Economic Inequality and Academic Achievement

Larry V. Hedges
Northwestern University, USA

Prepared for the 5th IEA International Research Conference, Singapore, June 25, 2013
Social background has been known to be linked to test scores since Binet and Simon.

Sometimes the dependence of test scores on social background leads to relevant variance, sometimes it is irrelevant variance.

The relation of social background to individual’s test scores has been a major research topic for half a century.

This relation has been called the most replicated result in social science.

It is a general result, internationally.
In the US, especially, there have sometimes been innatist interpretations.

There has also been serious work to understand what the causal elements of social class might be (e.g. the Alison Davis tradition, linguistic restrictions).

There has been serious work to understand how home environment factors correlated with social class could explain achievement differences (e.g., Benjamin Bloom).

There has recently been a great deal of more nuanced work focusing on achievement as a function of family income (e.g., Sean Reardon).

We also know that income is related to achievement both within and between countries.
There has been a parallel set of work on the impact of economic inequality and its impact on economic growth.

The argument is that economic inequality in a society can actually hamper economic growth.

That is, countries with greater inequality experience slower economic growth than countries that are more economically egalitarian.

The same kinds of theoretical arguments are beginning to be made about education.
My topic is the relation of economic inequality and the academic achievement of nations.

I will draw on IEA data (TIMSS and PIRLS) and UN and World Bank data on economies.

I look at average achievement, the fraction of students with (internationally benchmarked) high achievement, and low achievement.
How Do We Measure Economic Inequality?

There are lots of ways to do this.

One way is the ratio of the income of the top 10% of the population to that of the bottom 10% of the population (the 90/10 ratio).

The problem with this measure is that it focuses on two specific parts of the income distribution.

Another measure that takes the entire income distribution into account is the Gini coefficient.
Plot the percent of total income against the income percentile, the Lorentz curve.
Plot the percent of total income against the income percentile, the Lorentz curve.
If everyone had the same share of income, the Lorenz curve would be a line at 45°
If one person had all the income, the Lorentz curve would be a backwards L shape.
The real situation is between these two extremes, so the Lorentz curve looks like this.
The Gini coefficient is proportional to the area between the 45 line and the Lorentz curve.

Gini = 54

Line of Equality
The bigger the Gini coefficient, the greater the economic inequality.
The Gini coefficient is not a perfect measure of economic inequality

It does not reflect:

• resources available to all (e.g., health care in some countries)

• regional differences in income and cost of living

• restrictions on availability of resources

But any national measure of inequality must oversimplify to some extent

Results that follow would be qualitatively equivalent with 90/10 ratio used in place of Gini coefficients
Overall, it appears that there is:

- A slight negative relation between average achievement and inequality.
- A negligible relation between inequality and proportion of high achieving students.
- A weak positive relation between inequality and proportion of low achieving students.
- Results are quite similar in 8th grade Math and Science.
How Does National Wealth Affect These Results?

We might measure national wealth by GDP per capita

Fit a regression model like

$$\text{Achievement} = \beta_0 + \beta_1 \text{Gini} + \beta_2 \text{GDP/C} + \beta_3 \text{Gini} \times \text{GDP/C} + \epsilon$$

The interaction is significant in every analysis

(Deleting apparent outliers does not change results much)

It is easiest to summarize the analyses by using a simple dichotomization of countries by GDP per capita
GDP per Capita is an Imperfect Measure of National Wealth

GDP/Capita does not account for the distribution of wealth within countries
2011 TIMSS Math, 4th Grade
2011 TIMSS Science, 4th Grade

Average Science vs. Gini

Points represent individual data points, with a trend line and confidence interval shaded area.

X-axis: Gini
Y-axis: Average Science

Values range from 25 to 45 on the X-axis and from 300 to 600 on the Y-axis.
2011 PIRLS, 4th Grade

Below Median GDP/Capita

Above Median GDP/Capita

% High or above

Gini

25 30 35 40

25 30 35 40 45
2011 PIRLS, 4th Grade

Below Median GDP/Capita

Above Median GDP/Capita

% Low or below

Gini

25  30  35  40  45

25  30  35  40  45
Conclusions

The relation between inequality and achievement is very different in richer versus poorer countries

In poorer countries

• Inequality is negatively related to average achievement

• Inequality is negatively related to proportion of high achieving students

• Inequality is positively related to proportion with low achieving students
Conclusions

In richer countries

- Inequality is weakly related to average achievement
- Inequality is positively related to proportion of high achieving students
- Inequality is unrelated to proportion with low achieving students

But
Important Limitation

These are all associations

We’d like to know if they are causal

A difference in differences analysis (differences in Gini versus difference in achievement) would be more persuasive

There is too little variation to make these analysis credible (countries change slowly)
Thank You!