

# The Black-White Gap in Non-Cognitive Skills Among Elementary School Children

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- Previous research shows that racial disparities in achievement and educational attainment are persistent features of the U.S. educational system.

### Cognitive Skills

- Scott and Sinclair 1997, Fryer and Levitt 2013:  
The emergence of racial gap in children
- Jencks and Phillips 1998; Fryer and Levitt 2004, 2006:  
The evolution of racial gaps in test scores

# Introduction

## The Importance of Non-Cognitive skills

- Heckman and Rubinstein (2001):  
Demonstrate the quantitative importance of non-cognitive skills in determining earnings and educational attainment
- Heckman et. al 2006; Flossmann et. al 2006; Segal 2011:  
Non-cognitive skills play a significant role in determining educational achievement, wages, crime and other outcomes

# Introduction

## Racial Difference in Non-cognitive Skills

- Bertrand and Pan (2013)  
They find that non-cognitive returns to parental inputs differ markedly by gender.
- Goldhammer (2012)  
He estimates a dynamic model of skill formation, finding that non-cognitive skills can explain a portion of the Asian advantage in adult economic outcomes, relative to whites, blacks, and Hispanics.

# Introduction

## Main Results

**Racial Gaps** : We find large, statistically significant black-white gaps in several measures of non-cognitive skills.

**Subjective Measure** : The baseline estimates substantially understate true black-white differences in non-cognitive skills. Teachers might use relative comparisons across students to give grades.

**Latent Racial Gaps** : These corrected gaps are nearly as large as the corresponding gaps in cognitive skills.

**Adult Outcomes** : Non-cognitive skills significantly affect adult outcomes.

### ECLS-K 98-99 and 2010-11 : The Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 and 2010-11

- Cognitive Skills

- Objective: Reading, math and science IRT scores
- Subjective: Teachers reported grades measure students' mastery of specific skills in reading, math, and science.

- Non-Cognitive Skills: Subjective

Each of the five non-cognitive measures averages answers to several questions that are rated on a scale from 1 (never) to 4 (very often).

- Externalizing behaviors
- Approaches to learning
- Self-control
- Interpersonal skills
- Internalizing problems

## Summary Statistics: Non-Cognitive Skills

Variable	Full Sample (N = 10,885)	White (N = 8489)	Black (N = 2396)
<b>Approaches to Learning</b>			
Kindergarten	...	0.063	-0.268
1st Grade	...	0.058	-0.358
2nd Grade	...	0.049	-0.382
3rd Grade	...	0.062	-0.462
<b>Externalizing Problem Behaviors</b>			
Kindergarten	...	0.034	-0.364
1st Grade	...	0.013	-0.419
2nd Grade	...	0.012	-0.462
3rd Grade	...	0.021	-0.500
<b>Self-Control</b>			
Kindergarten	...	0.073	-0.325
1st Grade	...	0.069	-0.383
2nd Grade	...	0.052	-0.440
3rd Grade	...	0.054	-0.530



## Regression Form

$$y_{ij} = \gamma Black_i + X'_{ij}\Theta + \epsilon_{ij}$$

The vector  $X_{ij}$  denotes the control variables included in the regressions, and  $\epsilon_{ij}$  denotes unobserved determinants of skills. The indicator variable  $Black_i$  measures average black-white differences in outcomes  $y_{ij}$ .

# Baseline Estimates of Non-Cognitive Skills

## Approaches to Learning

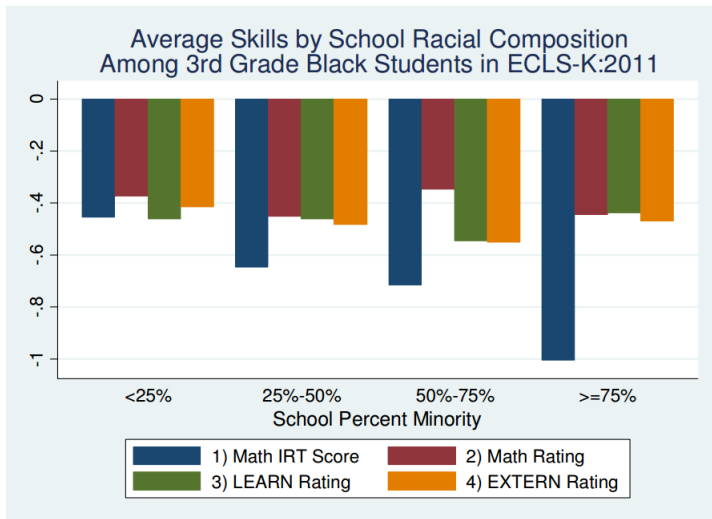
	ECLS-K:2011				ECLS-K:1999		
	(1)	(2)	(3)		(4)	(5)	(6)
Kindergarten	-0.331 (0.026)	-0.109 (0.028)	-0.242 (0.040)	Kindergarten	-0.454 (0.025)	-0.200 (0.035)	-0.242 (0.050)
Grade 1	-0.416 (0.030)	-0.158 (0.032)	-0.284 (0.048)	Grade 1	-0.441 (0.027)	-0.178 (0.037)	-0.251 (0.055)
Grade 2	-0.431 (0.032)	-0.129 (0.034)	-0.175 (0.053)	Grade 3	-0.545 (0.034)	-0.206 (0.047)	-0.350 (0.073)
Grade 3	-0.524 (0.035)	-0.218 (0.037)	-0.274 (0.058)	Grade 5	-0.538 (0.036)	-0.182 (0.052)	-0.221 (0.082)
Home Environment Controls		X	X			X	X
School Fixed Effects			X				X

# Baseline Estimates of Non-Cognitive Skills

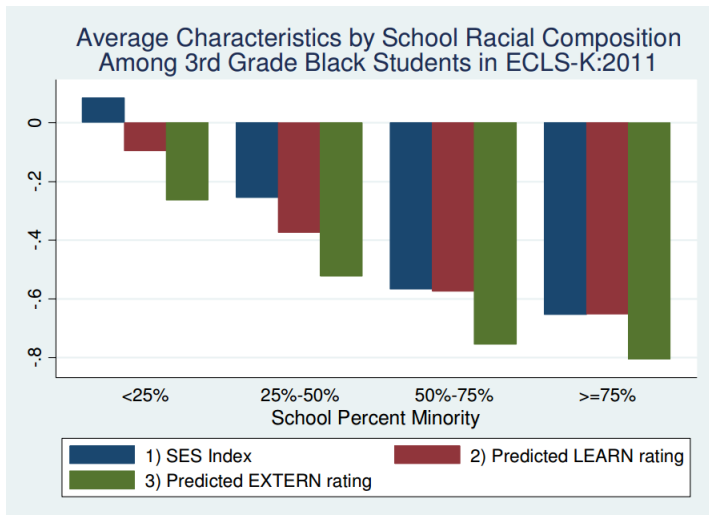
## Externalizing Problem Behaviors

	ECLS-K:2011				ECLS-K:1999		
	(1)	(2)	(3)		(4)	(5)	(6)
Kindergarten	-0.398 (0.027)	-0.172 (0.029)	-0.260 (0.042)	Kindergarten	-0.424 (0.027)	-0.249 (0.035)	-0.270 (0.050)
Grade 1	-0.432 (0.031)	-0.197 (0.034)	-0.274 (0.050)	Grade 1	-0.439 (0.027)	-0.222 (0.037)	-0.198 (0.055)
Grade 2	-0.475 (0.033)	-0.231 (0.036)	-0.205 (0.056)	Grade 3	-0.626 (0.034)	-0.290 (0.047)	-0.354 (0.072)
Grade 3	-0.521 (0.036)	-0.246 (0.039)	-0.201 (0.060)	Grade 5	-0.623 (0.037)	-0.309 (0.053)	-0.221 (0.082)
Home Environment Controls		X	X			X	X
School Fixed Effects			X				X

# Teachers' Subjective Ratings of Cognitive and Non-Cognitive Skills



# Teachers' Subjective Ratings of Cognitive and Non-Cognitive Skills



# Latent Racial Gaps in Non-Cognitive Skills

- The density function of a skill measure  $y_j$ :

$$(1) f(y_j) = \int_s f(y_j|s)dF(s)$$

$$(2) f(y_j) = \int_{\mu_{js}} f(y_j|\mu_{js})dF(\mu_{js})$$

## Condition 1

The distributions of latent mean skills across schools,  $dF(\mu_{js})$ , are common for all skills  $j$  up to a proportionality factor given by the within-school standard deviation of skills  $\sigma_j$ , i.e.,  $dF(\mu_{js}/\sigma_j)$  is constant for all skills  $j$ .

- $\sigma_j^2 / \text{Var}(\tilde{y}_j)$  is the same for all of skills measures.

# Latent Racial Gaps in Non-Cognitive Skills

The Ratio of Between-School Variance to Total Variance of Skill Measures

	Kindergarten (1)	1st Grade (2)	2nd Grade (3)	3rd Grade (4)
<i>Teacher Assessments</i>				
Approaches to Learning	0.085	0.066	0.069	0.079
Externalizing Problem Behaviors	0.116	0.085	0.106	0.144
Self-Control	0.127	0.101	0.088	0.110
Math ARS Rating	0.063	0.093	0.099	0.078
Reading ARS Rating	0.040	0.117	0.070	0.092
Math IRT Test Scores	0.249	0.248	0.296	0.310
Reading IRT Test Scores	0.212	0.277	0.314	0.316

# Latent Racial Gaps in Non-Cognitive Skills

## Approaches to Learning

	(1)	(2)	(3)	(4)	(5)
Kindergarten	-0.331 (0.026)	-0.109 (0.028)	-0.661 (0.025)	-0.294 (0.025)	-0.242 (0.040)
Grade 1	-0.416 (0.030)	-0.158 (0.032)	-0.720 (0.029)	-0.339 (0.030)	-0.284 (0.048)
Grade 2	-0.431 (0.032)	-0.129 (0.034)	-0.736 (0.032)	-0.316 (0.031)	-0.175 (0.053)
Grade 3	-0.524 (0.035)	-0.218 (0.037)	-0.830 (0.034)	-0.396 (0.034)	-0.274 (0.058)
Home Environment Controls		X		X	X
Estimated Latent Distribution			X	X	X
School Fixed Effects					X



# Latent Racial Gaps in Non-Cognitive Skills

## Externalizing Problem Behaviors

	(1)	(2)	(3)	(4)	(5)
Kindergarten	-0.398 (0.027)	-0.172 (0.029)	-0.668 (0.032)	-0.312 (0.034)	-0.260 (0.042)
Grade 1	-0.432 (0.031)	-0.197 (0.034)	-0.708 (0.033)	-0.353 (0.036)	-0.274 (0.050)
Grade 2	-0.475 (0.033)	-0.231 (0.036)	-0.765 (0.033)	-0.399 (0.036)	-0.205 (0.056)
Grade 3	-0.521 (0.036)	-0.246 (0.039)	-0.813 (0.034)	-0.405 (0.036)	-0.201 (0.060)
Home Environment Controls		X		X	X
Estimated Latent Distribution			X	X	X
School Fixed Effects					X

# The Effects of Non-cognitive Skills Gaps on Adult Outcomes

## Males

	HS Graduate	College Degree	Arrest	Unemployment	Log(Wages)
	(1)	(2)	(3)	(4)	(5)
Externalizing Problem Behaviors	0.039 (0.010)	0.019 (0.009)	-0.078 (0.010)	-0.013 (0.005)	-0.024 (0.018)
Approaches to Learning	0.101 (0.008)	0.079 (0.007)	-0.026 (0.008)	-0.008 (0.004)	0.077 (0.014)
Self-Control	-0.022 (0.010)	-0.008 (0.008)	-0.001 (0.010)	0.000 (0.005)	-0.015 (0.017)
Math Test Scores	0.034 (0.017)	0.064 (0.014)	-0.019 (0.017)	-0.013 (0.008)	0.090 (0.030)
Reading Test Scores	0.080 (0.017)	0.027 (0.014)	-0.014 (0.017)	-0.003 (0.008)	0.040 (0.030)

# The Effects of Non-cognitive Skills Gaps on Adult Outcomes

## Females

	HS Graduate	College Degree	Arrest	Unemployment	Log(Wages)
	(1)	(2)	(3)	(4)	(5)
Externalizing Problem Behaviors	0.007 (0.011)	0.005 (0.010)	-0.024 (0.006)	-0.011 (0.005)	0.001 (0.030)
Approaches to Learning	0.122 (0.009)	0.084 (0.007)	-0.007 (0.005)	-0.015 (0.004)	0.156 (0.023)
Self-Control	-0.022 (0.011)	-0.007 (0.009)	-0.018 (0.006)	0.006 (0.004)	-0.050 (0.027)
Math Test Scores	0.007 (0.017)	0.034 (0.014)	0.001 (0.009)	-0.009 (0.007)	0.116 (0.042)
Reading Test Scores	0.109 (0.016)	0.137 (0.014)	-0.006 (0.009)	0.002 (0.007)	0.047 (0.041)

# Conclusion

- Using the ECLS-K, we find evidence of significant differences in non-cognitive skills between white and black students.
- The baseline estimates substantially understate true black-white disparities. Teachers base their grades on the skills of "typical" students in their classrooms and black students are disproportionately likely to attend low-achieving schools.
- To correct the subjective bias, we adopt an approach that assume that the distributions of latent mean skills across schools are common for all skills up to a proportionality factor given by the within-school standard deviation of skills.
- The estimated latent gaps are substantially larger than the corresponding baseline gaps.
- Non-cognitive skills significantly affect adult outcomes.