)  H/W (NAEP)  H/W (State)
Estimated NCLB Effects on Achievement Gaps (CA Change Models)

Annual Rate of Gap Change (SDs)

Gap (Data Source/Model)

B/W(NAEP/Exp)
B/W (State/Exp)
B/W(NAEP/ITS)
H/W (NAEP/Exp)
H/W (State/Exp)
H/W(NAEP/ITS)
Estimated NCLB Effects on Achievement Gaps (CA Change Models)
Conclusions

- Black-white and Hispanic-white gaps have been narrowing over the last decade, at a rate of roughly $0.005 - 0.010$ standard deviations per year (less than $0.10$ sd’s per decade).
  - Gaps narrowed at 3-4x this rate in 1970s and early 1980s.
  - At this rate, it will take 60-70 years to eliminate the gap.
- There is, however, considerable heterogeneity across states in the size of the gap and the rate at which it is narrowing
  - (why? an important topic for future research)
- Our *preliminary* evidence regarding the effects of NCLB on achievement gaps is mixed
  - Some models suggest NCLB has narrowed black-white gaps in math, in particular; other models suggest no effect of NCLB on black-white gap.
  - Little evidence of effect of NCLB on Hispanic-white gap
  - Our estimates are imprecise in many cases, so effects are unclear.