Test Score Gaps and Non-Cognitive Skills Across Countries: Similarities and Differences

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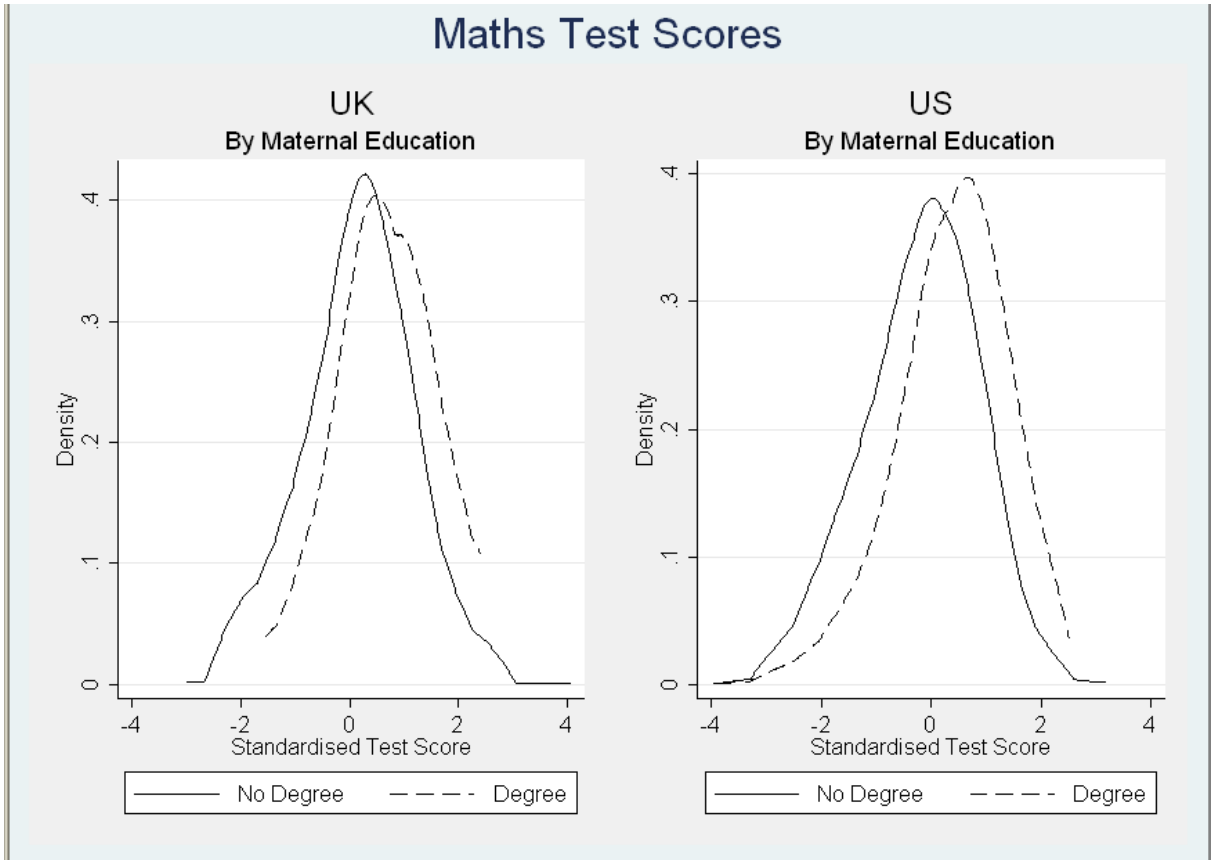
- Do these mechanisms have the same power across countries?
- For now, we focus mainly on the UK and US

Inequalities in Test Score Achievement

- For example, test score gaps by maternal education



Are there regularities in Test Score Gaps in the UK and US?

- We examine inequality in child test score outcomes by
  - Single parent status
  - Ethnicity: non-white, speak English as first language
  - Number of siblings in household
  - Maternal age at birth
  - Maternal education: degree?
  - Child's gender

Are There Regularities in Test Score Gaps in the UK and US? What do we Expect?

- Yes
  - Underlying mechanisms the same
  - Similar position of women in UK and US: labour force participation, legal systems
- No
  - More income inequality in the US than the UK
  - Banks et al (2006): steeper SES health gradient in the US than the UK
  - Welfare state more generous in UK than US
  - Free health care in UK, start education earlier
  - Different **measurement** of test scores and noncognitive skills

Measuring regularities I: Different Measurement of Test Scores

$$t^*_{yit} = \beta_{1y} X_{yit} + u_{yit}$$
$$t_{yit} = t^*_{yit} + v_{yit}$$

- If measurement error in the dependent variable is non-classical
- $\hat{\beta}_{1y} \neq \hat{\beta}_{1y'}$ even though $\beta_{1y} = \beta_{1y'} = \beta_1; y \neq y'$

- We have access to two datasets in which children take **identical tests**
- Compare the children of UK NCDS and US NLSY

Measuring regularities II

$$t_{yit} = \beta_{1y} X_{yit} + u_{yit}$$

- Include many controls
  - Todd & Wolpin, *The Economic Journal*, 2003.
    - compensatory behaviour to an endogenous control
  - If the controls have different meanings in UK and US: we lose our identical comparison
- We control for each family trait in turn (conditional on maternal age at birth)

Data

- **UK 1958 National Child Development Study**
  - All children born March 1958
  - Followed until 2004
  - Their children born 1970s onwards
  - Cognitive and socio-emotional tests in 1991 (mothers aged 33)
- **US 1979 National Longitudinal Survey of Youth**
  - Born 1956-1964
  - Followed until 2006
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  - Cognitive and socio-emotional tests biennially 1986 onwards
- **Identical Test Scores**

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- **Identical Test Scores**
  - Peabody Individual Attainment Tests: Maths, Reading Recognition, Reading Comprehension
  - Standardised to have mean(0), standard deviation(1)

Statistics I

Test Score Descriptives

- Equi-percentile method constructs age 9 sample

UK children achieve higher test scores by

- 4% in Maths and Reading Recognition
- 10% in Reading Comprehension

Statistics II

Inequality Measure Descriptives

Similarities in stocks of

- Lone Parents
- # Siblings
- Mum's age at birth
- Child Gender

Differences in stocks of

- Ethnicity (more non-whites in NLSY)
- Mum's degree (30% in US, 18% in UK)

Regression Results for Reading 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Lone Parents	Non White	Speak English	# siblings	Mum's age at birth	Mum university	Child male
UK	**-0.384**	**0.378**	-0.165	**-0.151**	**-0.033**	**0.487**	-0.090
	(0.136)	(0.176)	(0.255)	(0.051)	(0.016)	(0.091)	(0.071)
N=1023							
US	**-0.526**	**-0.528**	0.082	**-0.108**	**0.036**	**0.533**	**-0.164**
	(0.058)	(0.040)	(0.057)	(0.024)	(0.004)	(0.049)	(0.042)
N=3373							

Dependent variable standardised to mean(0) standard deviation(1)

These similarities are supported in other data

PIRLS 2001: Identical cognitive assessment to 9-year old children
Countries with a deviation from mean effect $<=$**0.1 standard deviation**

# Siblings		Mother's Education		Child Gender	
Argentina	Lithuania	Belize	Latvia	Argentina	Macedonia
Belize	Moldova	Bulgaria	Lithuania	Belize	Moldova
Bulgaria	New Zealand	England	Moldova	Bulgaria	New Zealand
Canada	Norway	France	Norway	Canada	Norway
England	Romania	Germany	Romania	England	Romania
France	Russia	Greece	Scotland	Germany	Russia
Germany	Scotland	Hungary	Singapore	Greece	Scotland
Greece	Singapore	Iceland	Slovak	Hungary	Singapore
Hungary	Slovak Republic	Israel	Slovenia	Iceland	Slovak Republic
Iceland	Slovenia	Italy	Sweden	Iran	Slovenia
Iran	Sweden			Israel	Sweden
Israel	Turkey			Italy	Turkey
Italy				Latvia	
Latvia				Lithuania	
Macedonia		Argentina		France	
		Iran			
		New Zealand			
		Russia			
		Turkey			

Mechanisms

We explore 2 potential mechanisms

- **Non-cognitive / soft skills, eg**
  - Anxiety
  - Antisocial behaviour
  - Hyperactivity

Cross-dimension complementarity in formation of skills

- Cunha, Heckman (2008)

- **Parental Investment, eg**
  - Eat together as a family
  - # books in household
- Carneiro, Salvanes, Tominey (2008)

Mechanisms: Estimation of Non-Cognitive Skills and Parental Investment

Let each Z_{jt} denote measure j in time period t of the latent non-cognitive skill, θ_t^N.

$$Z_{jt} = \gamma_{jt}\theta_t^N + \varepsilon_{jt}; j = 1, ..., m_{jt}$$

Construct an index θ_{yt}^N from measures Z_{jt}
Assume mean independence of ε across time, individuals, measures and uncorrelated with θ_t^N
Measures are **IDENTICAL** in UK and US

Non-Cognitve (Behavioural Problem Index) and Parental Investment Descriptives

	Antisocial	Anxious	Headstrong	Hyperactivity	Peer	Investment
UK	-0.110	0.099	0.080	0.044	0.158	0.286
	0.923	1.079	1.022	0.934	1.090	0.690
US	0.044	-0.006	-0.006	0.003	-0.031	-0.080
	1.022	0.987	0.993	1.018	0.976	1.052

Conditional Regression Results

	UK			US		
	# siblings	Mum university	Child male	# siblings	Mum university	Child male
Raw	**-0.151**	**0.487**	-0.090	**-0.108**	**0.533**	**-0.164**
	(0.051)	(0.091)	(0.071)	(0.024)	(0.049)	(0.042)
+ NC	**-0.143**	**0.384**	-0.001	**-0.104**	**0.467**	**-0.100**
	(0.048)	(0.088)	(0.069)	(0.024)	(0.049)	(0.042)
+ NC + Invest	**-0.123**	**0.341**	-0.010	**-0.082**	**0.414**	**-0.095**
	(0.048)	(0.089)	(0.069)	(0.024)	(0.050)	(0.042)
Coefficient change	-0.008	0.103	-0.089	-0.004	0.066	-0.064
	-0.028	0.146	-0.08	-0.026	0.119	-0.069

Non-Cognitives and Parental Investments reduce test scores by similar magnitudes across countries

Model 1: $t_{yit} = \beta_{1y} X_{yit} + u_{yit}$

Model 2: $t_{yit} = \beta_2 X_{yit} + \beta_3 \theta^N_{yit} + \beta_4 \theta^P_{yit} + u_{yit}$

The change in the coefficient controlling for non-cognitive skills (parallel analysis for parental investment) is given by

$$\hat{\beta}_1 - \hat{\beta}_2 = \hat{\beta}_3 * \frac{cov(X_{yit}, \theta^N_{yt})}{\vee ar(X_{yit})}$$

We see **remarkable similarity** in the UK and the US in

- The **correlations between NC/Parental Investment** and the measure of **inequality**
- The effect of the **NC/Parental Investment upon the test score**

Summary of Results

- We can find similarities across the UK and US in test score gaps by:
  - # siblings
  - Mother's education
  - Sex of child
- Mechanisms
  - The path through which Non-cognitive skills and parental investment drive the test score gap is very similar
  - Personality most important mechanism for gender gap
  - Investment most important for # siblings (although v important for education too)

Future Work

- Dynamic Skill Formation
- Understanding Mechanisms

Non Cognitive Skills

- Antisocial
  - Does the child lie/cheat
  - Does the child bully other kids
- Anxious/Depressed
  - Sad/depressed
  - Does the child worry a lot
- Headstrong
  - Is the child disobedient at home
  - Does the child obsess a lot
  - Is the child stubborn
- Hyperactivity
  - Difficulty conce
  - Restless
- Peer problems
  - Trouble getting on with other kids
  - Not liked by other kids
- Parental investment
  - Number of books in household
  - Eat together as a family
  - Number of trips to museum