the widening academic achievement gap between the rich and the poor: new evidence and possible explanations

sean f. reardon
stanford university

november, 2012

social reproduction

- on average, students from families of higher socioeconomic status perform better on academic tests, attain higher levels of schooling, and (as a consequence) attain higher socioeconomic status themselves as adults
- however, the extent of social reproduction – the strength of the correlation between parental socioeconomic status and children's outcomes – is mutable; it may vary across time and place, as a result of social policy, norms, values, and economic conditions.

key questions

- how large is the socioeconomic achievement gap in the US?
  - specifically, how large is the *income* achievement gap?
  - how does it compare to other countries?
- how has this gap changed over the last 50 years?
- what accounts for the evident changes?

data

- all available US studies meeting three criteria:
  - nationally-representative sample
  - standardized achievement test
  - information on family income
- 13 studies included
  - **Project TALENT, NLS72, HS&B, NLSY79, NELS, Add Health, Prospects, NLSY97, ELS, SECCYD, ECLS-K, HSLS, ECLS-B.**
- these include student cohorts born 1943-2001 and tested 1960-2009

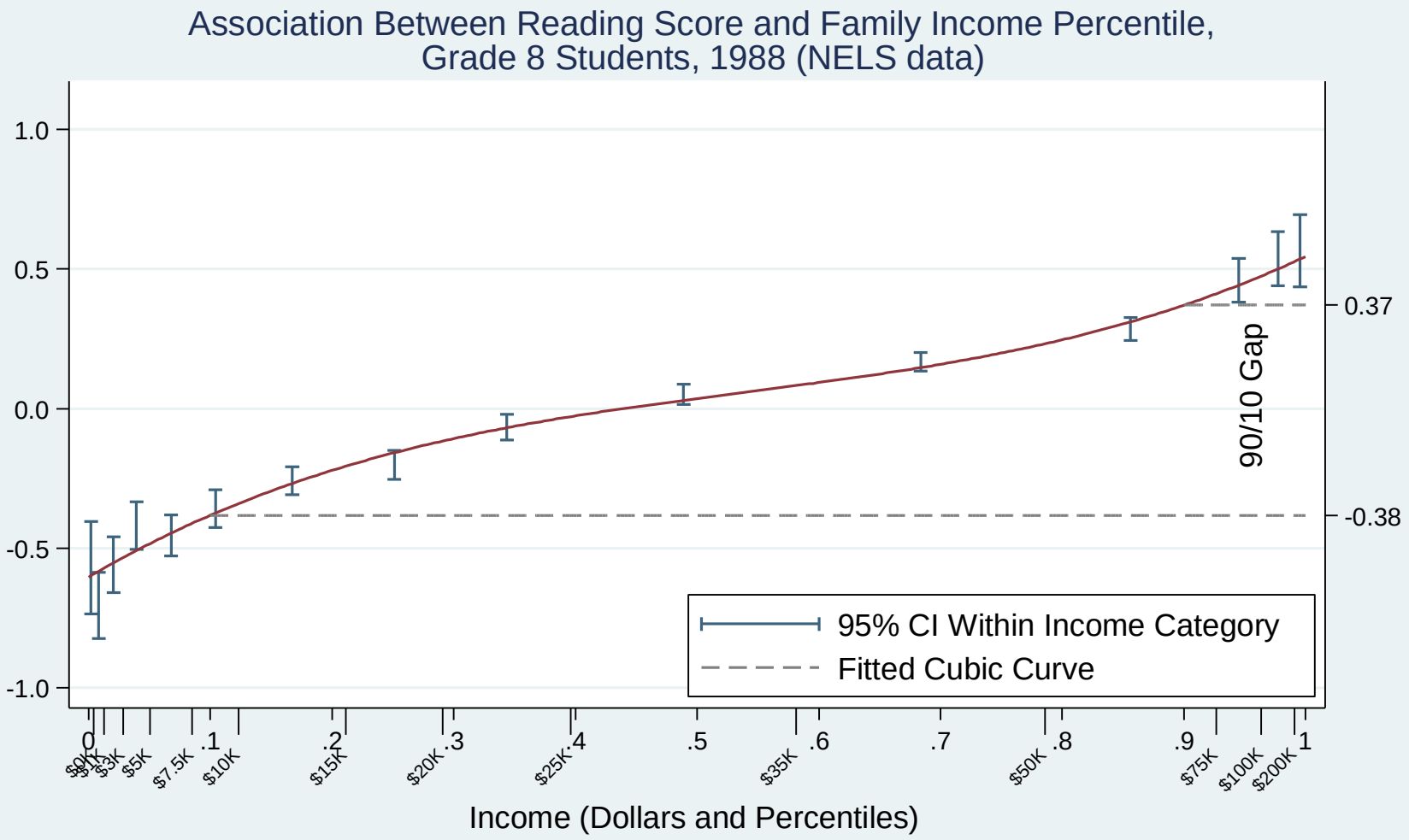
measuring achievement gaps

- Measuring gap between high- and low-income students is complicated…
  - …because income is continuous, not a binary variable
  - …because income distribution changes over time
  - …because income is reported in categories
  - …because income is reported with error
- Comparing gaps across studies is complicated…
  - …because test content differs
  - …because test scales differ
  - …because test reliabilities differ
  - …because samples differ (in age/grade, representativeness)

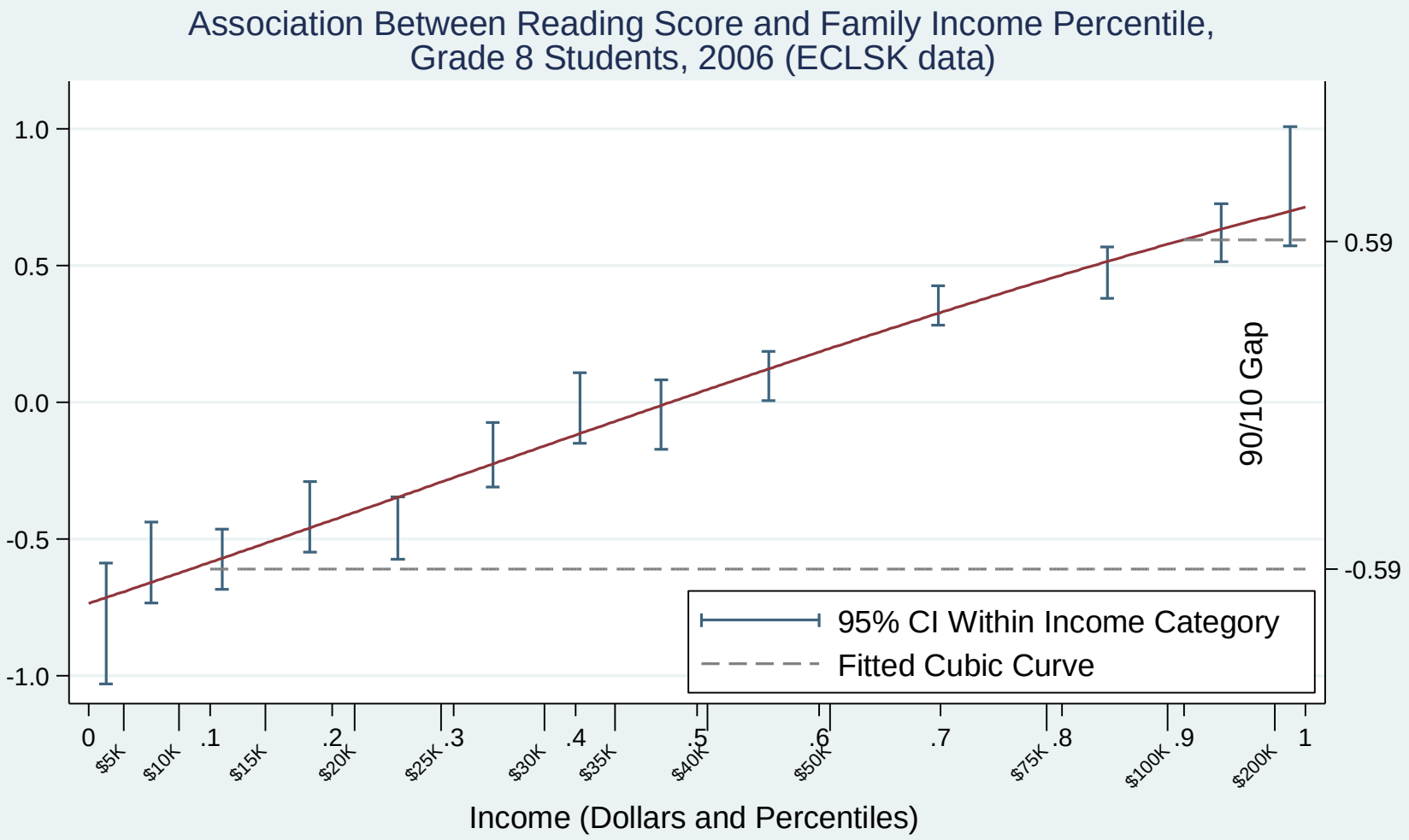
Computing income achievement gaps

- Solution
  - Standardize test scores within each study
  - Use categorical income data to estimate average achievement of children in families at 90th and 10th percentiles of the income distribution
  - Adjust for estimated reliability of income
  - Adjust for estimated reliability of achievement test
  - Use longitudinal studies to assess if/how gaps vary with age/grade
  - Sensitivity analysis to assess sensitivity to different sampling designs
  - Weight estimates by inverse of sampling variance

computing income achievement gaps



computing income achievement gaps



Adjusting gaps for reliability

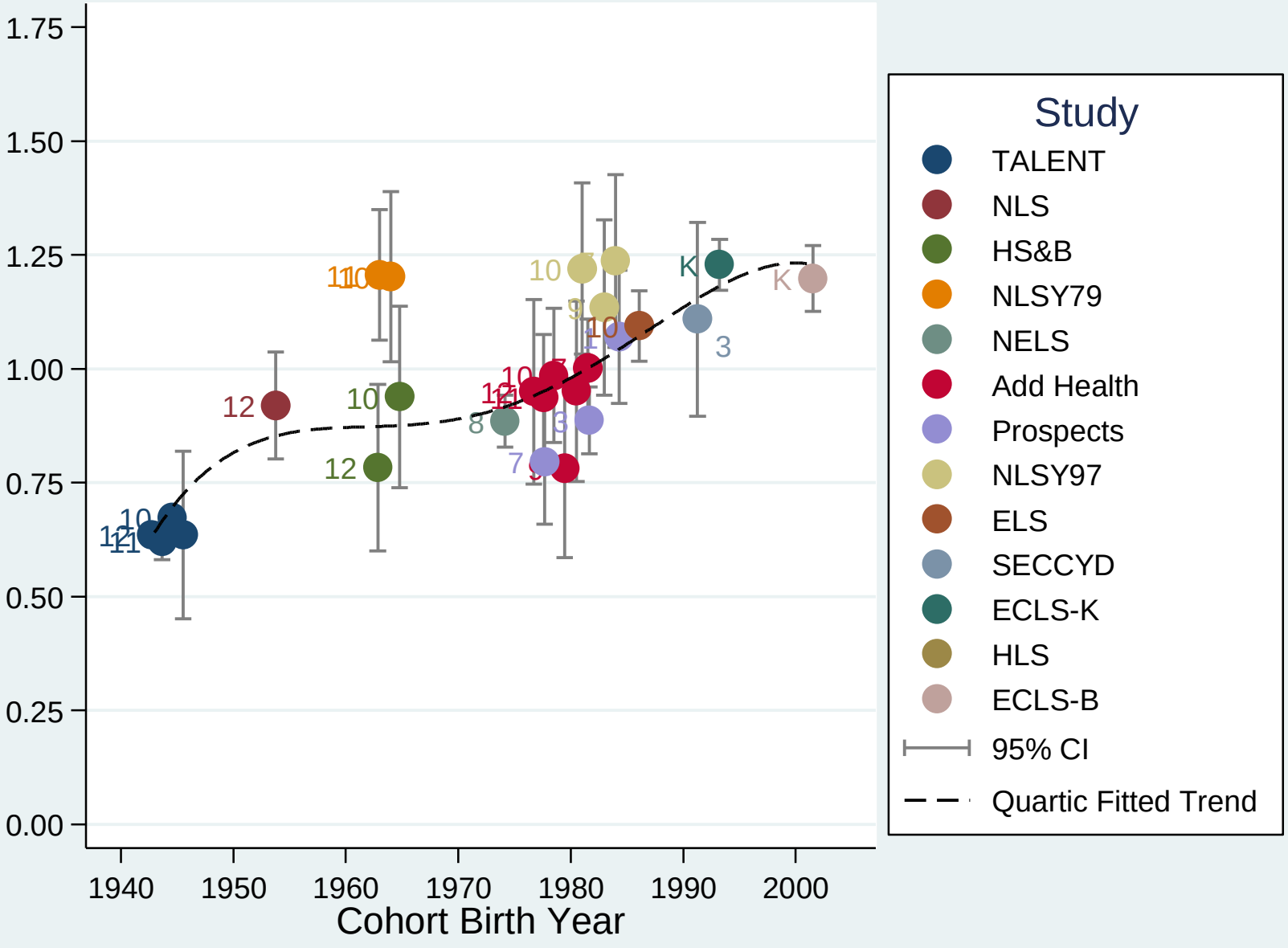
- Both income and academic achievement are measured with error
- Both will cause estimated gaps to be biased toward zero (attenuation bias)
- Obtain estimates of reliability of income ($\hat{r}_{inc}$) and reliability of achievement ($\hat{r}_{ach}$) for each test
- Disattenuated gap estimate is:

$$\hat{G}^* = \frac{\hat{G}}{\sqrt{(\hat{r}_{inc} \cdot \hat{r}_{ach})}}$$

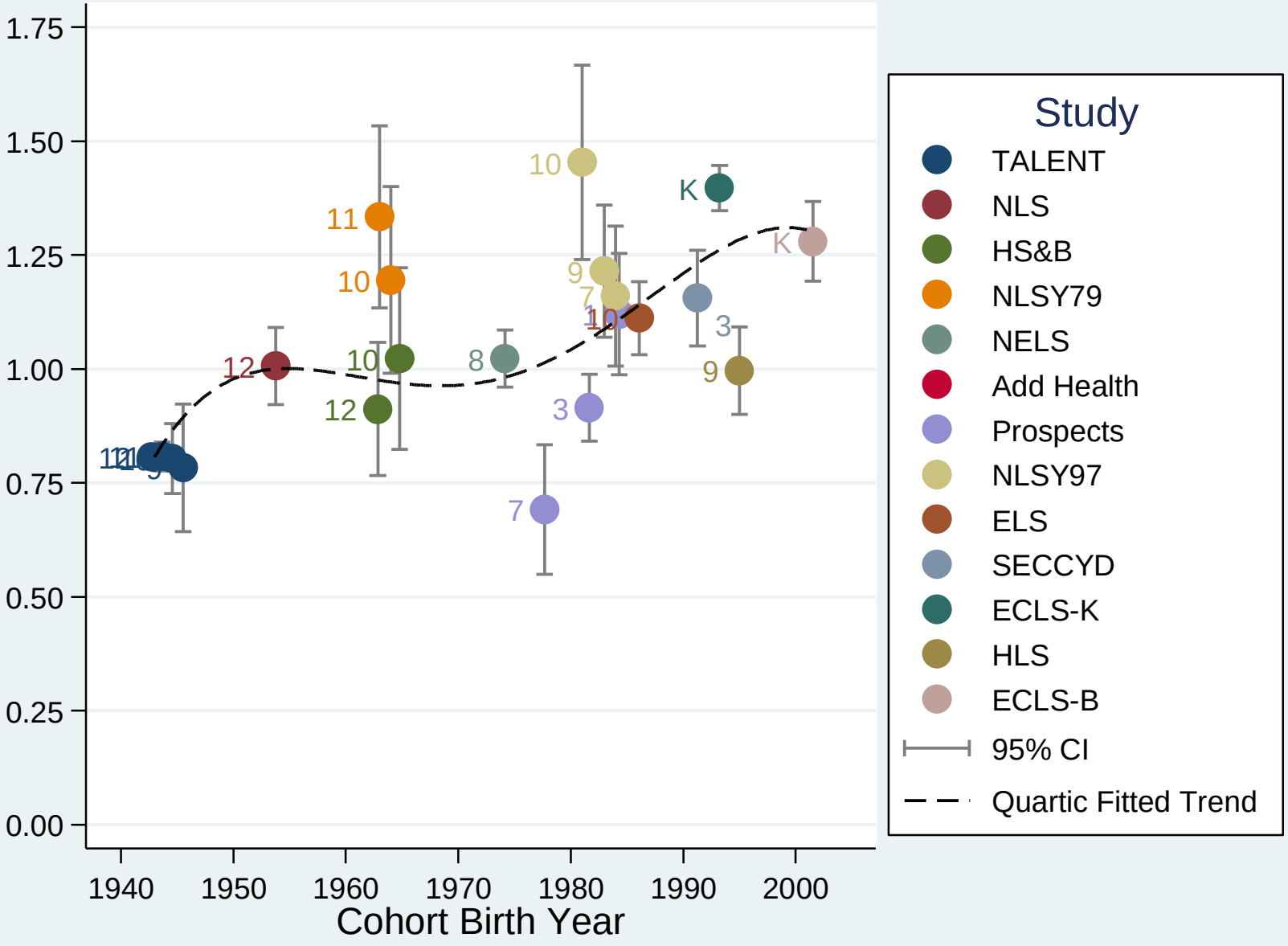
findings

- How has the achievement gap changed in the last 50 years?
  - … between high-income (90th percentile) and low-income (10th percentile) children?
  - … between high-income (90th percentile) and middle-income (50th percentile) children?
  - … between middle-income (50th percentile) and low-income (10th percentile) children?

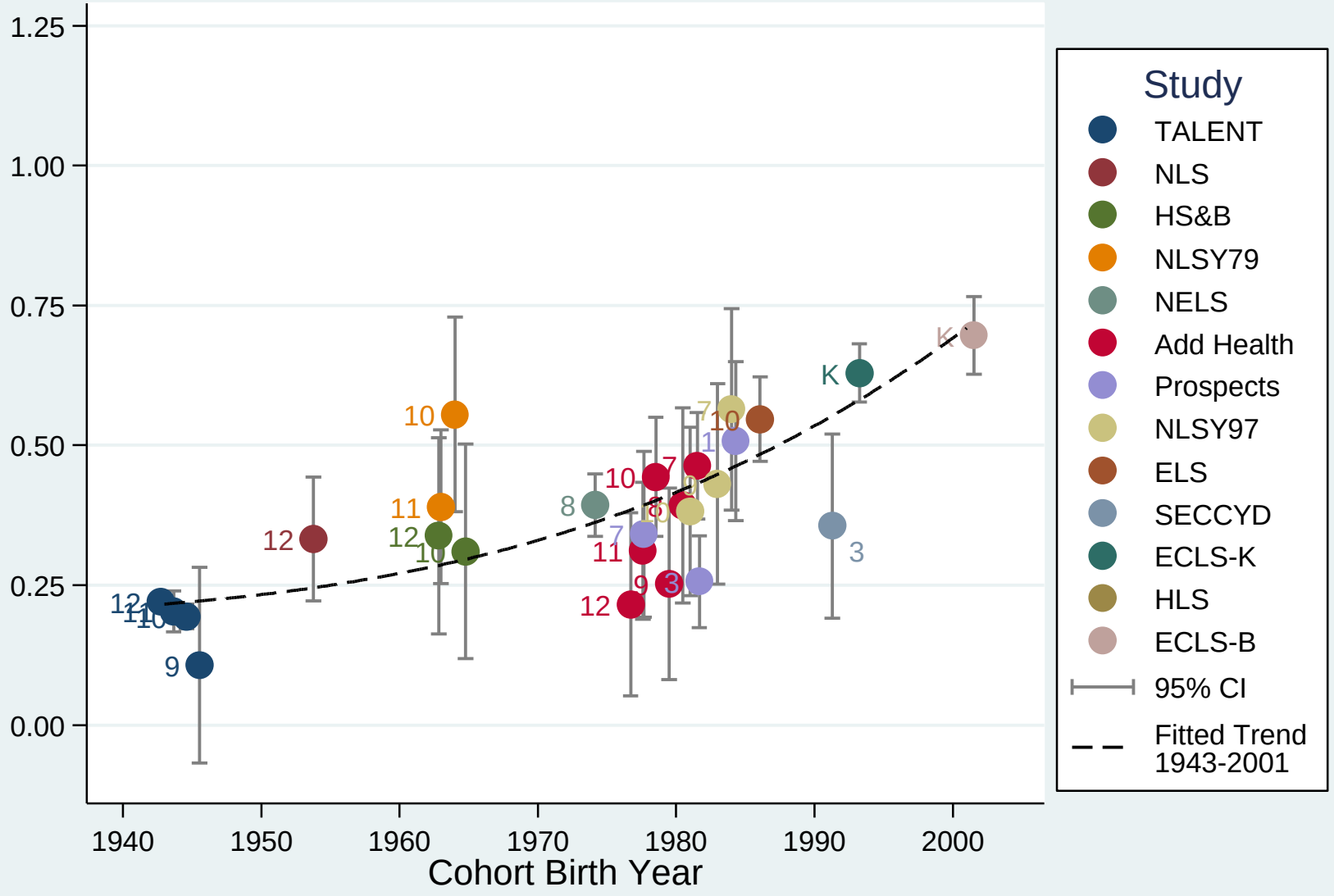
Trend in 90/10 Income Gap in Reading, 1940-2001 Cohorts



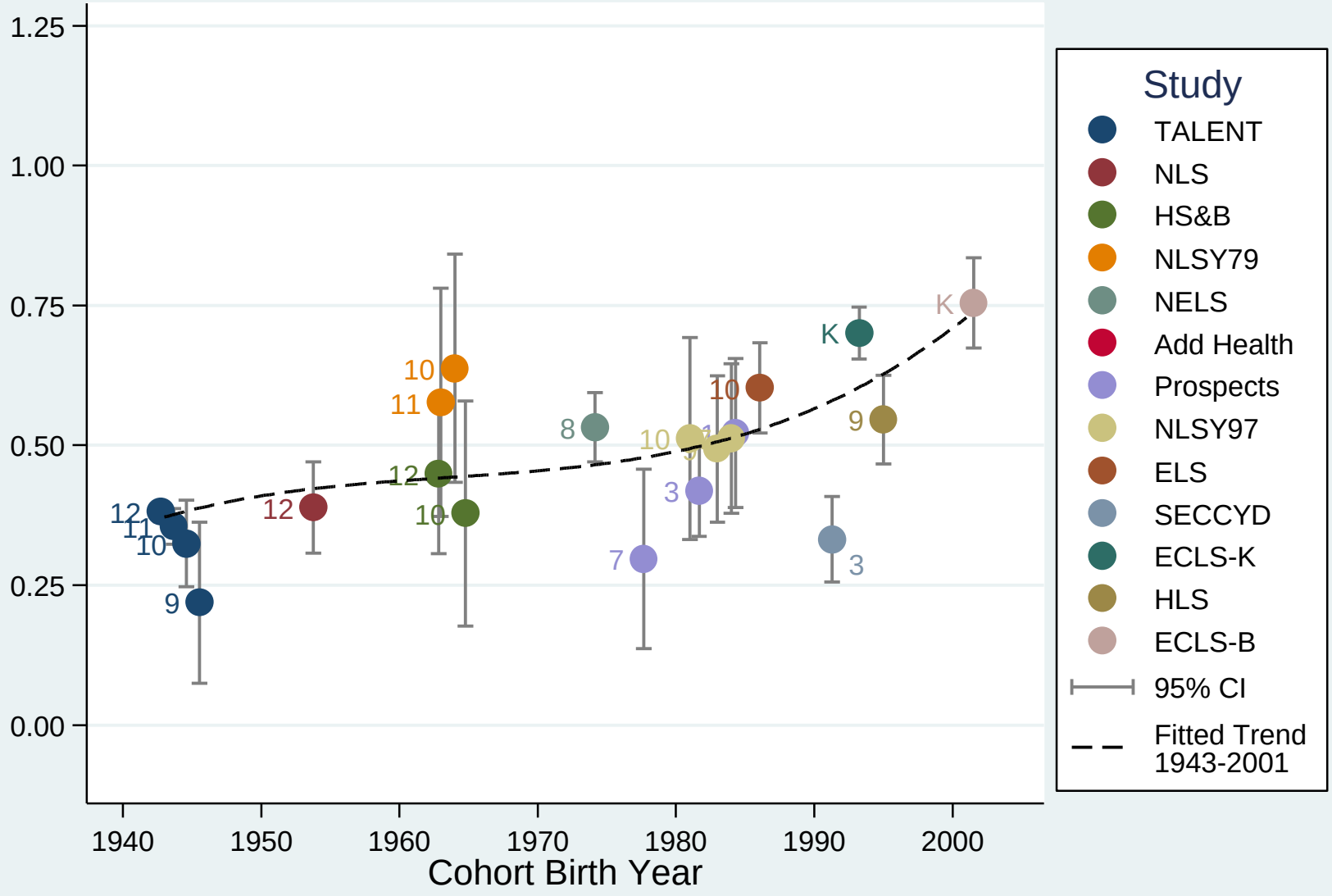
Trend in 90/10 Income Gap in Math, 1940-2001 Cohorts



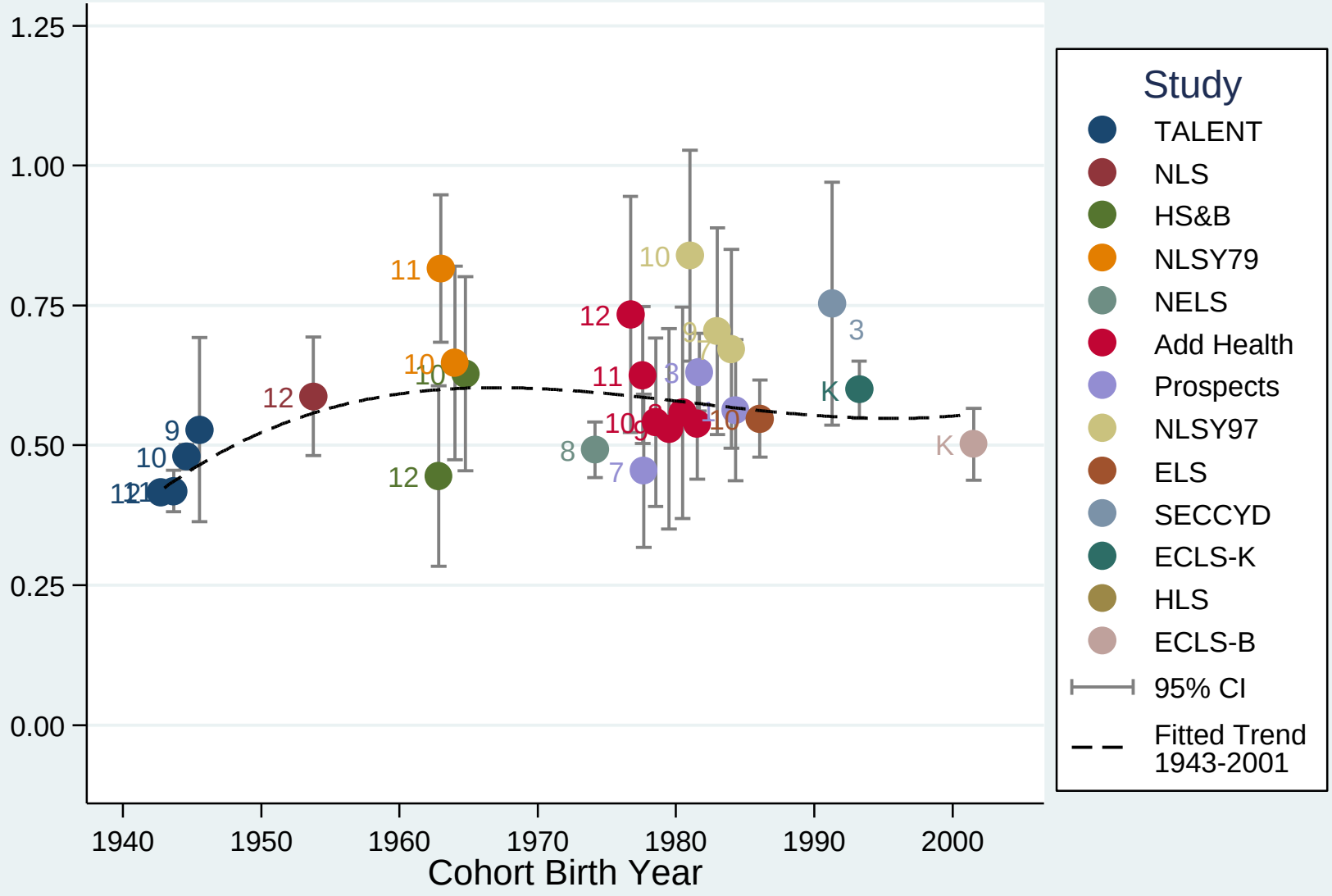
Trend in 90/50 Income Gap in Reading, 1940-2001 Cohorts

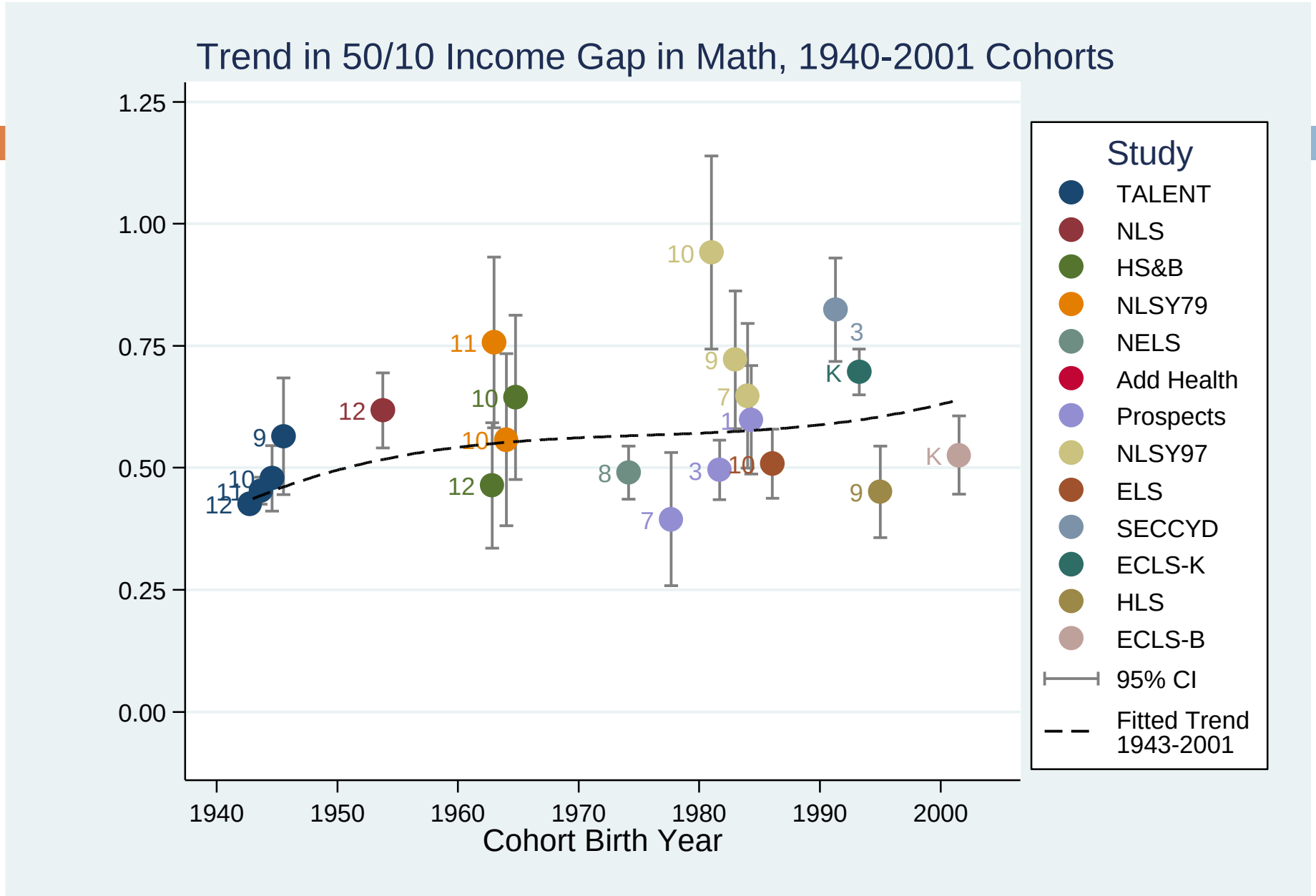


Trend in 90/50 Income Gap in Math, 1940-2001 Cohorts



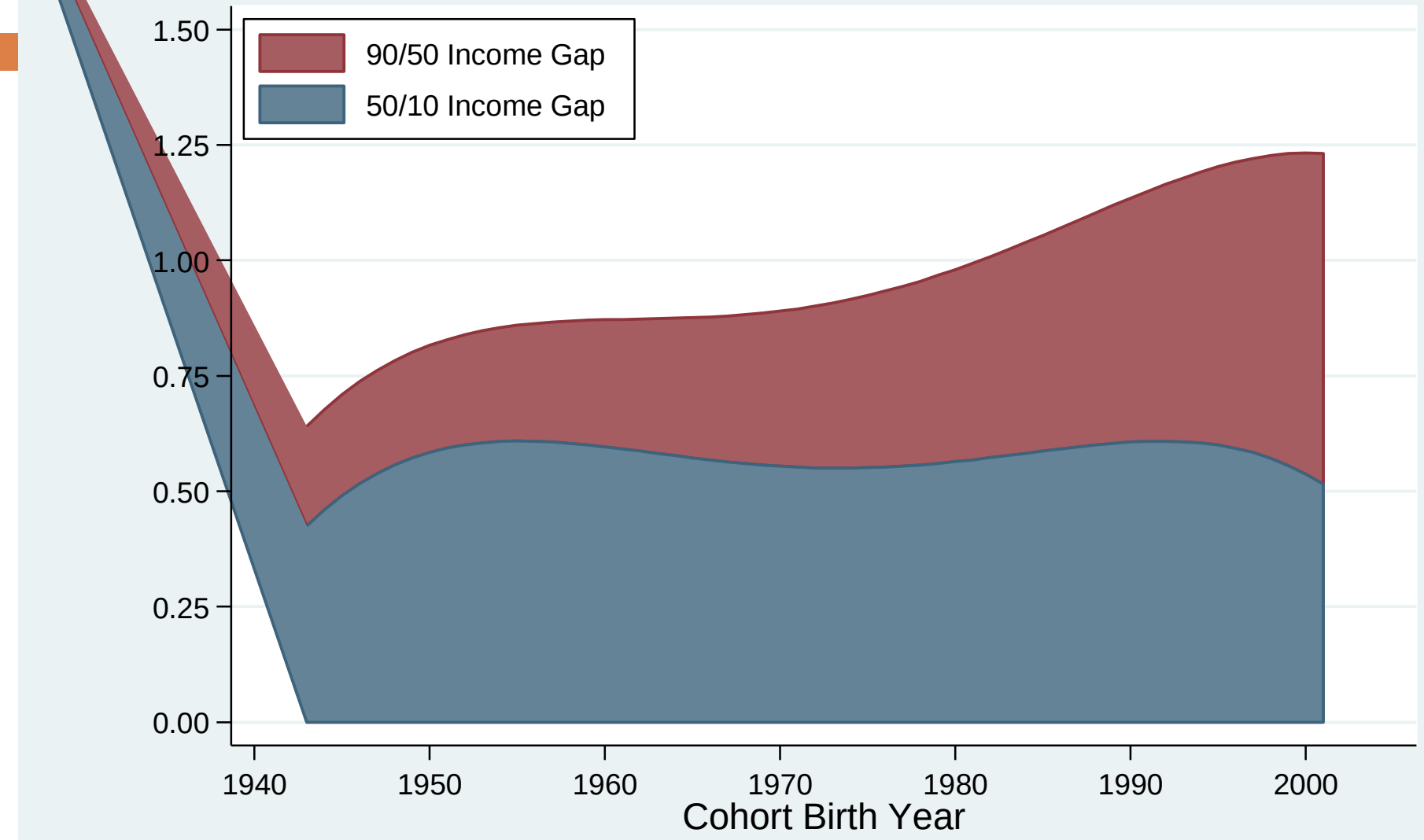
Trend in 50/10 Income Gap in Reading, 1940-2001 Cohorts




Trend in 50/10 Income Gap in Math, 1940-2001 Cohorts
1.25
1.00
0.75
0.50
0.25
0.00
1940
1950
1960
1970
1980
1990
2000
Cohort Birth Year
Study
TALENT
NLS
HS&B
NLSY79
NELS
Add Health
Prospects
NLSY97
ELS
SECCYD
ECLS-K
HLS
ECLS-B
95% CI
Fitted Trend 1943-2001

Income Achievement Gaps (90/50 and 50/10 Gaps)

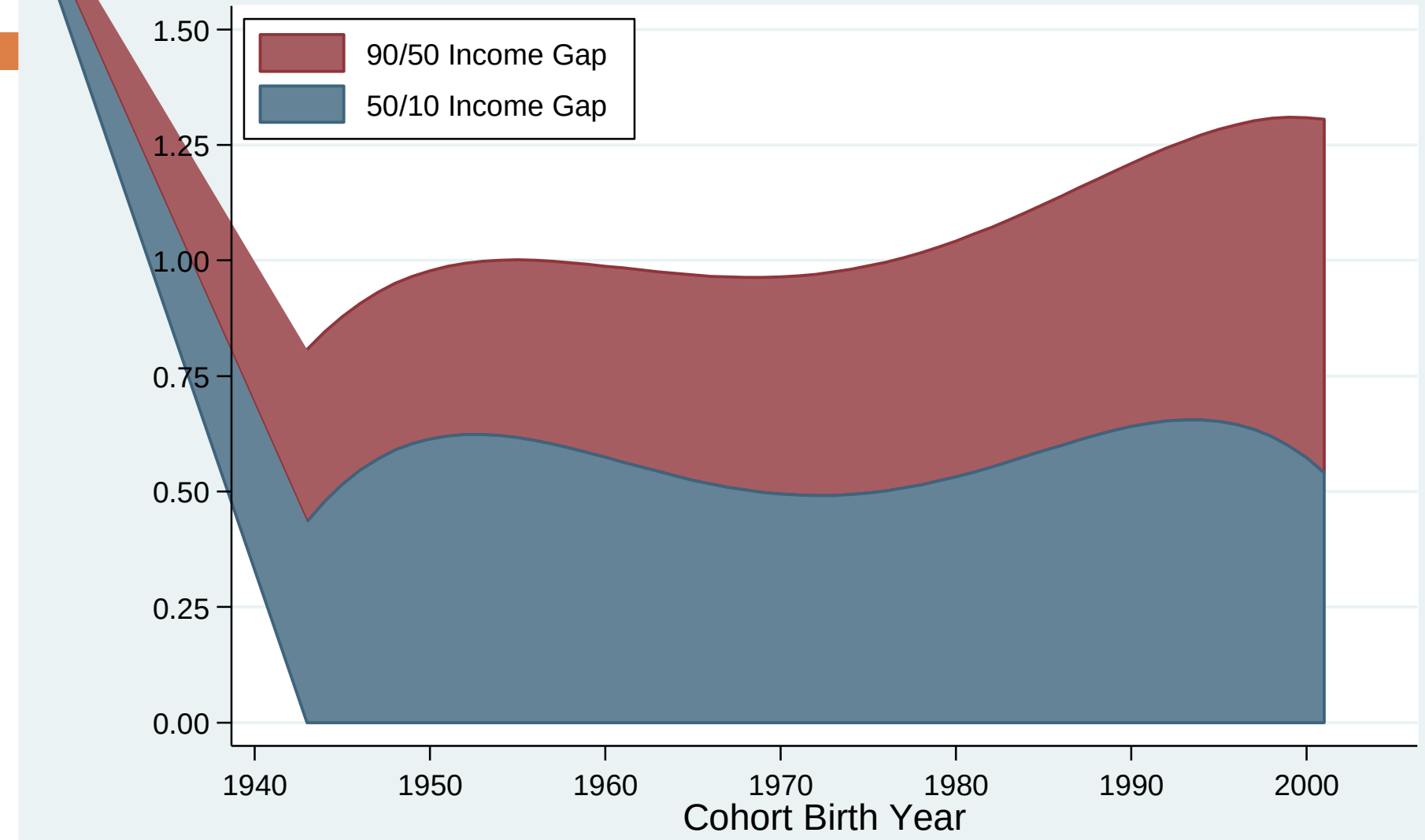
Reading, 1943-2001 Birth Cohorts



Source: Reardon (2011)

Income Achievement Gaps (90/50 and 50/10 Gaps)

Math, 1943-2001 Birth Cohorts



Source: Reardon (2011)

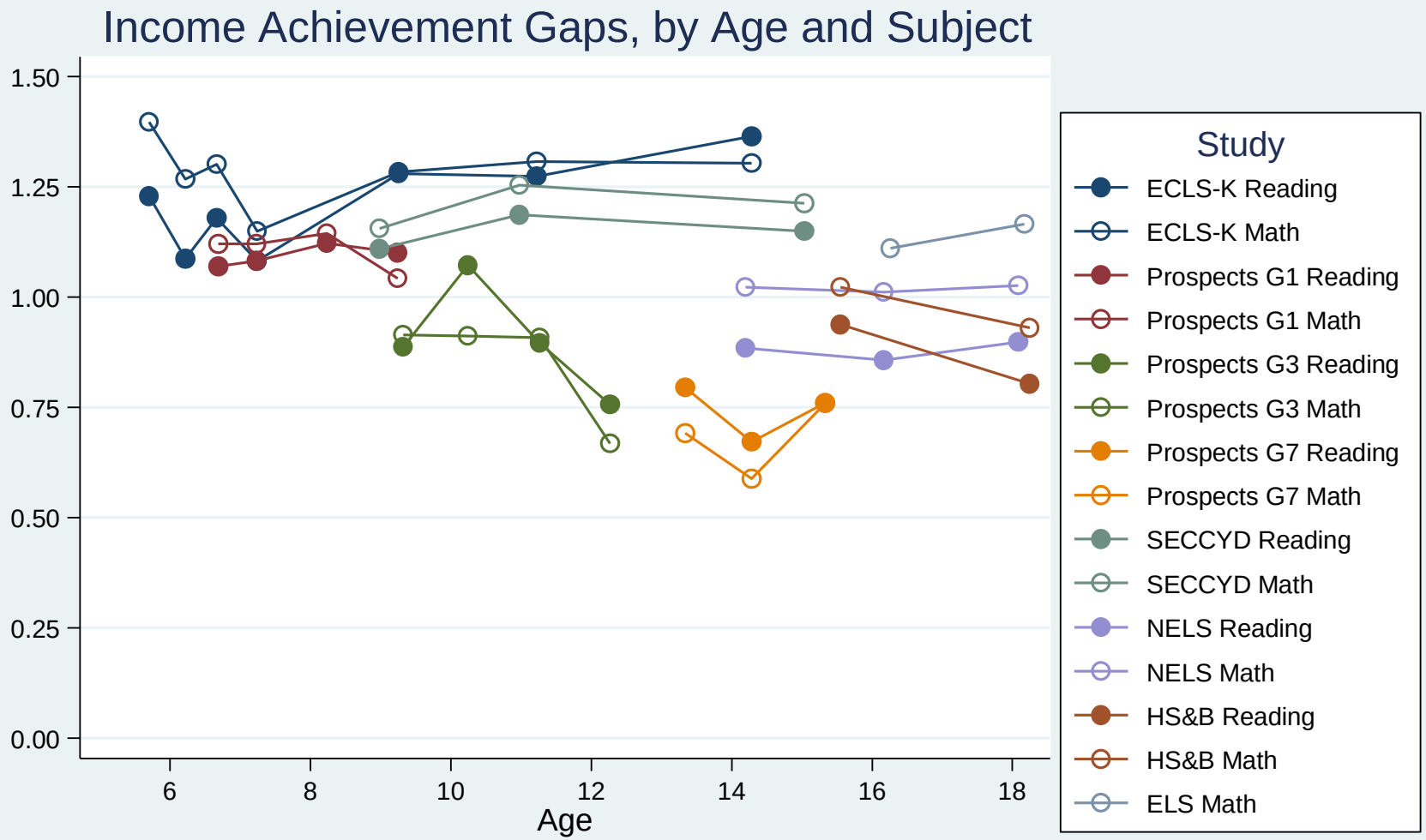
how large are these gaps?

- one standard deviation is the difference between the 31st and 69th percentile
- if the gap is one standard deviation, this implies that the average student in a family at the 10th percentile of the income distribution has test scores lower than 84% of students in families at the 90th percentile of the income distribution
- one standard deviation is the amount a typical student learns in
  - a year in K-1
  - 3 years in elementary-middle school
  - 6 years in middle-high school

findings

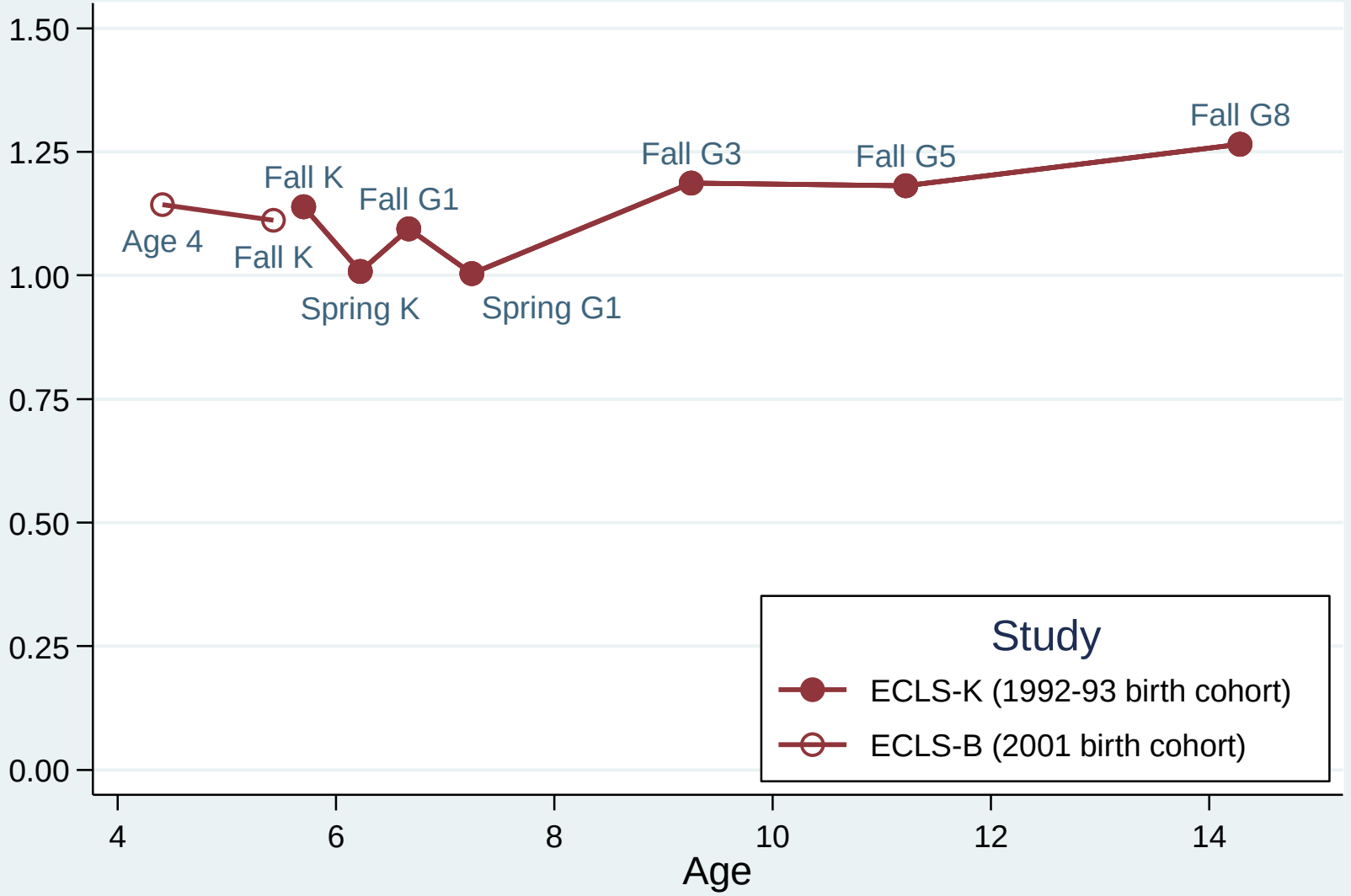
- How does the achievement gap change as children progress through school?

development of income achievement gap, by age and subject, all longitudinal studies



Development of Income Achievement Gap (90/10 Gap)

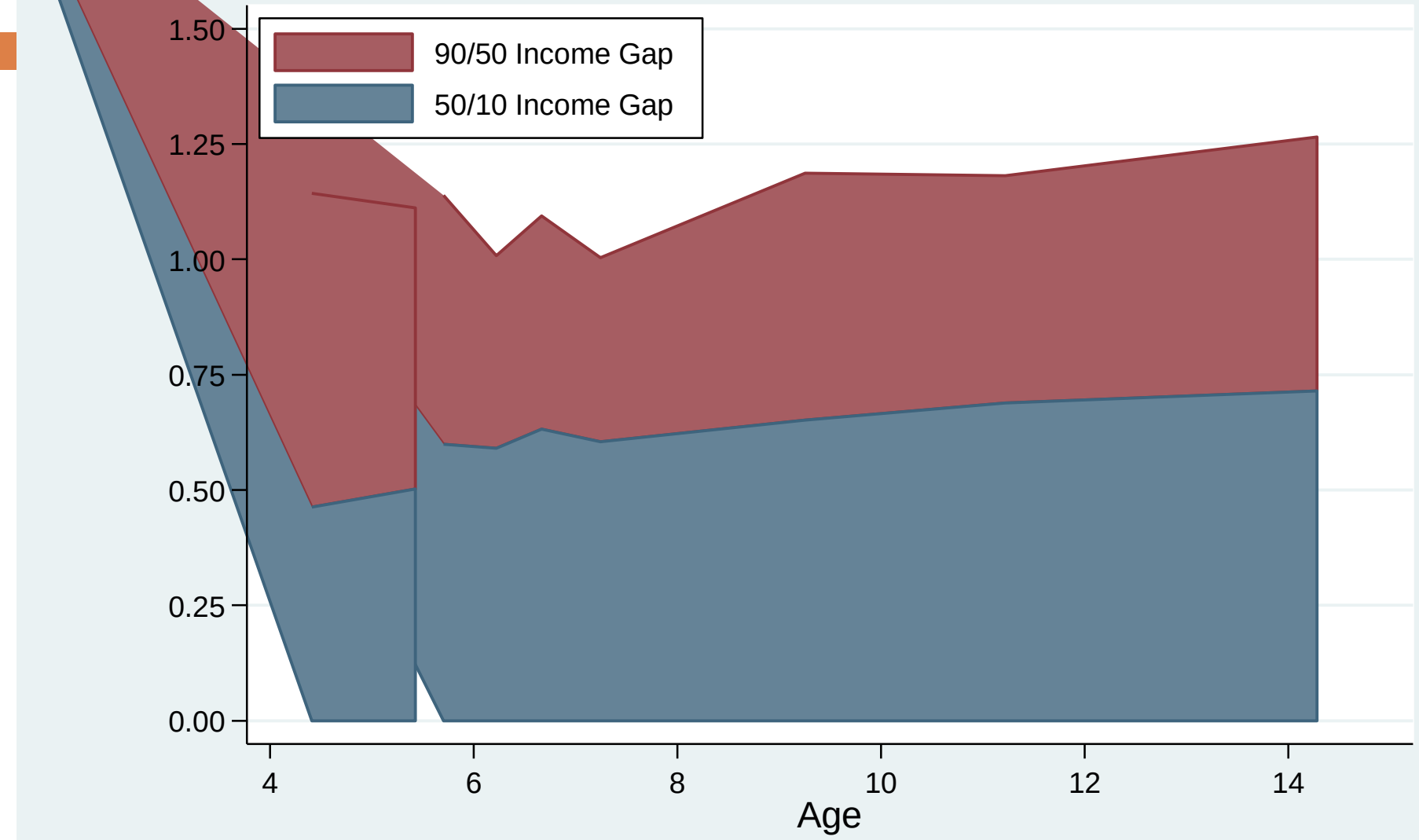
Reading, Ages 4-15



Source: Reardon (2011)

Income Achievement Gaps (90/50 and 50/10 Gaps)

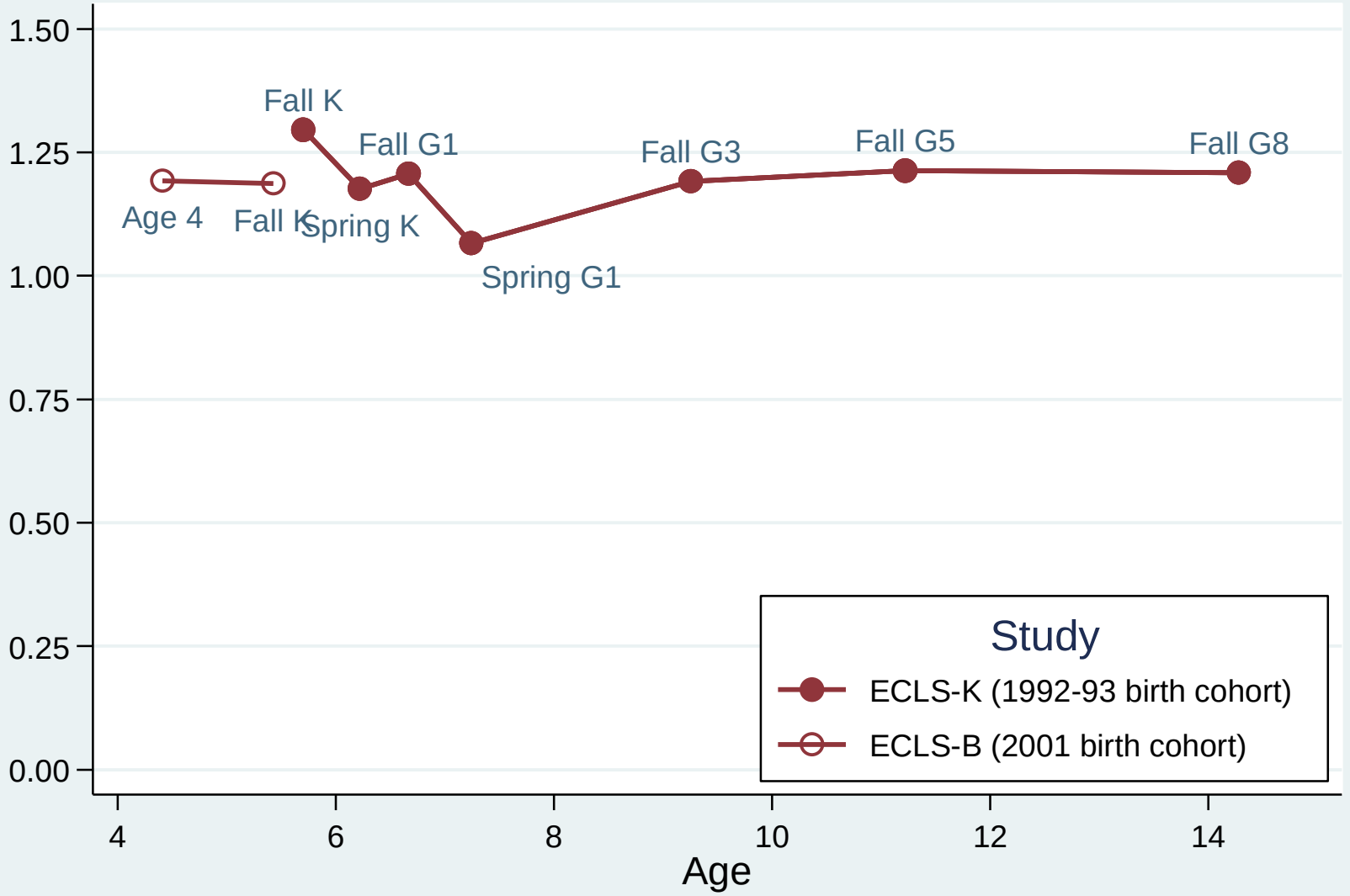
Reading, Ages 4-15



Source: Reardon (2011)

Development of Income Achievement Gap (90/10 Gap)

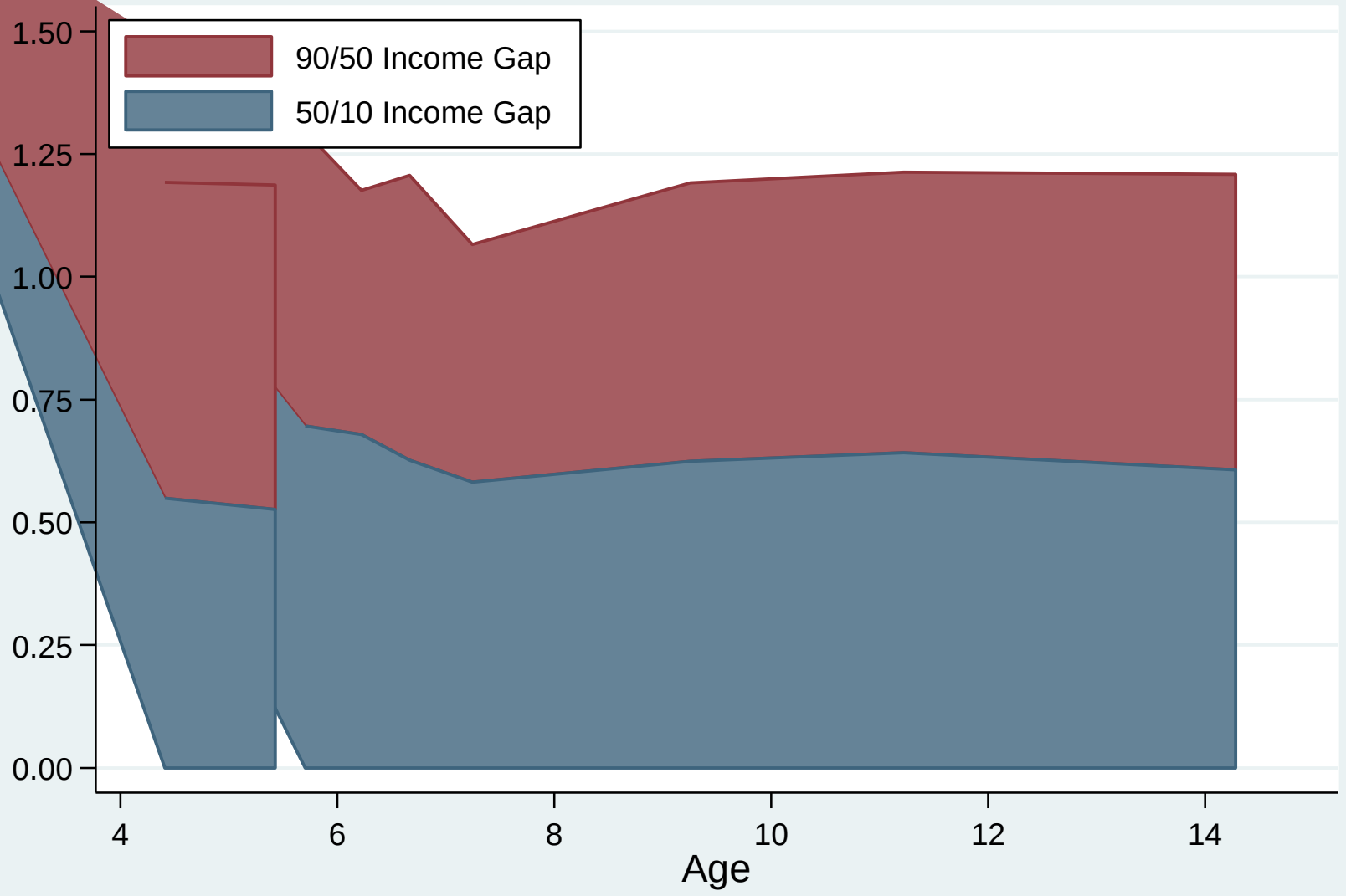
Math, Ages 4-15



Source: Reardon (2011)

Income Achievement Gaps (90/50 and 50/10 Gaps)

Math, Ages 4-15

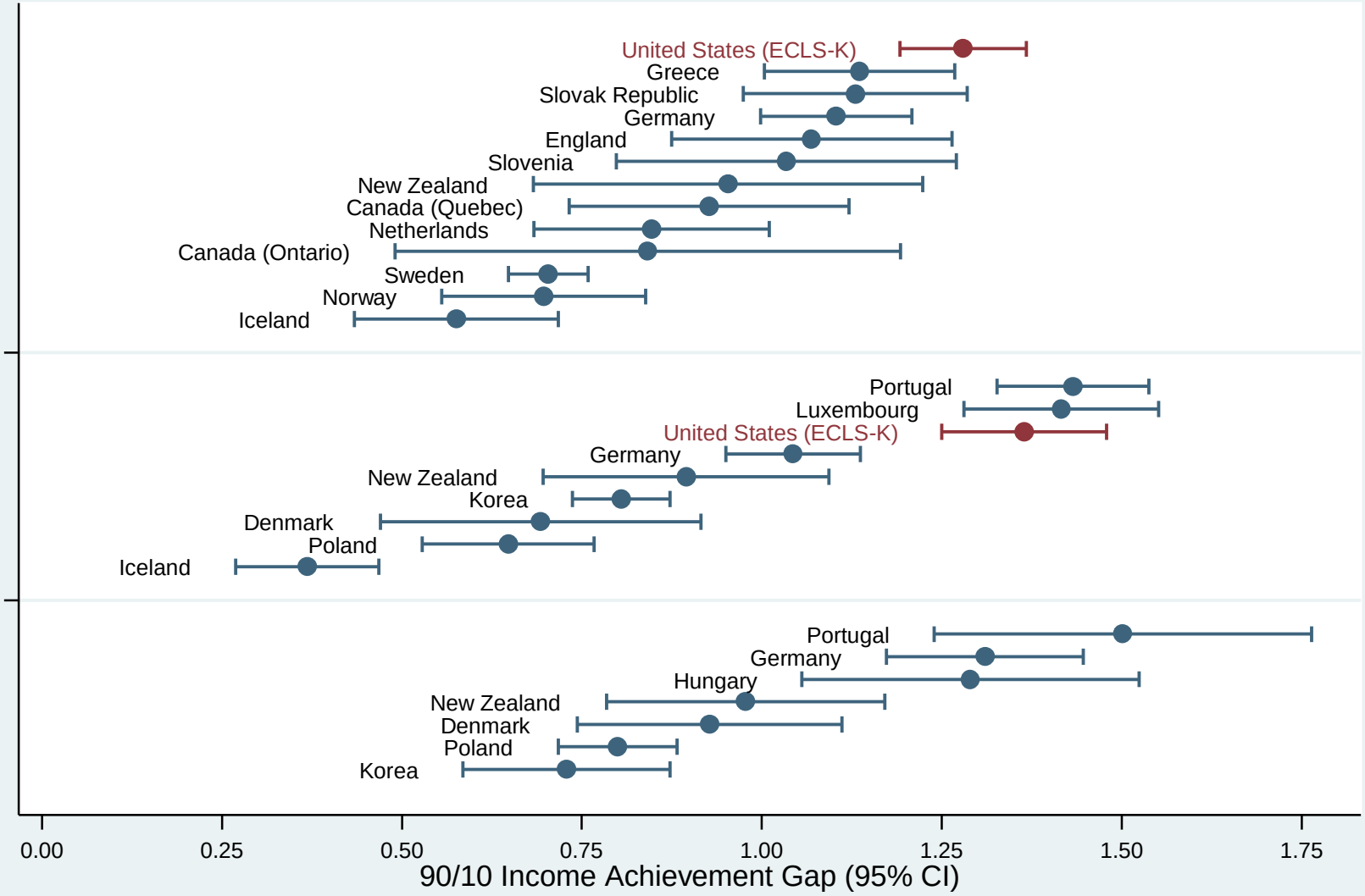


Source: Reardon (2011)

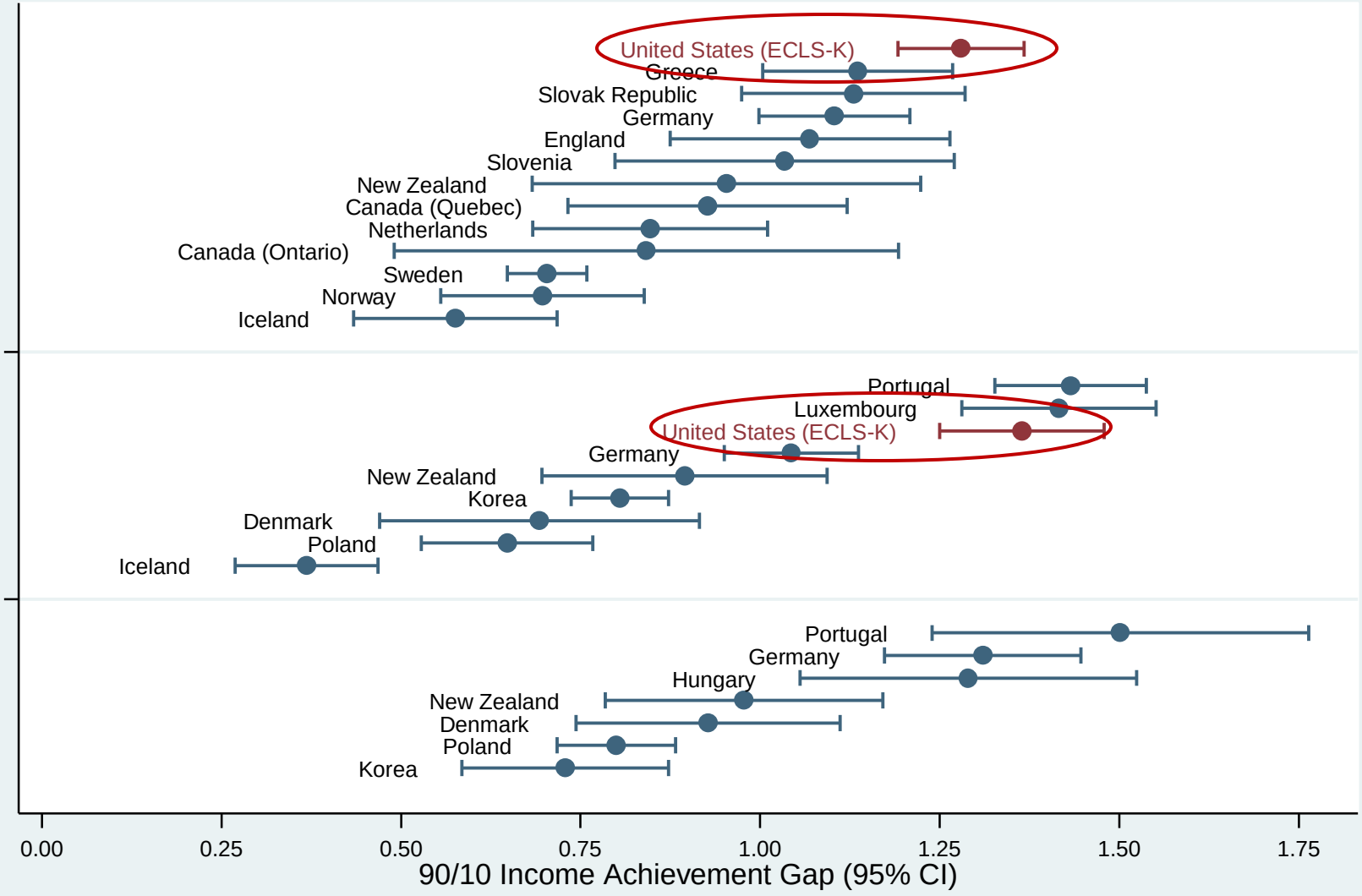
findings

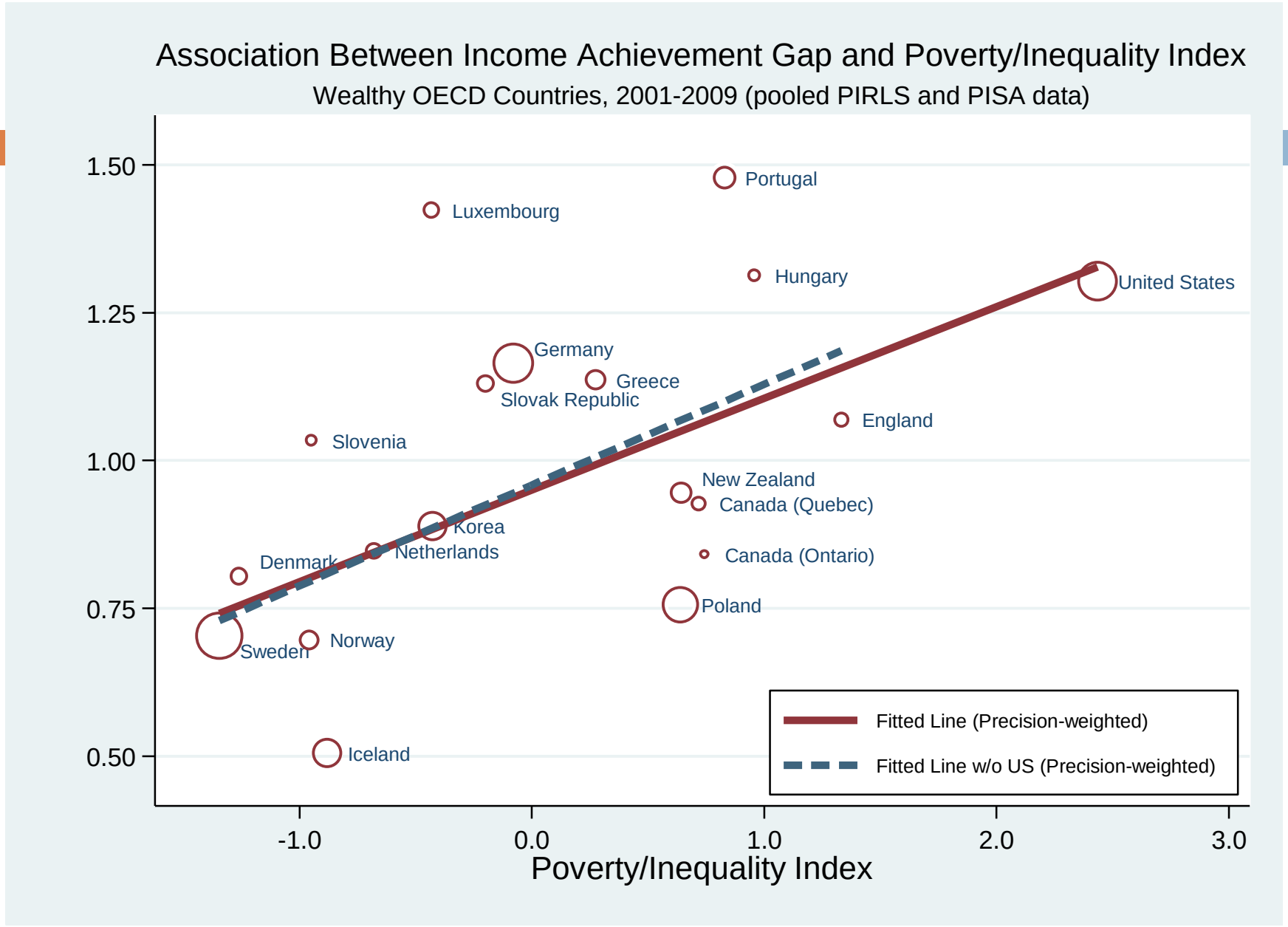
- How does the achievement gap in the US compare to the gap in other countries?

Estimated 90/10 Income Achievement Gaps, Reading, PIRLS & PISA



Estimated 90/10 Income Achievement Gaps, Reading, PIRLS & PISA




Association Between Income Achievement Gap and Poverty/Inequality Index
Wealthy OECD Countries, 2001-2009 (pooled PIRLS and PISA data)
1.50
1.25
1.00
0.75
0.50
Portugal
Luxembourg
Hungary
United States
Germany
Greece
Slovak Republic
England
Slovenia
New Zealand
Canada (Quebec)
Korea
Netherlands
Denmark
Canada (Ontario)
Poland
Sweden
Norway
Iceland
Fitted Line (Precision-weighted)
Fitted Line w/o US (Precision-weighted)
-1.0
0.0
1.0
2.0
3.0
Poverty/Inequality Index

why has the income achievement gap grown?

- rising income inequality?
- changes in family investment patterns
  - rising returns to income?
  - rising investment in children's cognitive development (among high-income families)?
  - changing parenting practices?
- Increasing correlation between income and other family resources?
- increasing socioeconomic segregation?
- changing social policies (changing social safety net for the poor)?

why has the income achievement gap grown?

- **rising income inequality?**
- changes in family investment patterns
  - rising returns to income?
  - rising investment in children's cognitive development (among high-income families)?
  - changing parenting practices?
- Increasing correlation between income and other family resources?
- increasing socioeconomic segregation?
- changing social policies (changing social safety net for the poor)?

income and educational outcomes

- Assume a very simple (stylized) association between educational outcome ($\boldsymbol{Y}$) and income ($\boldsymbol{Inc}$):

$$\boldsymbol{Y} = \boldsymbol{\beta} \cdot \ln(\boldsymbol{Inc}) + e$$

- Then the average difference in $\boldsymbol{Y}$ between those at the 90th and 10th percentile of the income distribution is

$$90/10\ Gap = E\left[\boldsymbol{Y^{90}} - \boldsymbol{Y^{10}}\right] = \boldsymbol{\beta} \cdot \left[\ln\left(\boldsymbol{Inc^{90}}\right) - \ln\left(\boldsymbol{Inc^{10}}\right)\right]$$

$$= \boldsymbol{\beta} \cdot \ln\left(\frac{\boldsymbol{Inc^{90}}}{\boldsymbol{Inc^{10}}}\right)$$

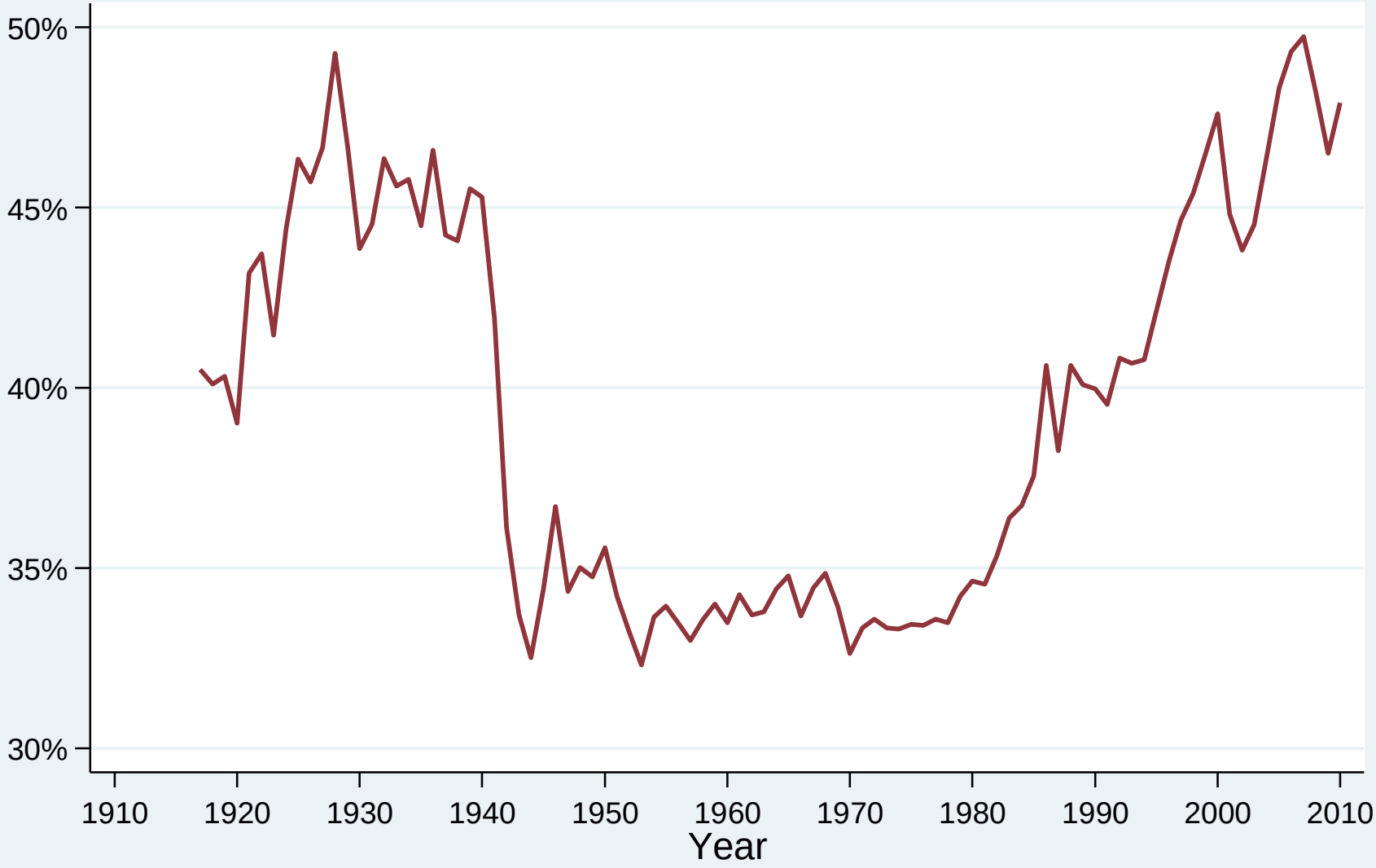
- The 90/10 gap in $\boldsymbol{Y}$ depends on both $\boldsymbol{\beta}$ and $\boldsymbol{Inc^{90}}/\boldsymbol{Inc^{10}}$

income inequality and educational inequality

- $$90/10\ Gap = E\left[Y^{90} - Y^{10}\right] = \boldsymbol{\beta} \cdot \ln\left(\frac{Inc^{90}}{Inc^{10}}\right)$$
- Is the change in the 90/10 income achievement gap due to a **mechanical** association between income and achievement?
  - i.e., income directly affects educational outcomes, so wider income dispersion leads to wider dispersion of educational outcomes
  - implies $\boldsymbol{\beta}$ is constant as Inc^{90}/Inc^{10} (income inequality) grows
- and/or to a change in the **contextual** association between income and achievement
  - i.e., income inequality leads to stronger association between income and achievement
  - implies $\boldsymbol{\beta}$ grows as Inc^{90}/Inc^{10} (income inequality) grows

Share of Total Income Accruing to 10% Highest Income Families,

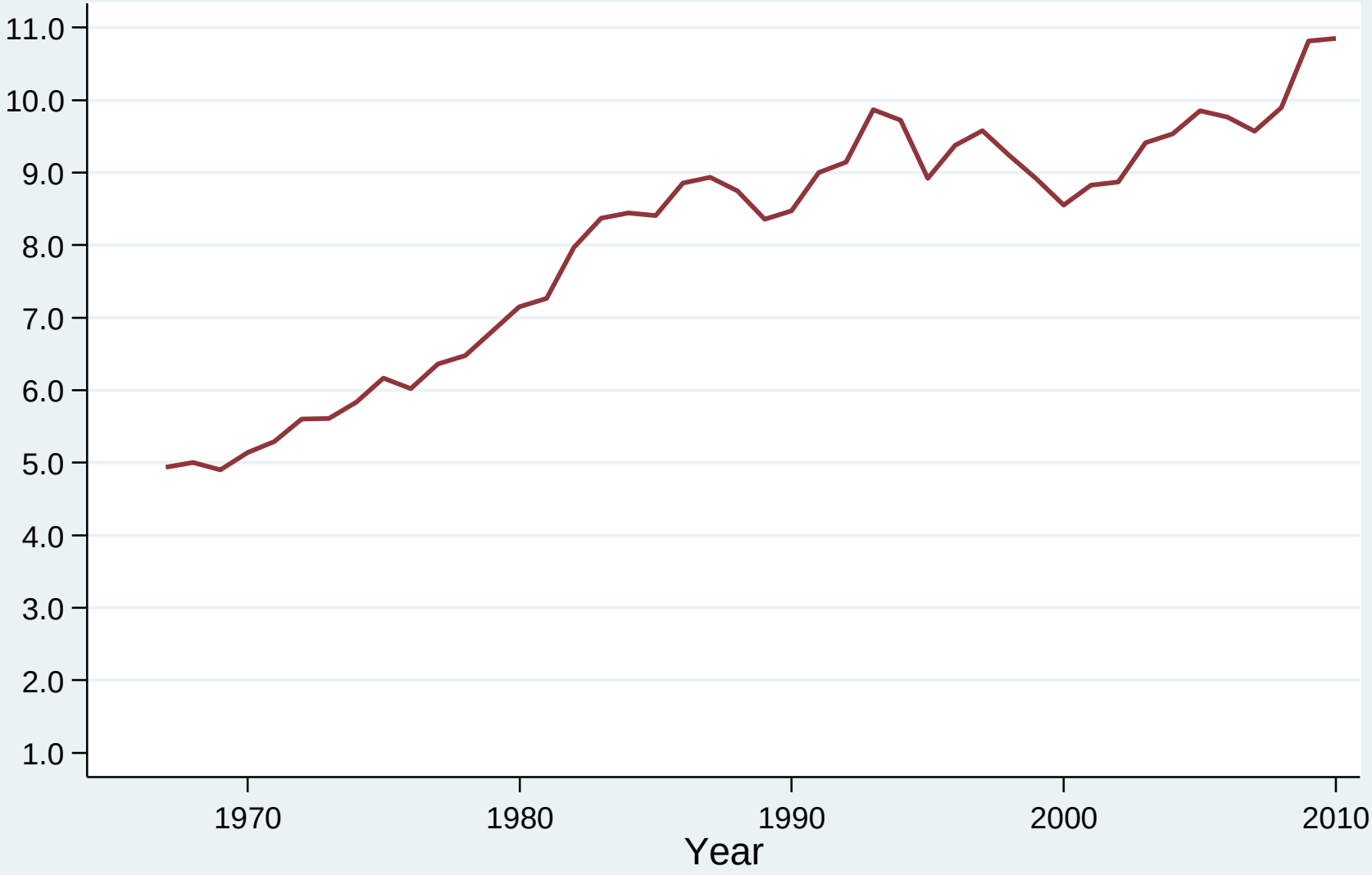
(Includes Capital Gains), 1918-2010



Source: Piketty & Saez (2012): http://www.econ.berkeley.edu/~saez/TabFig2010.xls

Income Inequality (90/10 Income Ratio), 1967-2010

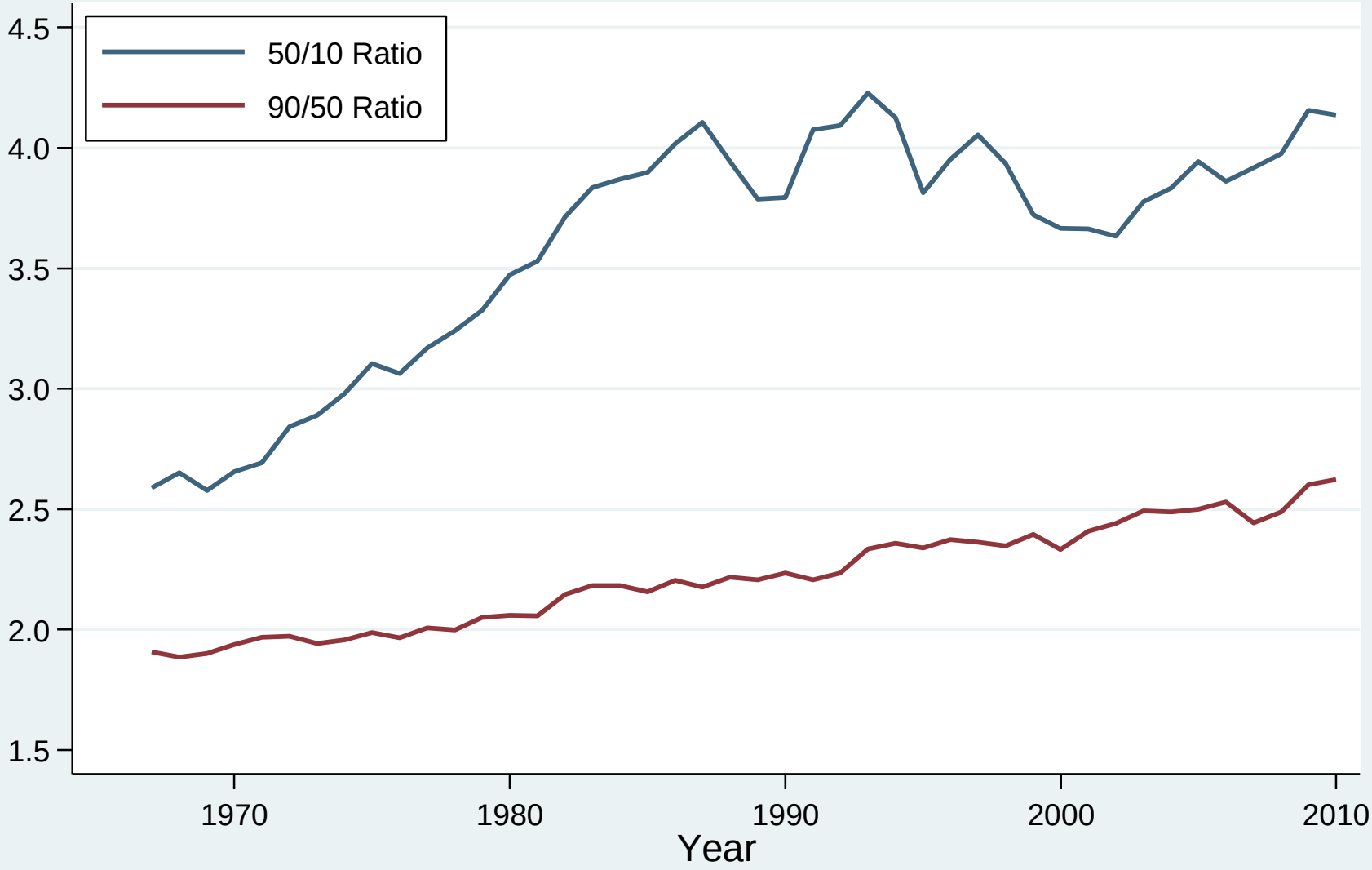
Among Families of School-Age Children



Source: Author's calculations from CPS data 1968-2011

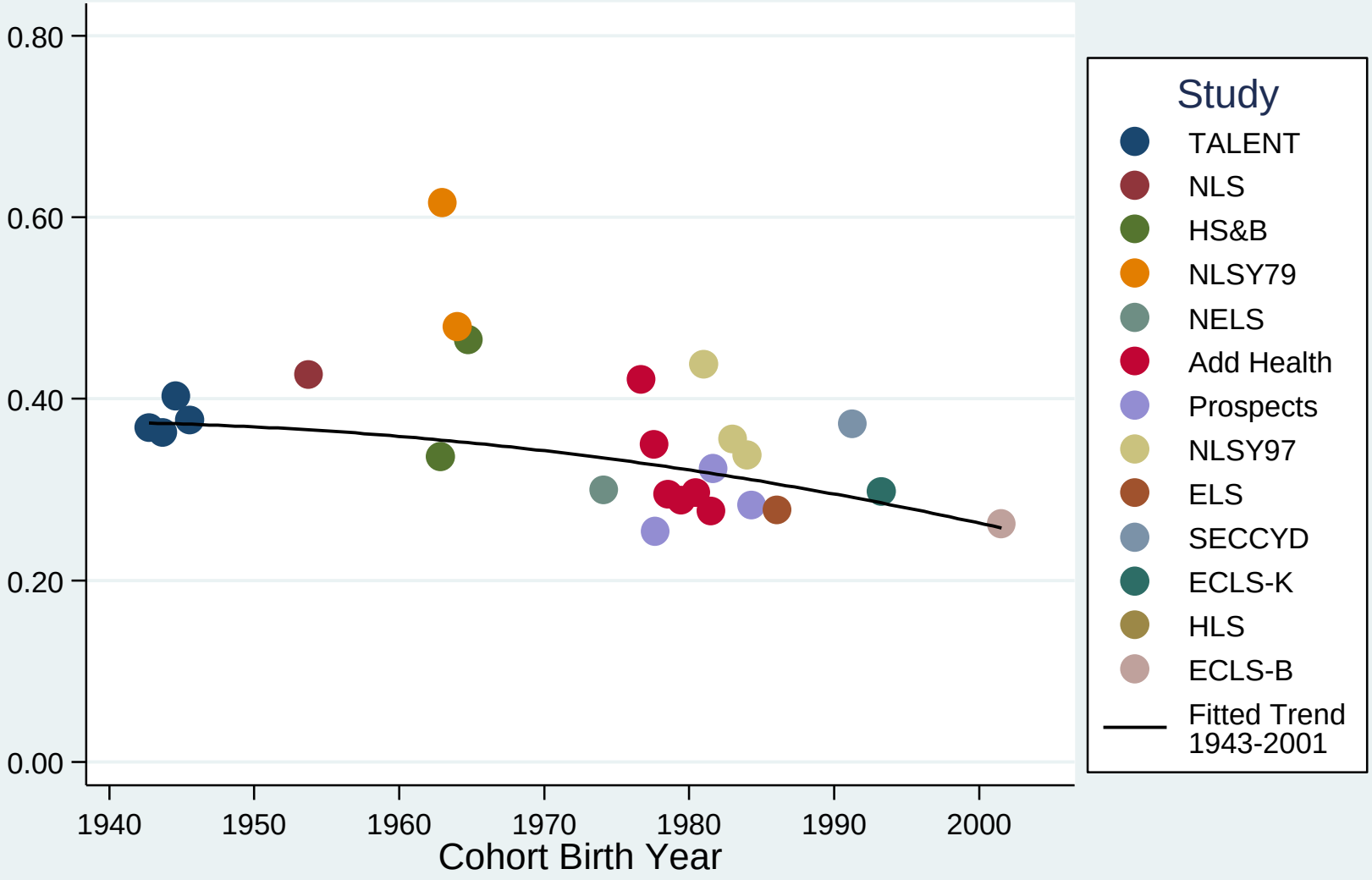
Income Inequality (50/10 and 90/50 Income Ratio), 1967-2010

Among Families of School-Age Children

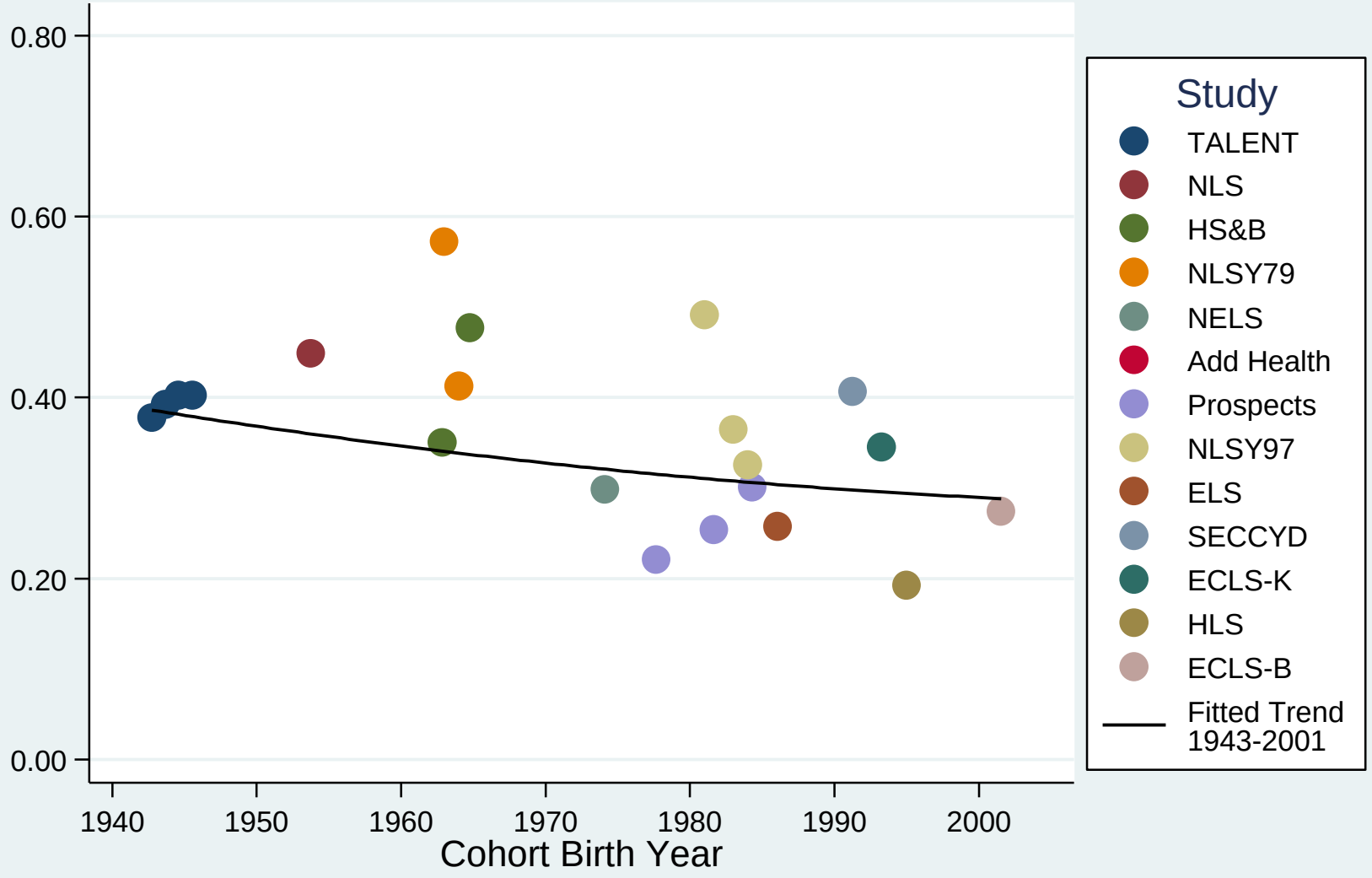


Source: Author's calculations from CPS data 1968-2011

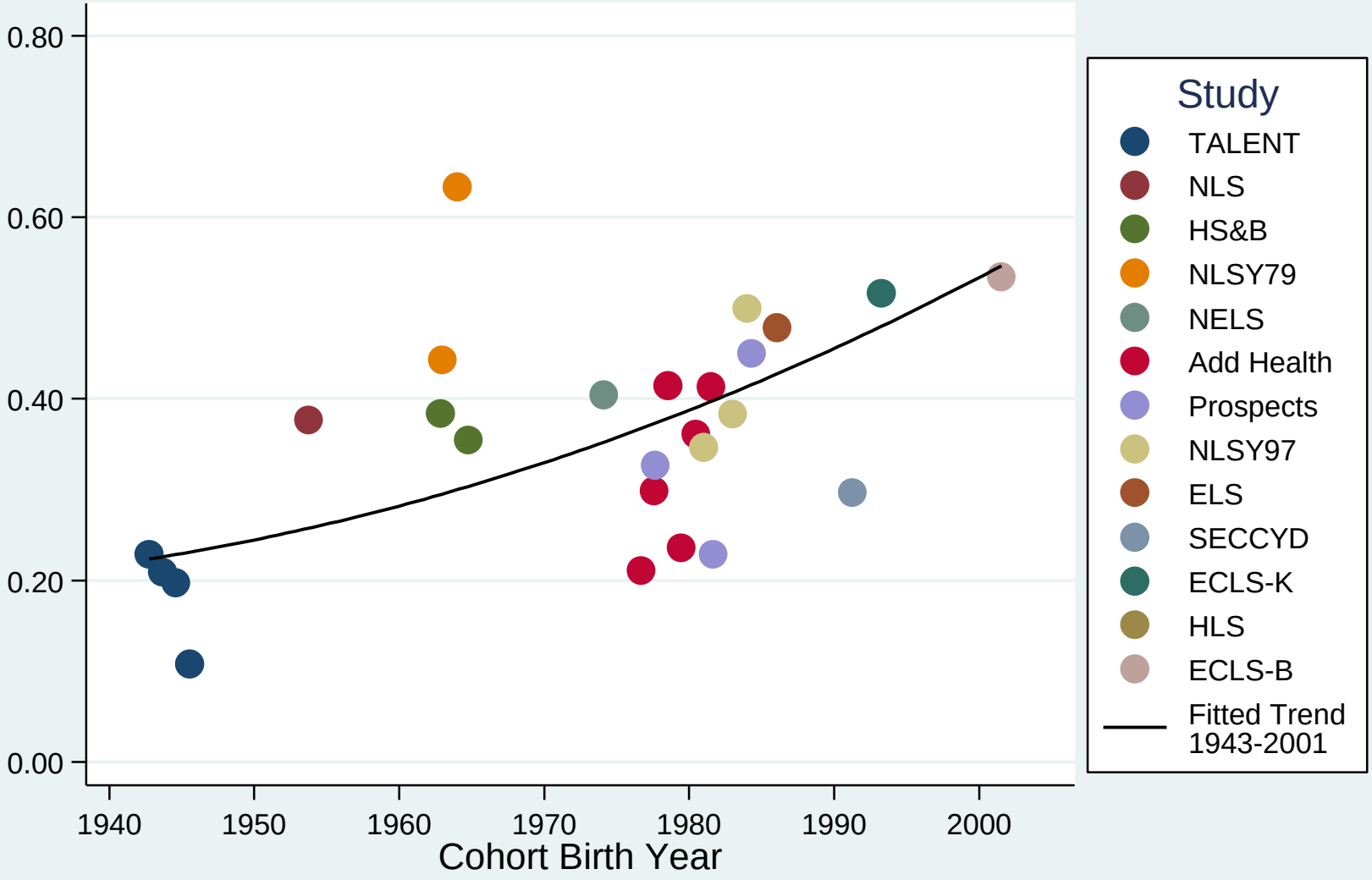
Trend in Association Between Income and Reading Achievement, Families Below Median Income, 1940-2001 Cohorts



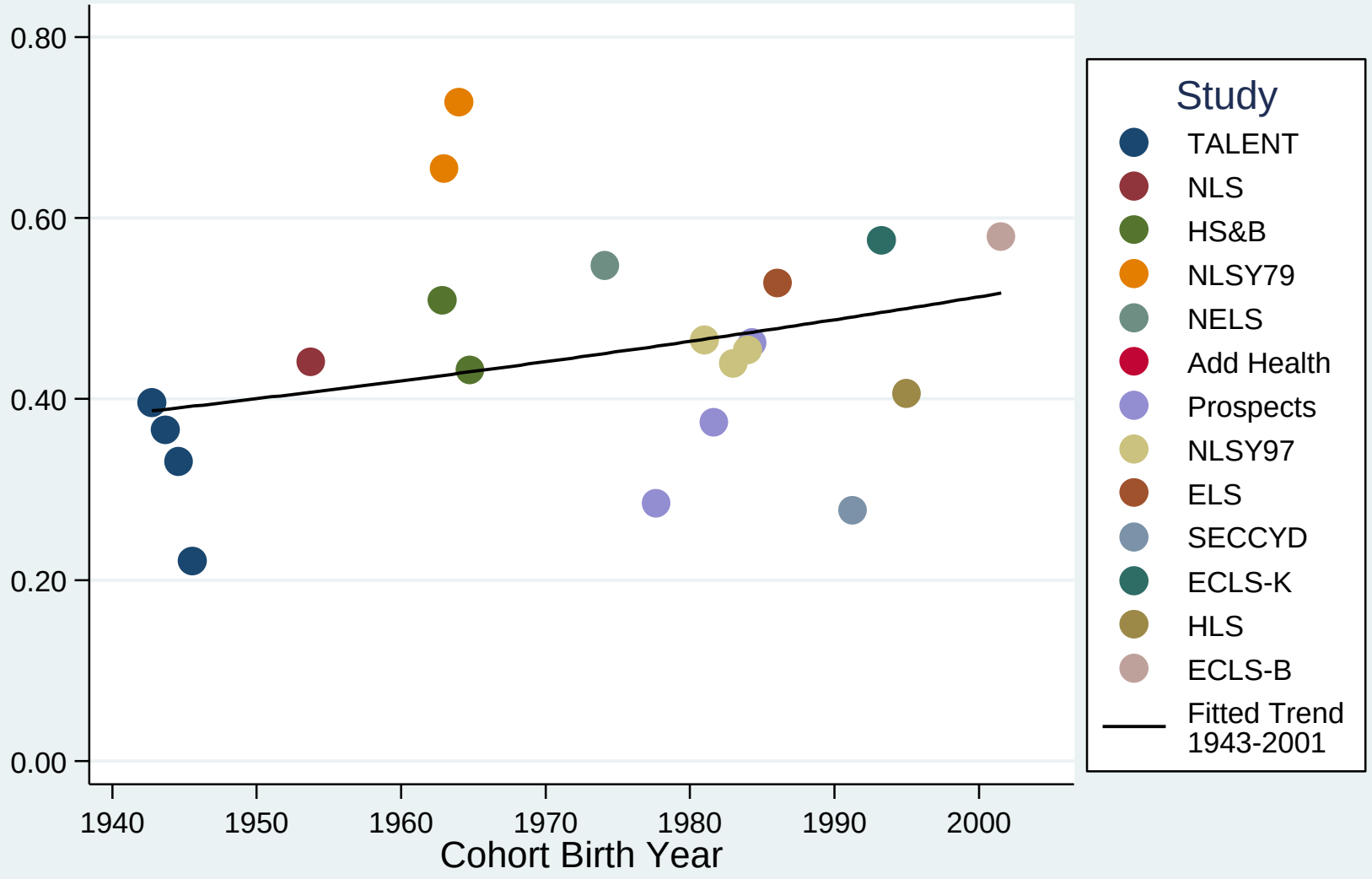
Trend in Association Between Income and Math Achievement, Families Below Median Income, 1940-2001 Cohorts



Trend in Association Between Income and Reading Achievement, Families Above Median Income, 1940-2001 Cohorts



Trend in Association Between Income and Math Achievement, Families Above Median Income, 1940-2001 Cohorts



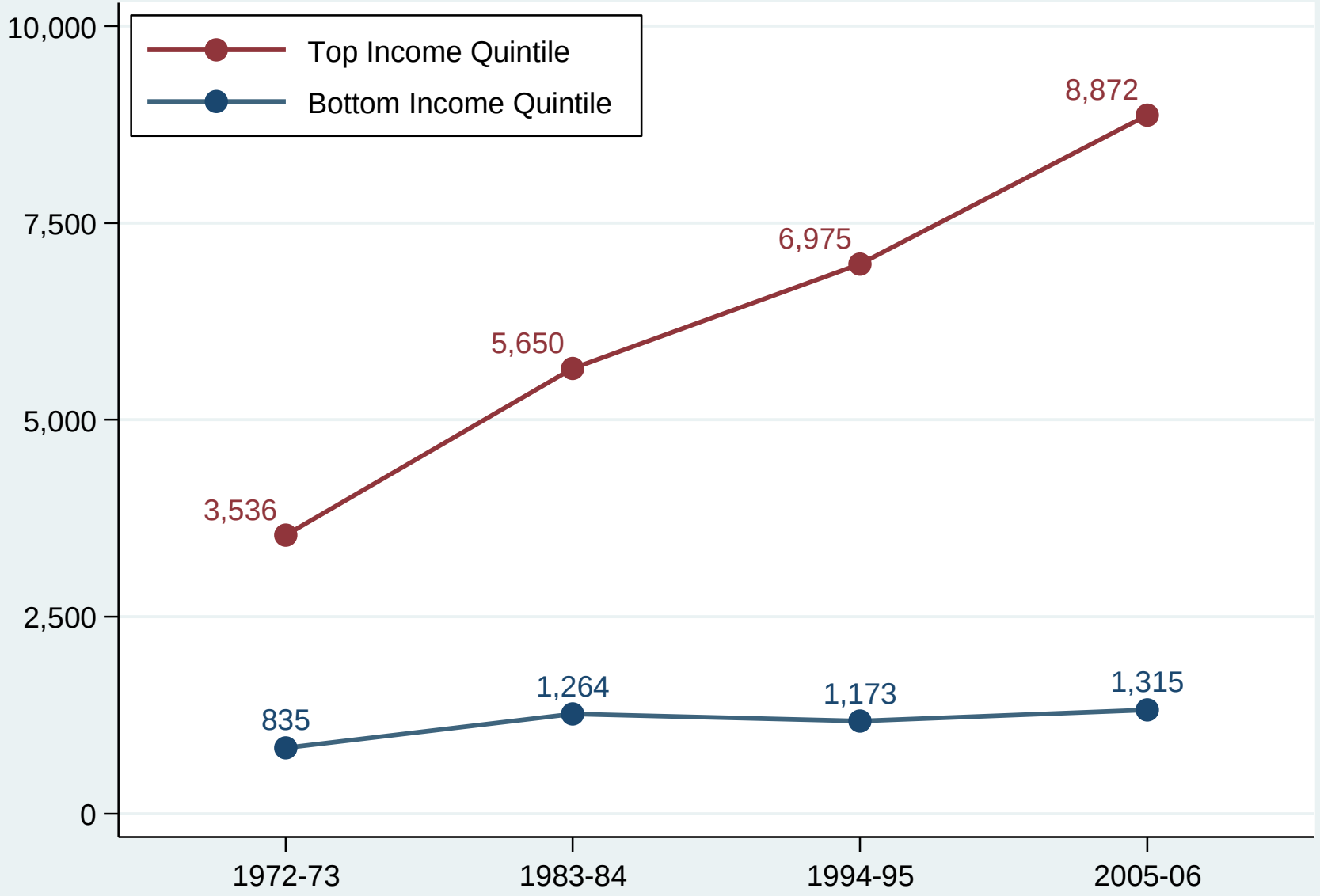
why has the income achievement gap grown?

- rising income inequality?
- **changes in family investment patterns**
  - rising investment in children's cognitive development (among high-income families)?
  - changing parenting practices?
- Increasing correlation between income and other family resources?
- increasing socioeconomic segregation?
- changing social policies (changing social safety net for the poor)?

why has the income achievement gap grown?

- rising income inequality?
- **changes in family investment patterns**
  - **rising investment in children's cognitive development (among high-income families)?**
  - changing parenting practices?
- Increasing correlation between income and other family resources?
- increasing socioeconomic segregation?
- changing social policies (changing social safety net for the poor)?

Family Enrichment Expenditures on Children, 1972-2006



Source: Duncan & Murnane (2011)

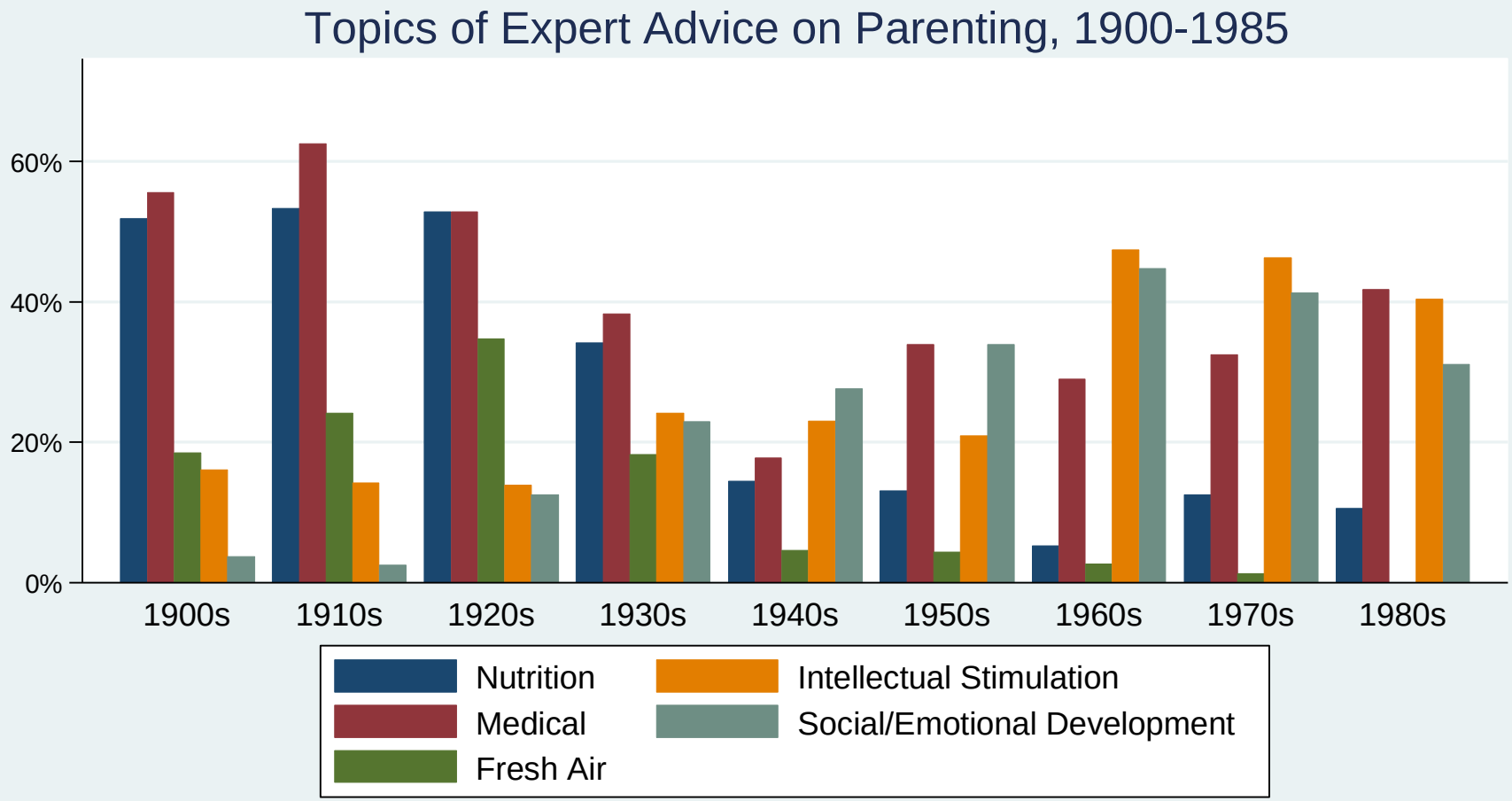
why has the income achievement gap grown?

- rising income inequality?
- **changes in family investment patterns**
  - rising investment in children's cognitive development (among high-income families)?
  - **changing parenting practices?**
- Increasing correlation between income and other family resources?
- increasing socioeconomic segregation?
- changing social policies (changing social safety net for the poor)?

changing view of parental role

- parental views of their role as parents has changed over twentieth century (wrigley, 1989; schaub, 2010)
  - increasing focus on importance of parenting for cognitive development
- some evidence of social class differences in parenting practices (lareau, 2003)
  - middle/upper-class: *concerted cultivation*
  - working-class: *accomplishment of natural growth*
- education policy may play a role, by focusing and legitimating test scores as primary goal of schooling and evidence of success (schaub, 2010)

changing views of parenting, 1900-1985 (wrigley, 1989)



Source: Wrigley, Julia. (1989). Do Young Children Need Intellectual Stimulation? Experts' Advice to Parents, 1900-1985. History of Education Quarterly 29/1:41-75 (Table 1).

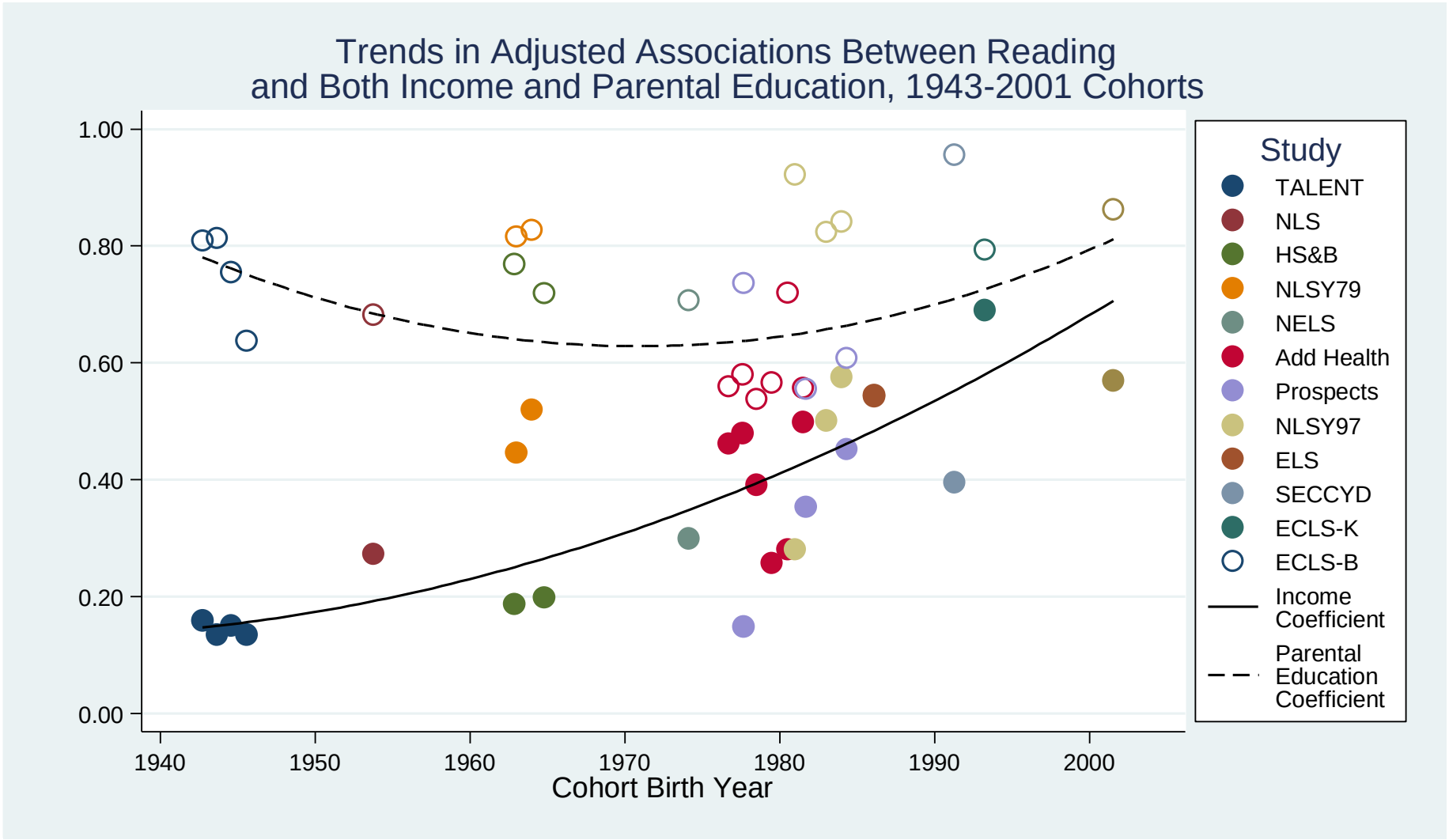
why has the income achievement gap grown?

- rising income inequality?
- changes in family investment patterns
  - rising investment in children's cognitive development (among high-income families)?
  - changing parenting practices?
- **Increasing correlation between income and other family resources?**
- increasing socioeconomic segregation?
- changing social policies (changing social safety net for the poor)?

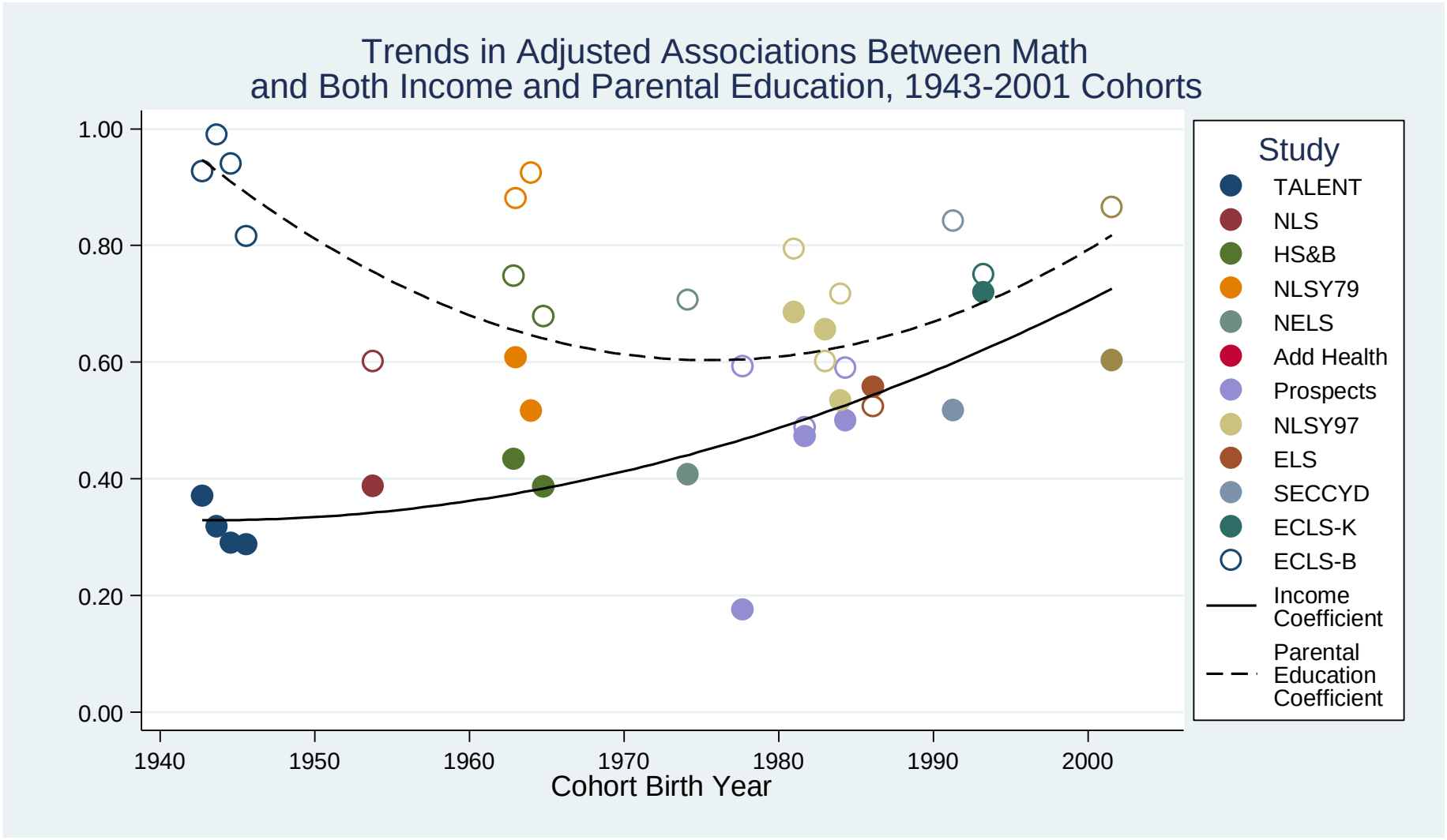
relationship between income and other family resources

- polarization of families (mclanahan 2004)
- increasing returns to college education and cognitive skill (murnane, willett, & levy, 1995)
  - income more strongly associated with parental education and cognitive skill
- increased assortative mating (schwartz & mare, 2005)
- high-income families not only have more income, but increasingly also have more of other resources that matter (dual parents, high educational attainment & cognitive skill, smaller families, fewer very young mothers)

adjusted trends in income-achievement and education-achievement associations, reading, 1940-2001



adjusted trends in income-achievement and education-achievement associations, math, 1940-2001

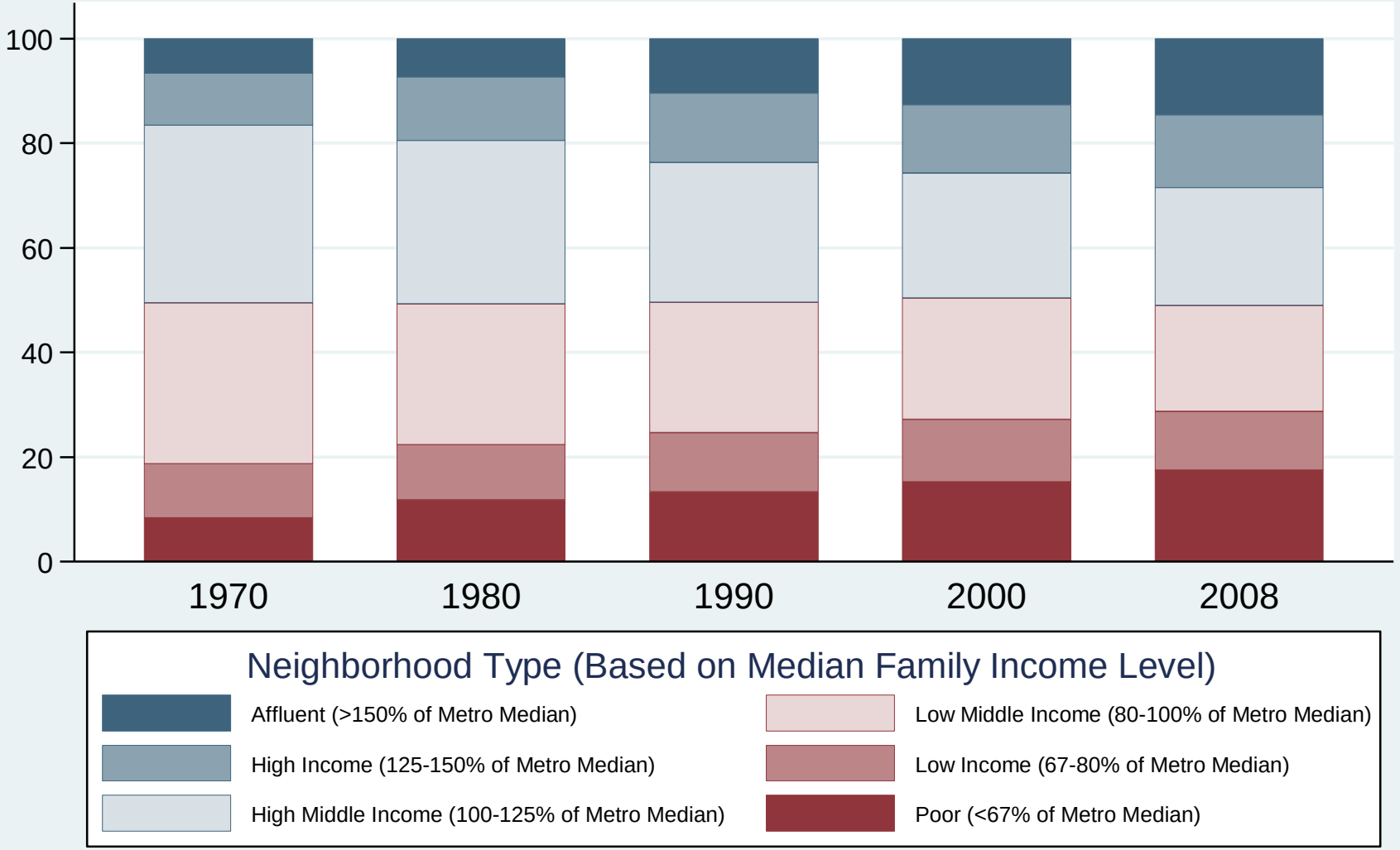


why has the income achievement gap grown?

- rising income inequality?
- changes in family investment patterns
  - rising investment in children's cognitive development (among high-income families)?
  - changing parenting practices?
- Increasing correlation between income and other family resources?
- **increasing socioeconomic segregation?**
- changing social policies (changing social safety net for the poor)?

Proportion of Families Living in High-, Middle-, and Low-Income Neighborhoods

Metropolitan Areas with Population > 500,000, 1970-2008



summary of trends

- income achievement gaps have grown sharply in recent decades (since 1970s birth cohorts, maybe before)
- income gaps have grown most rapidly in the top half of the income distribution
- income gaps now larger than black-white gap
- gaps present when students start school (at least in recent cohorts; no data on earlier cohorts)

inequality and education

- differences in inequality, coupled with a stable association between income and educational achievement, seems insufficient to explain the patterns of association between inequality and income achievement gaps
- rather, the association between income and achievement has changed as well
- but why?

a provisional hypothesis

- For young workers, the returns to a college degree doubled from 1980-2000 (card & lemieux, 2001)
- The increasing importance of education in the labor market and economic mobility have made educational success ever more important
  - This **changes parental behavior/investment** – changes how parents think about children
  - It also changes how we think about **the role of schools**—increased focus on academic success (as measured by test scores)
- This leads to increased competition for educational advantage
  - Money (and other forms of capital) is an advantage in this competition
  - So income matters more than before (i.e., β is larger)

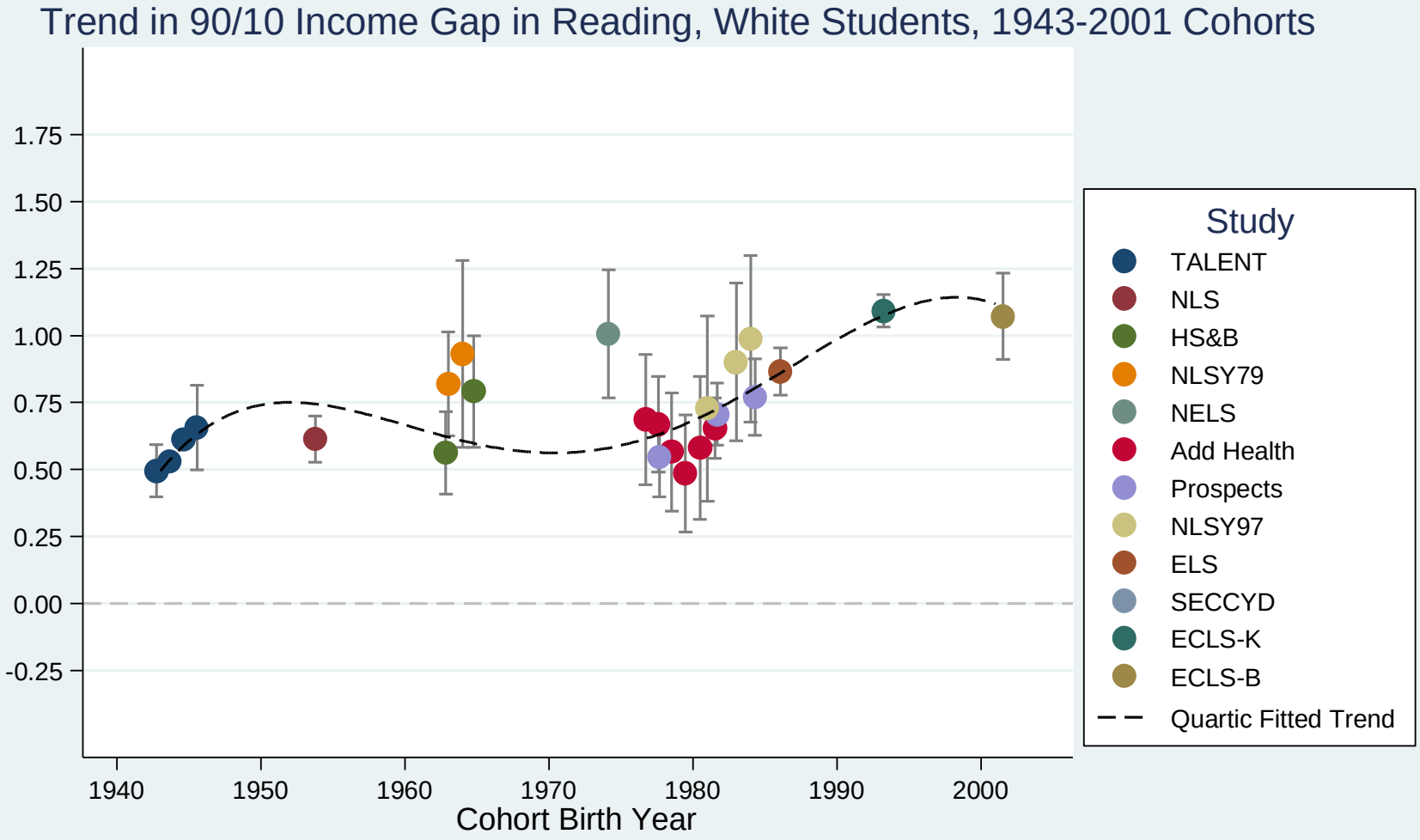
implications

- the link between family income and children's achievement, coupled with the increasing importance of cognitive skills in determining earnings, produces a feedback cycle that leads to low socioeconomic mobility and growing inequality.
- this feedback cycle may operate partly through schooling, though schools (in a narrow, functional sense) do not appear to be a primary cause of this trend
- nor is it clear that schools (alone) can reverse this trend, though they may be a helpful mechanism.

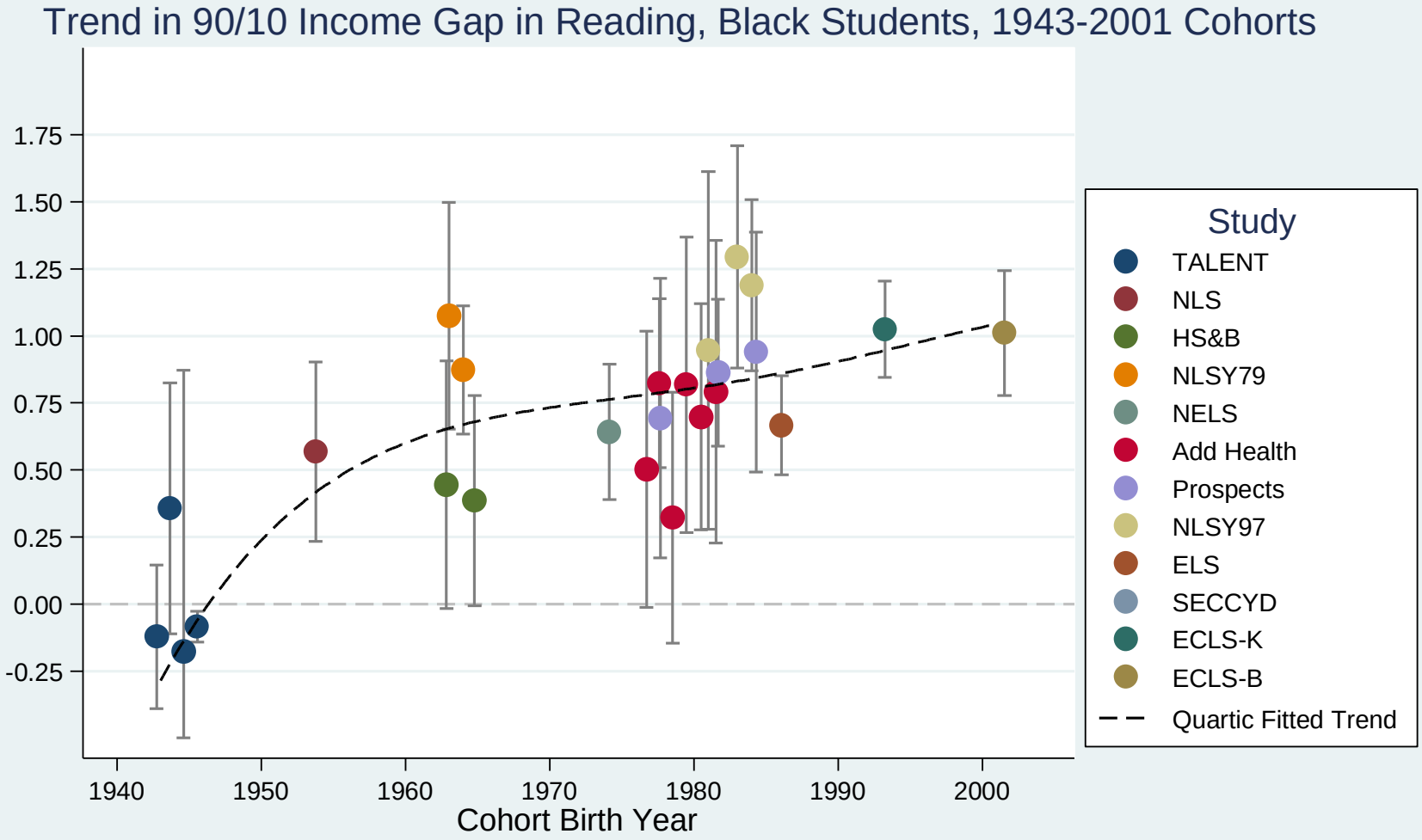
policy implications

- reduce economic inequality
- greater investment in early childhood
  - prevent development of gaps (easier than remedying later)
  - most cost-effective developmental age for investment
  - means-targeted programs likely most cost-effective (though maybe less politically feasible?)
- support for low-income families
  - repair/strengthen social safety net
  - programs to develop parenting skills (e.g., Nurse-Family Partnership)
- increase education policy focus on students from low-income families and communities
  - develop and test strategies for improving instruction/learning for low-income students

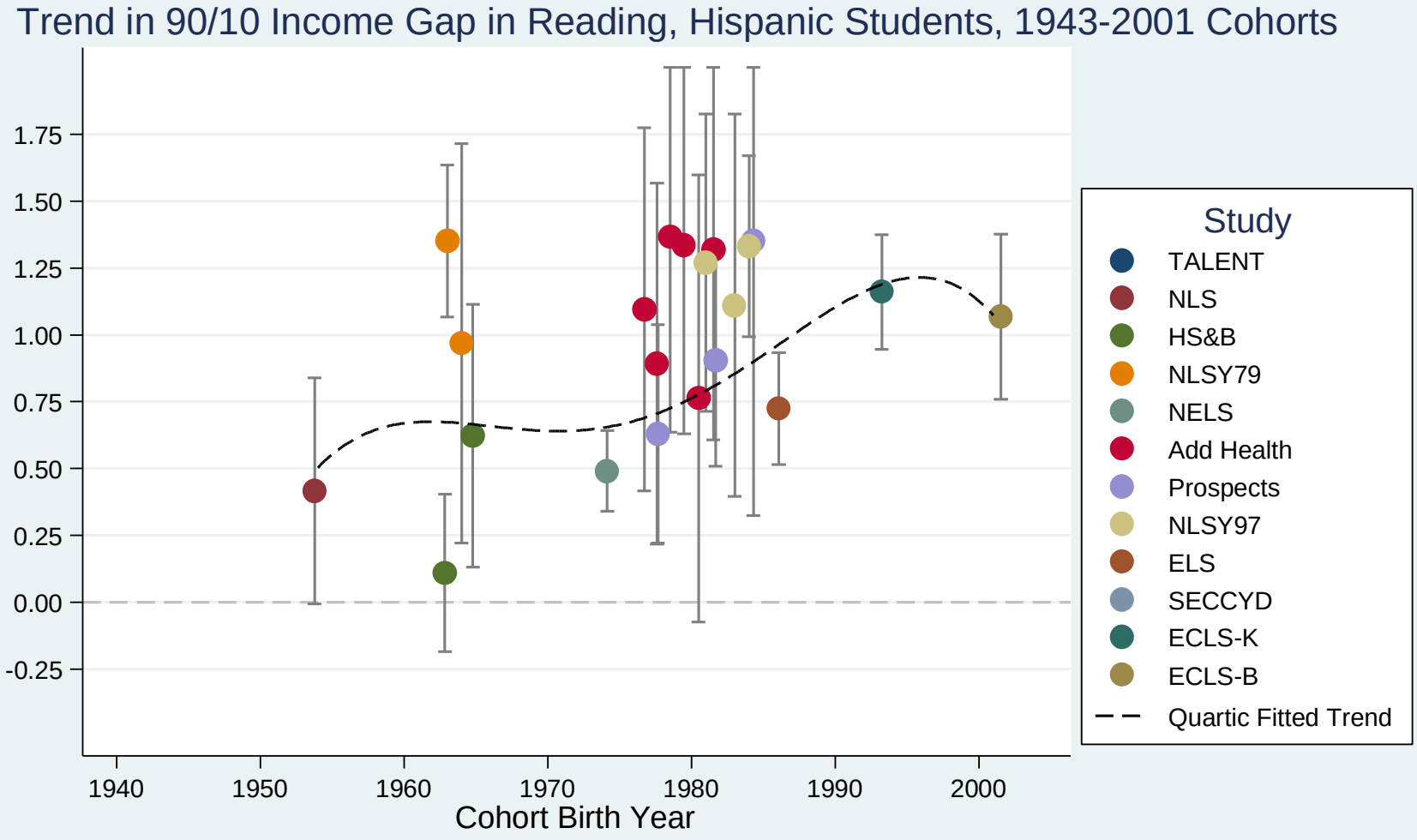
income achievement reading gaps, 1940-2001 cohorts, white students



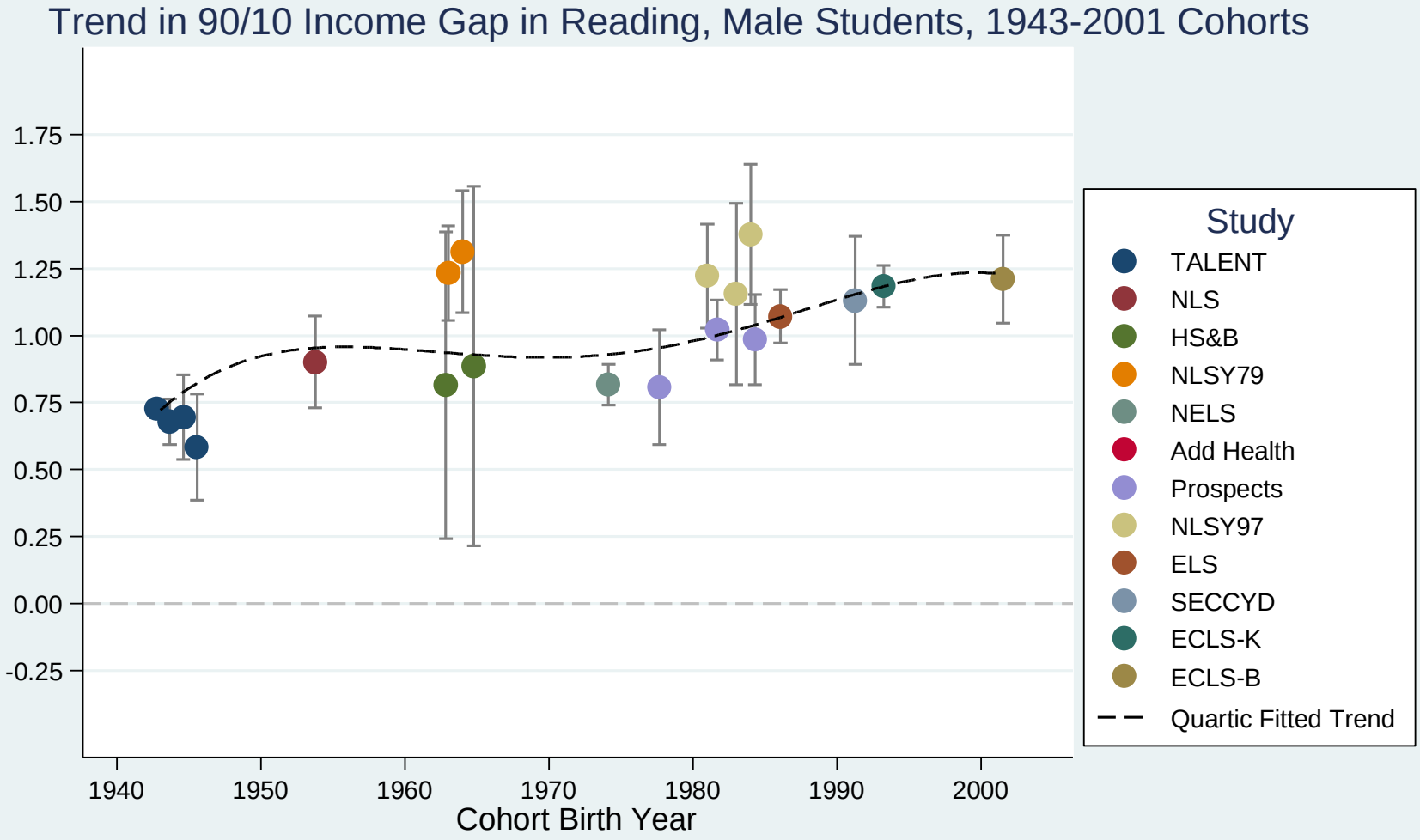
income achievement reading gaps, 1940-2001 cohorts, black students



income achievement reading gaps, 1940-2001 cohorts, hispanic students



income achievement reading gaps, 1940-2001 cohorts, male students



income achievement reading gaps, 1940-2001 cohorts, female students