

Early Life Health: Consequences for Human Capital Formation

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Research supports the idea that the roots of adult inequality lie early in life

e.g. Case and Paxson, 2008, 2010;

Chetty et al. 2010;

Currie 1999, 2011;

Currie and Thomas 1995, 2001;

Cunha and Heckman 2008;

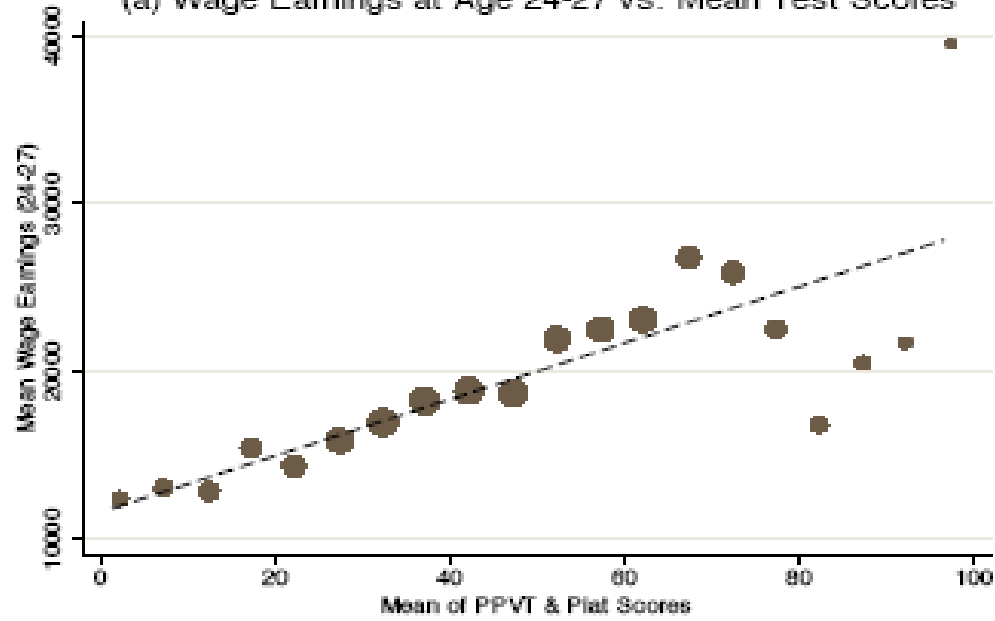
Cunha, Heckman, Schennach 2010,

Smith, 2005.

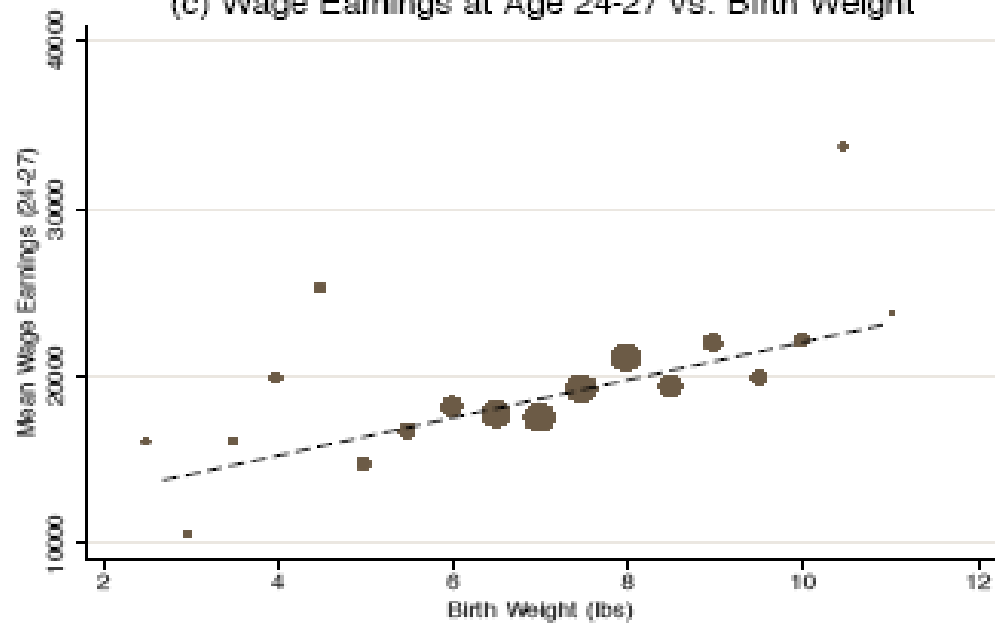
This relationship can be illustrated using the U.S. children of the NLSY

- Children of women who were 14-21 in 1978.
- What is the relationship between the earliest test scores (measured at ages 3 to 6) and earnings in young adulthood?
- Plot earnings against the child's percentile test score.
- For comparison, plot earnings against birth weight

(a) Wage Earnings at Age 24-27 vs. Mean Test Scores



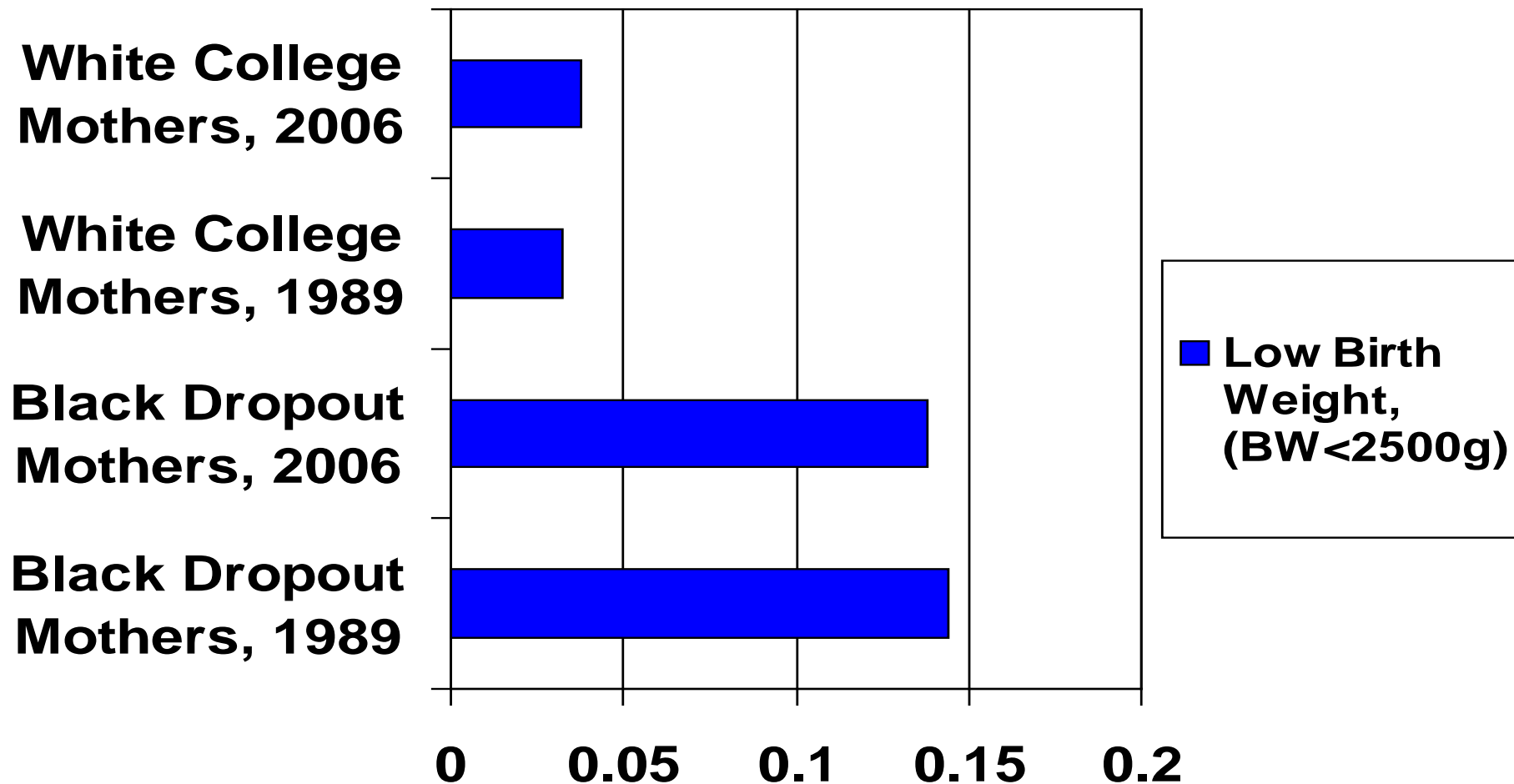
(c) Wage Earnings at Age 24-27 vs. Birth Weight



Similarly, in the 1958 British Birth Cohort Study, LBW has a larger effect on age 7 math scores than moving from low to high SES (Source Currie and Hyson, 1999).

| | Males | Females |
|------------|-------------------------------|-------------------------------|
| LBW | -0.21 [.081] | -0.21 [.075] |
| High SES | 0.078 [.033] | 0.14 [.034] |
| Low SES | -0.016 [.033] | -0.078 [.034] |

Within some rich countries, gradients in health at birth are large. E.g. U.S. Low Birth Weight (single births only)



Fetal Origins Hypothesis Suggests that These Differences Have Long-Term Effects

- Conditions in utero (and in early life?) “program” the developing child in ways that affect future development.
- E.g. exposure to famine in utero may affect the metabolism, pre-disposing individuals to obesity, diabetes, and heart disease (the “Barker Hypothesis”).

How Does this Happen?

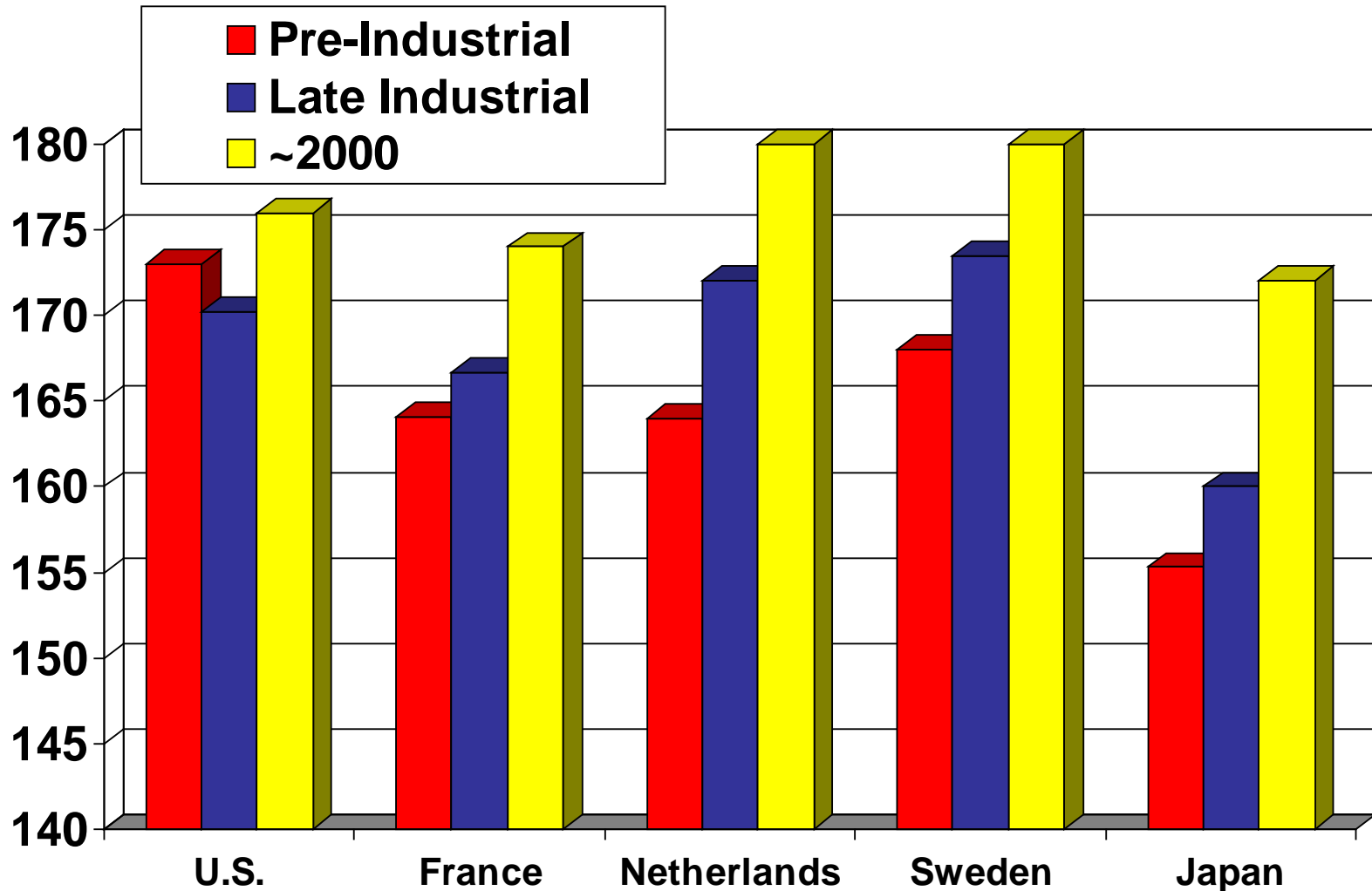
- The epigenome determines which parts of the DNA are turned “on” or “off.”
- Environmental factors affect this process.
- *Thus, phenotypes arise through interactions of “nature” and “nurture” (not nature or nurture).*

The Example of Height

- An important predictor of future outcomes (Case and Paxson, 2008, 2010)
- Strongly heritable, that is tall parents tend to have tall children.
- Over 40 areas of the DNA affect height.
- But together, variations in these regions of the genome explain less than 5% of the heritability of height (Mayer, 2008).
- Moreover, height of populations has changed rapidly over time.

Trends in Heights of Adult Men, cm

(Main source=Steckel and Floud, 1997 for historical data, official statistics for modern)



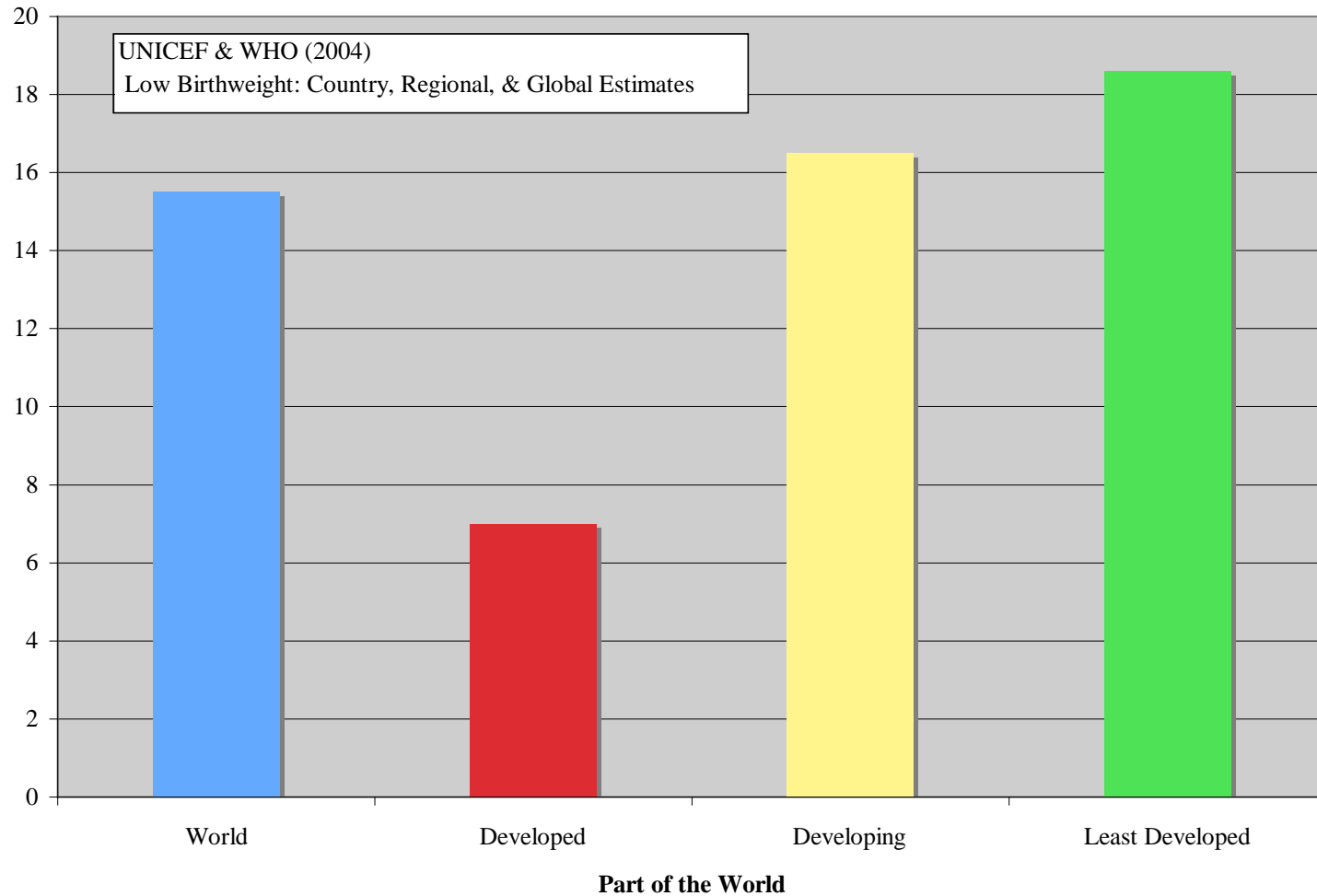
Epigenetics suggests that we should see environmental influences on health at birth, and that these could explain a large fraction of the differences between individuals.

Provides an explanation for something observed in many economic studies: health at birth is extremely malleable.

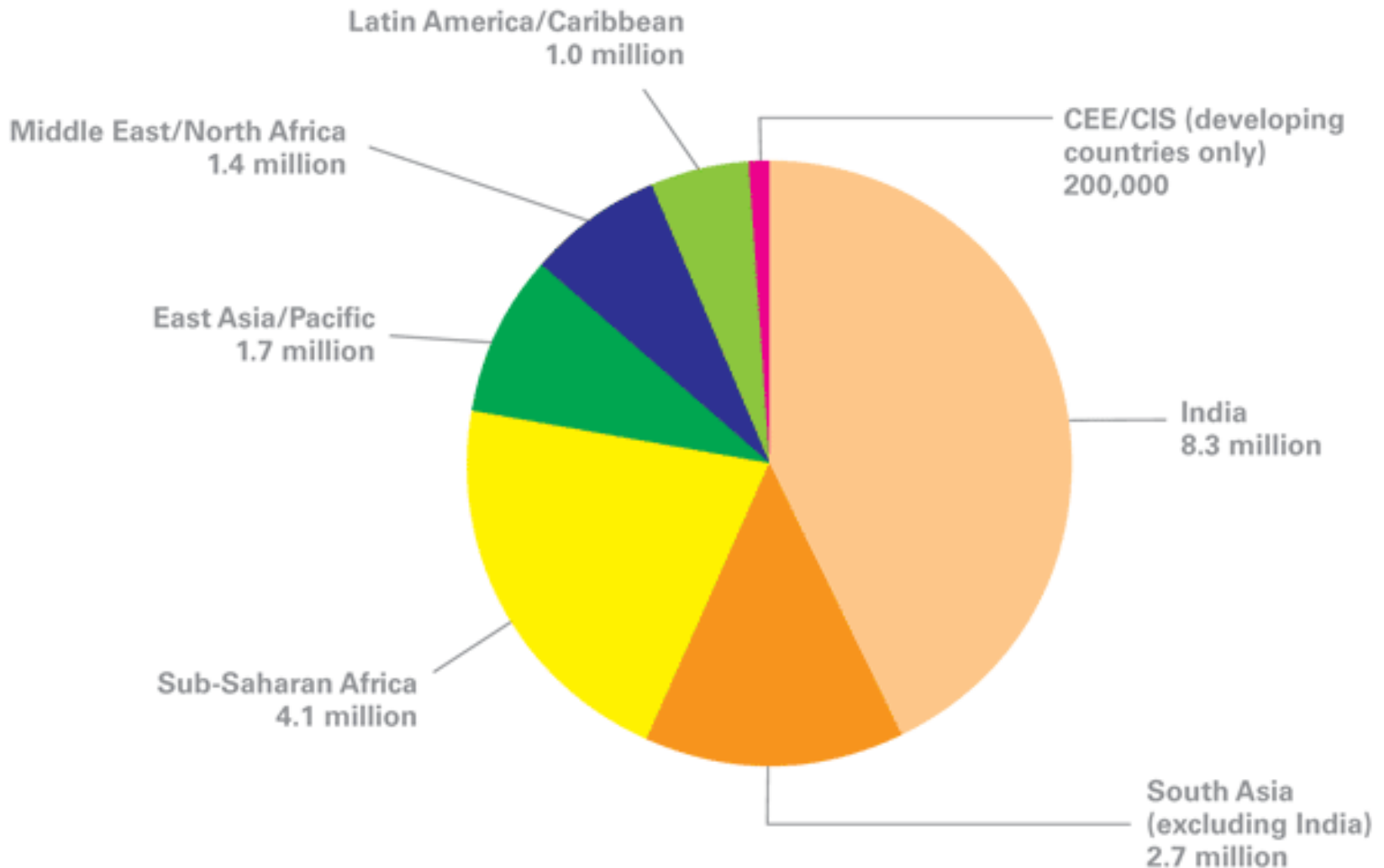
Birth Weight & Low Birth Weight (<2500 gm) Often Used as Summary Measures of Health at Birth

- Birth weight has been measured over a long period of time and in many populations.
- It is well measured and objectively measured relative to other indicators.

Low Birth Weight Around the World



Low Birth Weight by Region in the Developing World

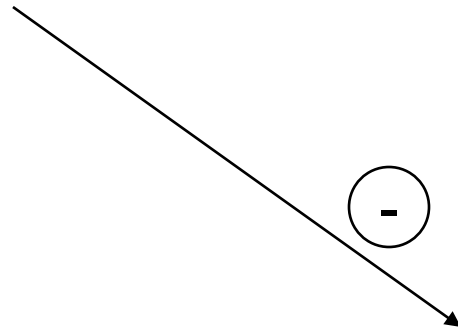


Low Birth Weight May be Understated in Developing Countries

- Measurement error: *Very* limited historical data
- 58% (68%) of births not weighed in developing (least developed) countries. Those not weighed may be most likely to be LBW.

Recent economic studies in rich countries show that health at birth is subject to many environmental influences

Poor Nutrition, Illness, Stress

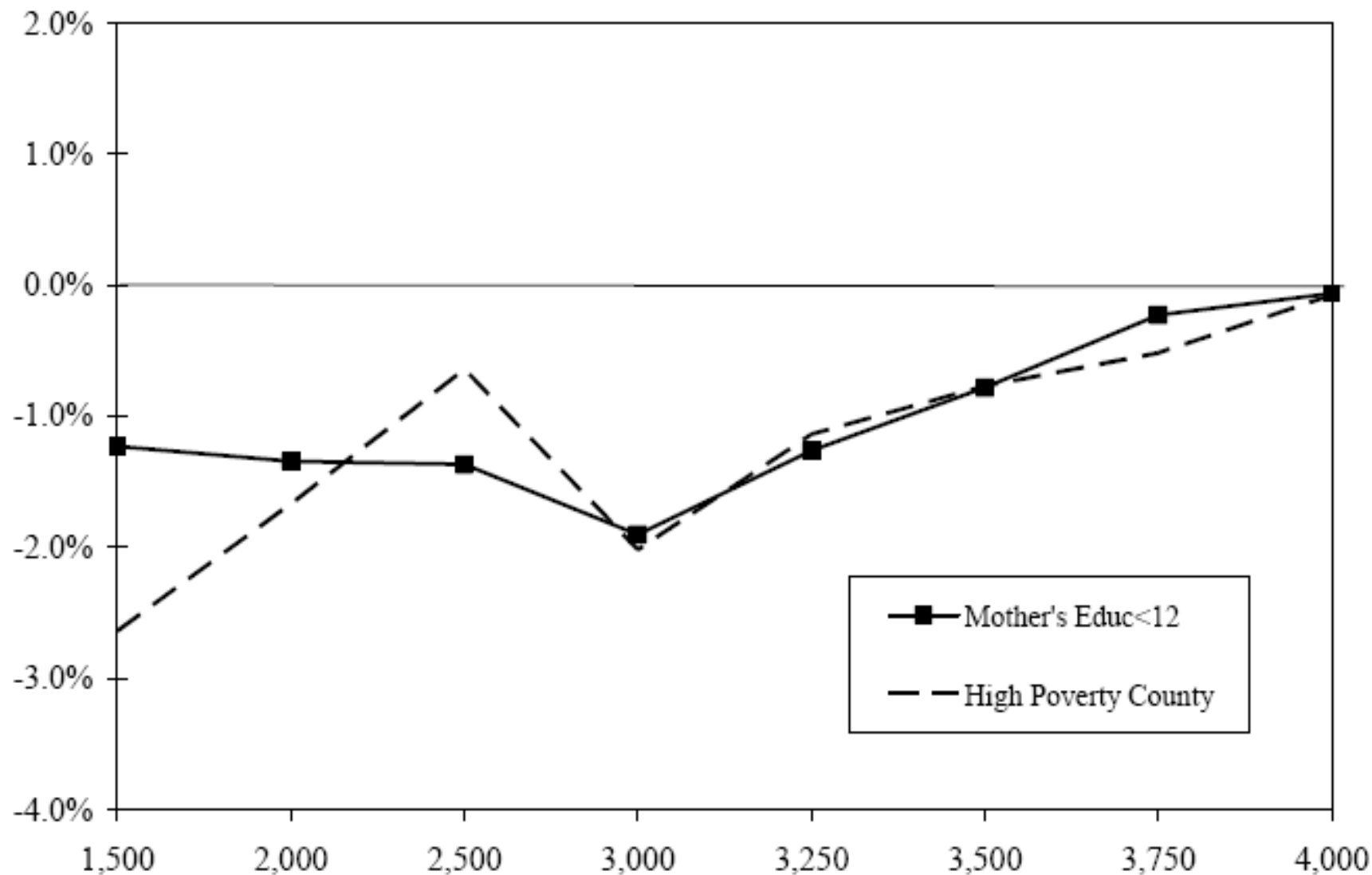


Birth weight

E.g. Hoynes, Page, Stevens (2009)

- Study the Supplemental Feeding Program for Women, Infants, and Children (WIC).
- Provides supplemental food to pregnant women.
- Program was rolled out on a city/county basis between 1972 and 1979.
- HPS examine the effect of the rollout of WIC on birth weight.

Effect of WIC Implementation on Fraction of Births Below Each Birth Weight Threshold, Coefficient/Mean



**Poor Nutrition, Illness,
Stress**

**Smoking, Drinking,
Drugs**

-

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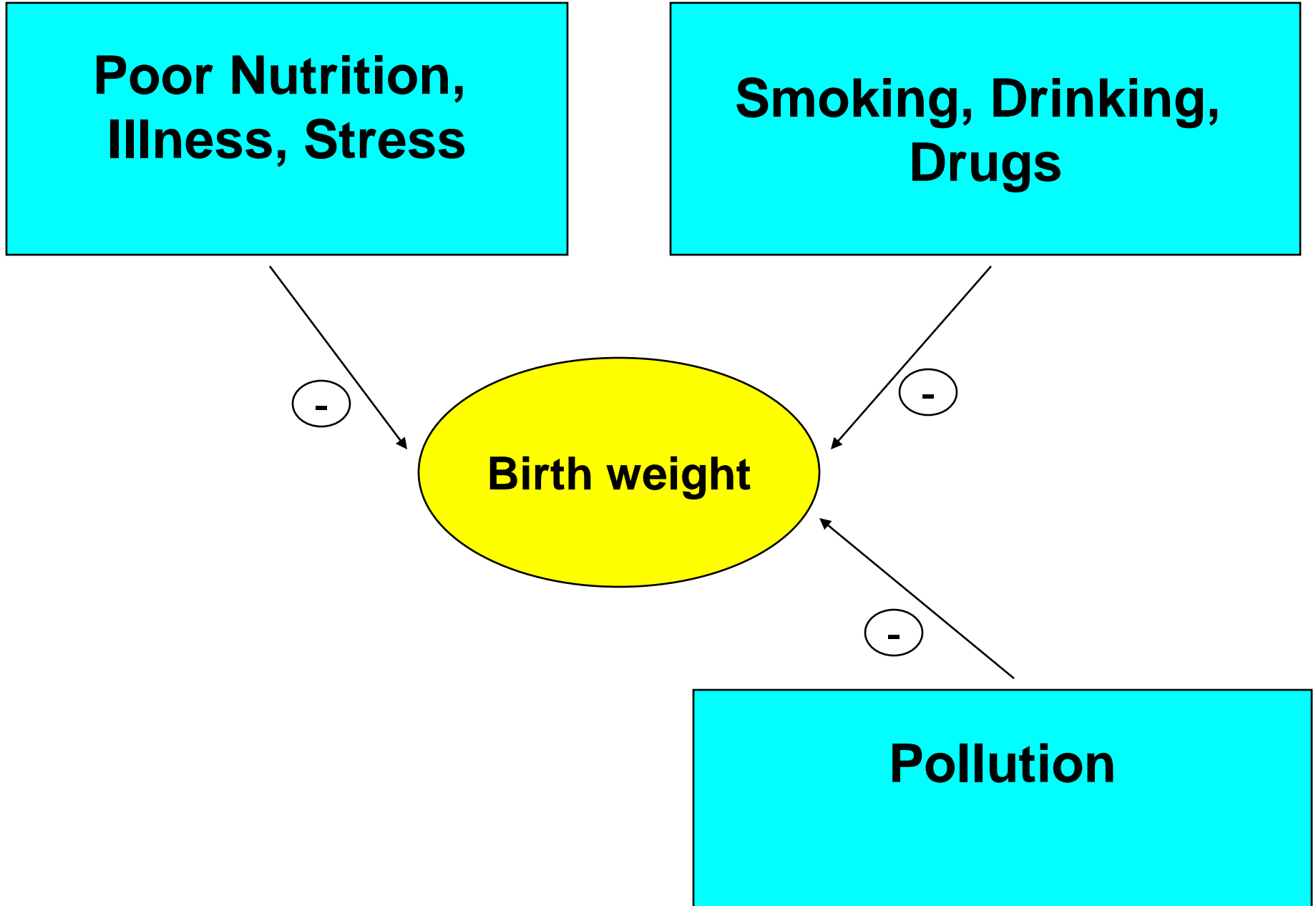
Birth weight

**Poor Nutrition,
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Birth weight

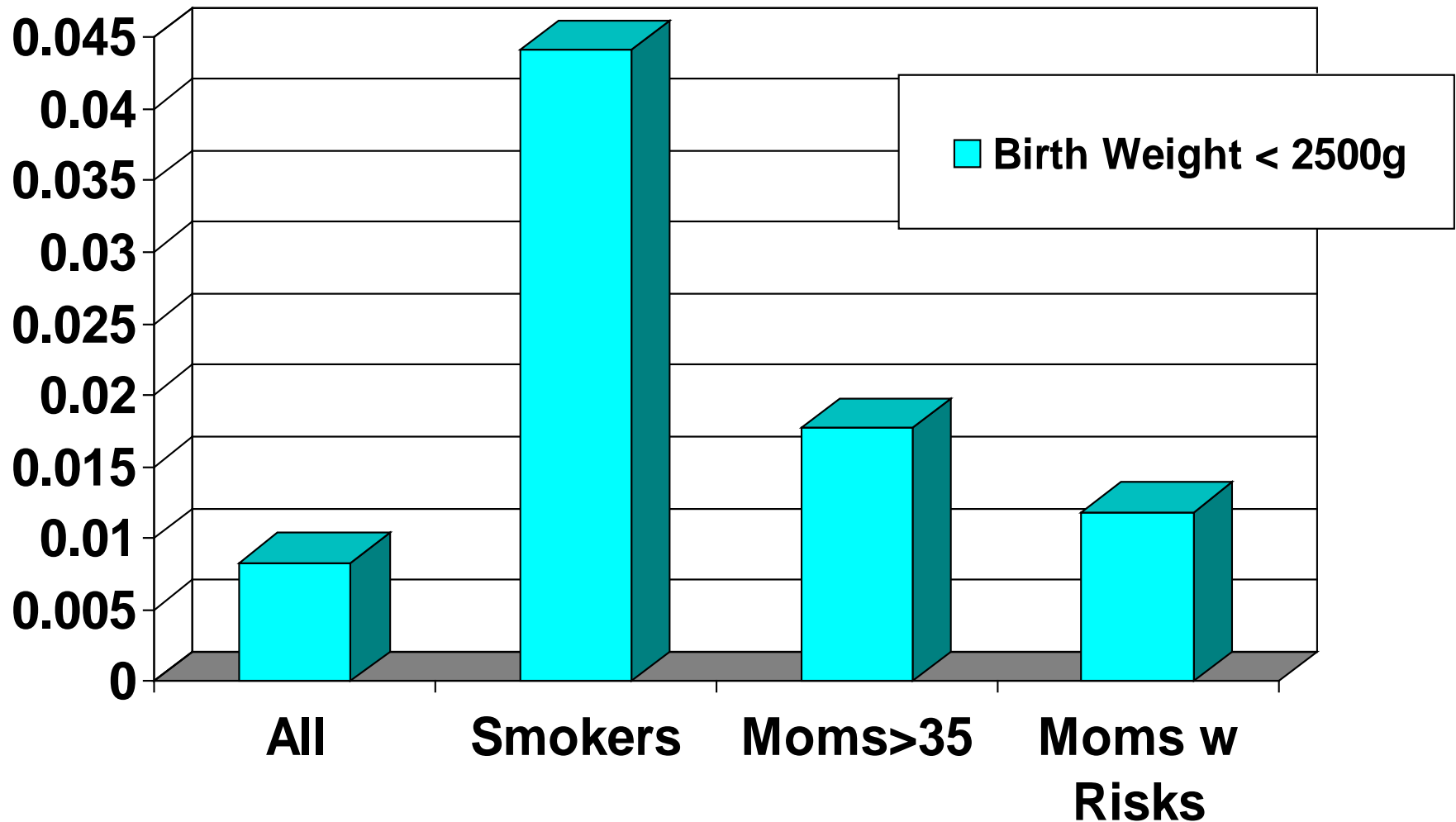
Pollution



E.g. Currie, Schmeider, and Neidell (2009)

- Look at 1.5 million New Jersey births between 1989 and 2003 using data from birth certificates.
- Confidential version of the data allows us to geocode and link births to same mothers.
- Select mothers who live near fixed air quality monitors.
- Examine the effect of changes in criterion air pollutants (CO, PM10, Ozone) between births on the fetal health of siblings.

Effect of a 1 Unit Change in CO (Mean=1.6, SD=13) on Incidence of Low Birth Weight



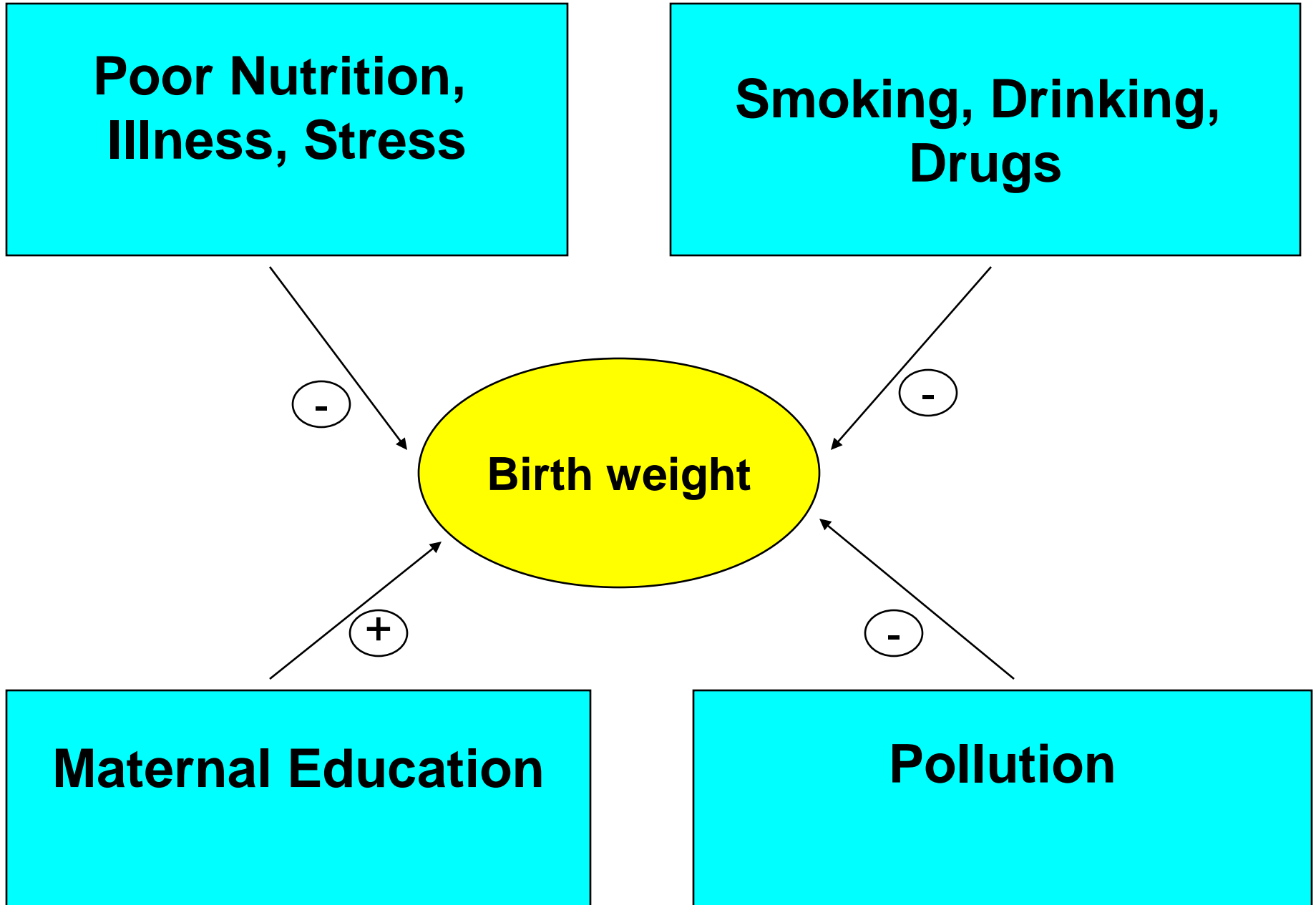
**Poor Nutrition,
Illness, Stress**

**Smoking, Drinking,
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Birth weight

Maternal Education

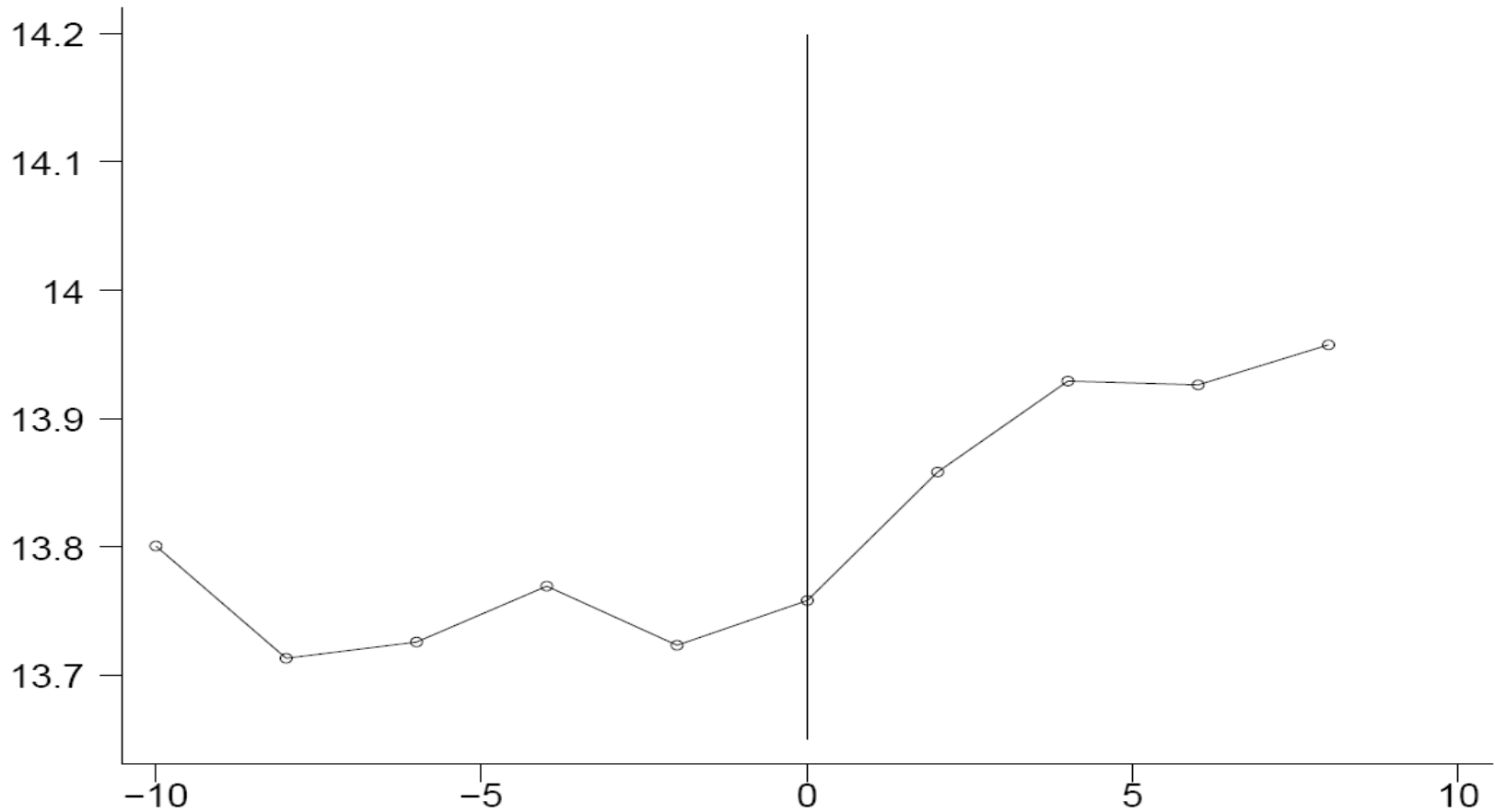
Pollution



E.g. Currie and Moretti (2003)

- Use national birth data and a data set we collected of college openings.
- Use college openings in the woman's county in the year in which she was 17 as an instrument for education.
- Examine the effects of college education on birth weight and inputs such as prenatal care and smoking.

College Openings Increase Education



Avg. years education 1st time mothers 24+
Before & after opening of 4-year college

Mother's Education and Infants Health

U.S. Vital Statistics Data: IV=College Openings, Mothers
25-45 years old

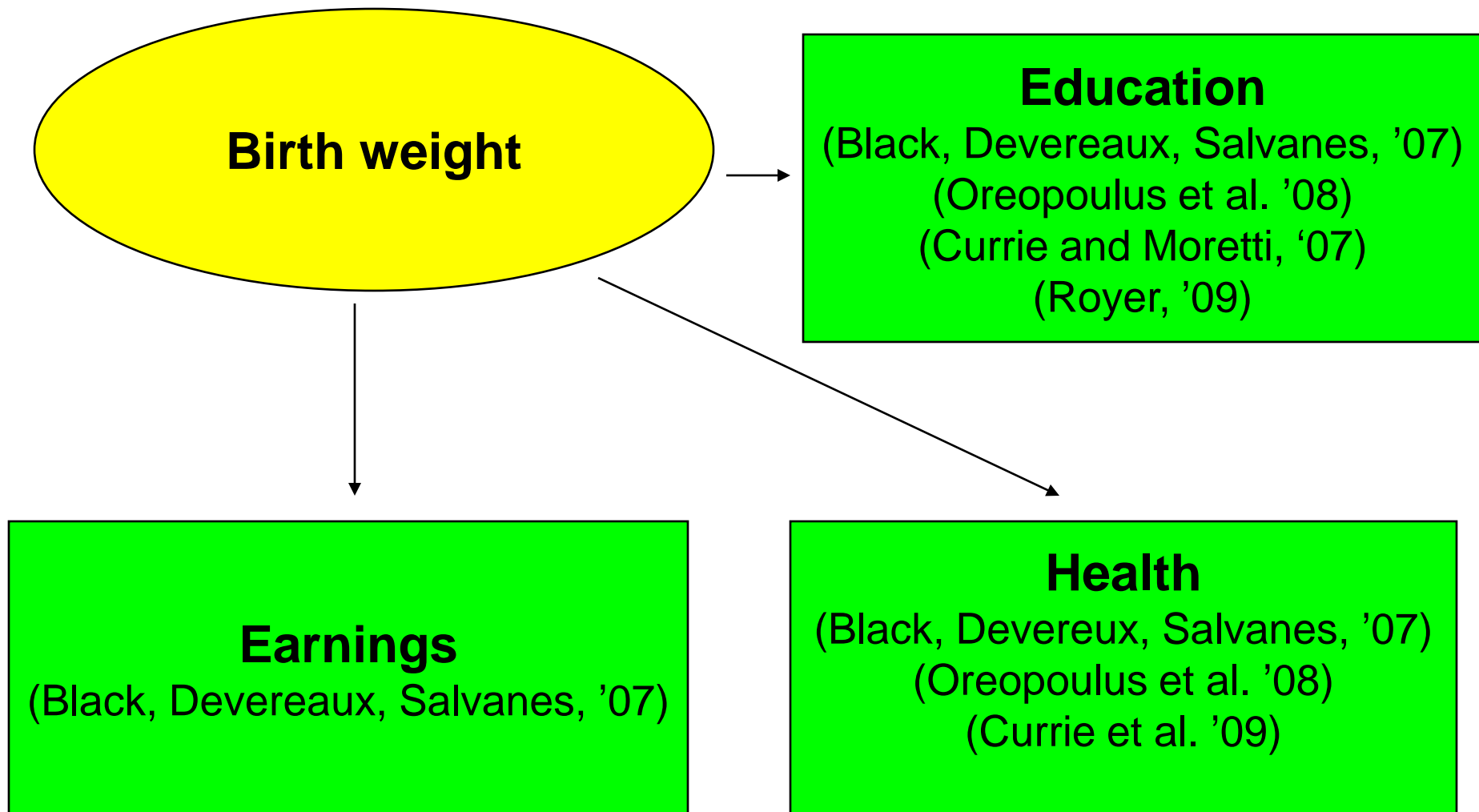
| | Coeff. Estimate | Mean of Dep. Var. |
|-----------------------------------|--------------------|----------------------|
| 1. Low Birth Weight | -0.0098 [.0038] | 0.049 |
| 2. Preterm Birth | -0.01 [.0044] | 0.069 |
| 3. Prenatal Care 1st trimester | 0.0234 [.0055] | 0.921 |
| 4. Smoked During Pregnancy | -0.0583 [.0118] | 0.078 |

Notes: Std. errors in brackets. Models include mother age, cohort, county*year-of-child's birth. Each row is from a separate regression.

Carneiro, Meghir, and Parey (forthcoming)

- Use data from NLSY79 on mothers and children
- Show that additional year of education (instrumented using distance to college, tuition, local labor market conditions) increases child test scores at ages 7&8 and reduces behavior problems.
- Show that changes in maternal inputs (books, lessons, computers) may account for some of the effect.

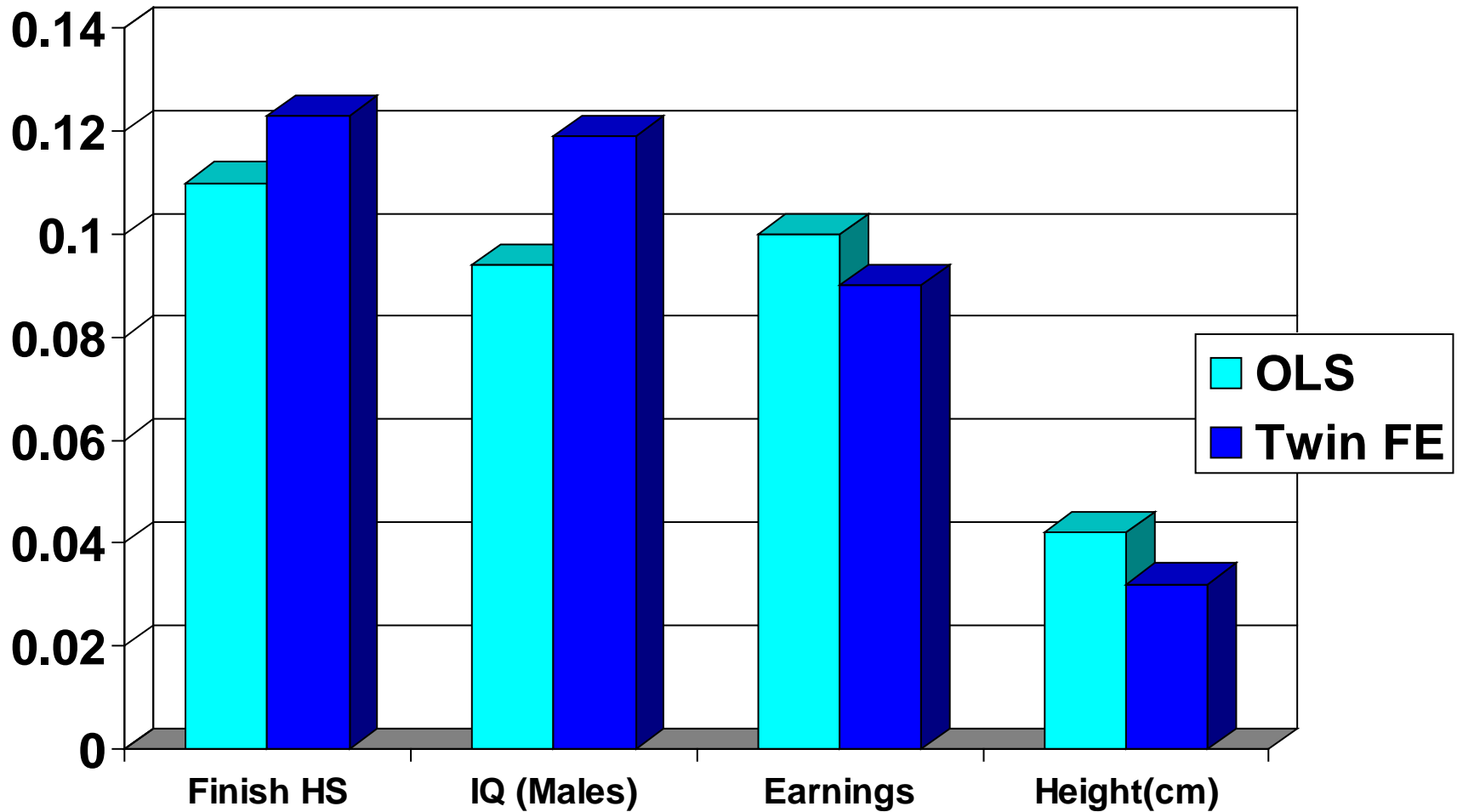
Large scale sibling studies link birth weight to positive adult outcomes



E.g. Black, Devereux, and Salvanes (2007)

- All Norwegian births from 1967-1997.
- Focus on twins.
- Match to Norwegian registry data for 1982-2002 (i.e. administrative records on educational attainment, earnings, etc.)
- For men, match to military records for 1984-2005 (IQ + height [for subset])

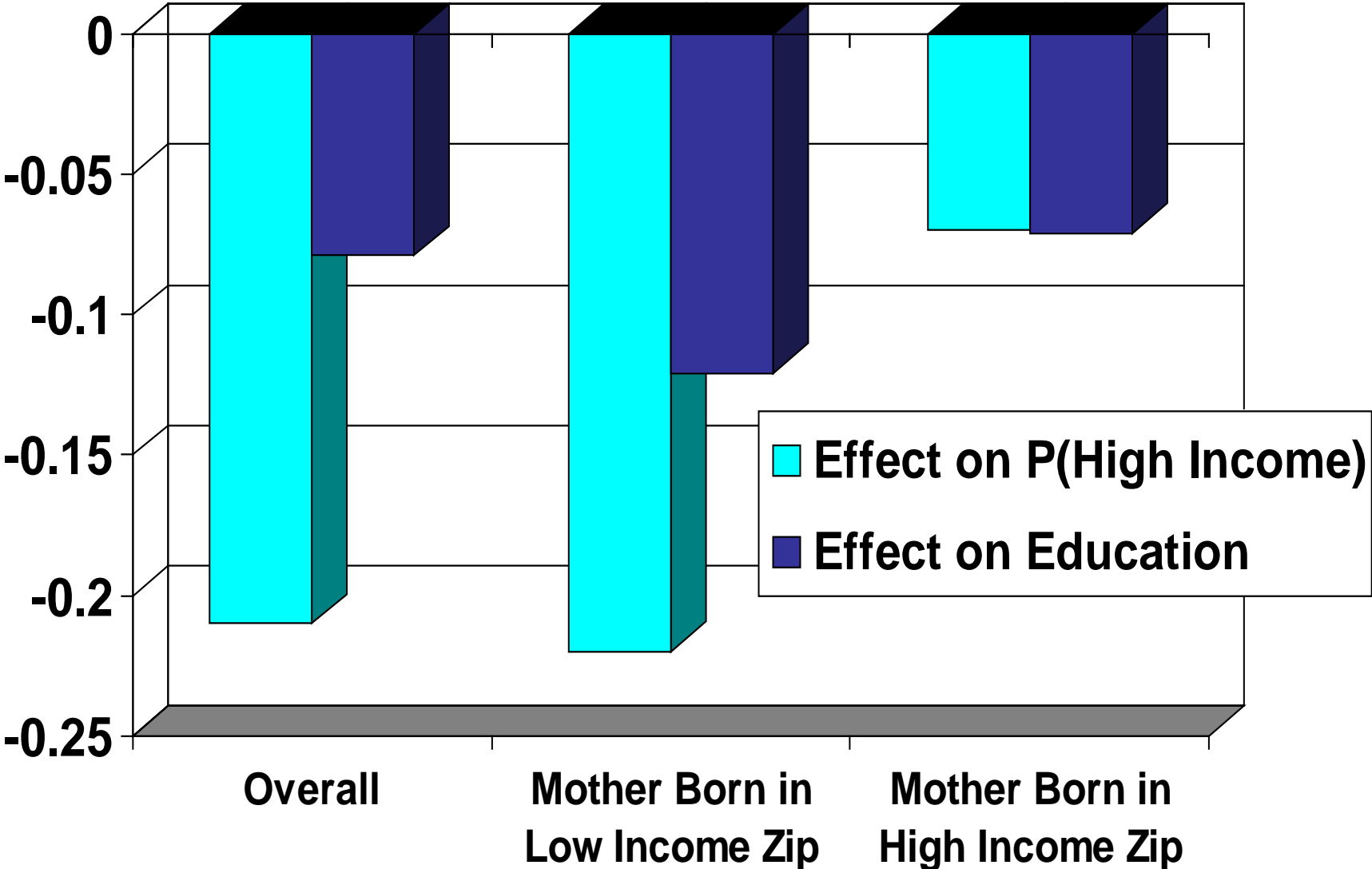
Estimated Elasticity of Outcome wrt to Birth Weight (data from Black, Devereaux and Salvanes)



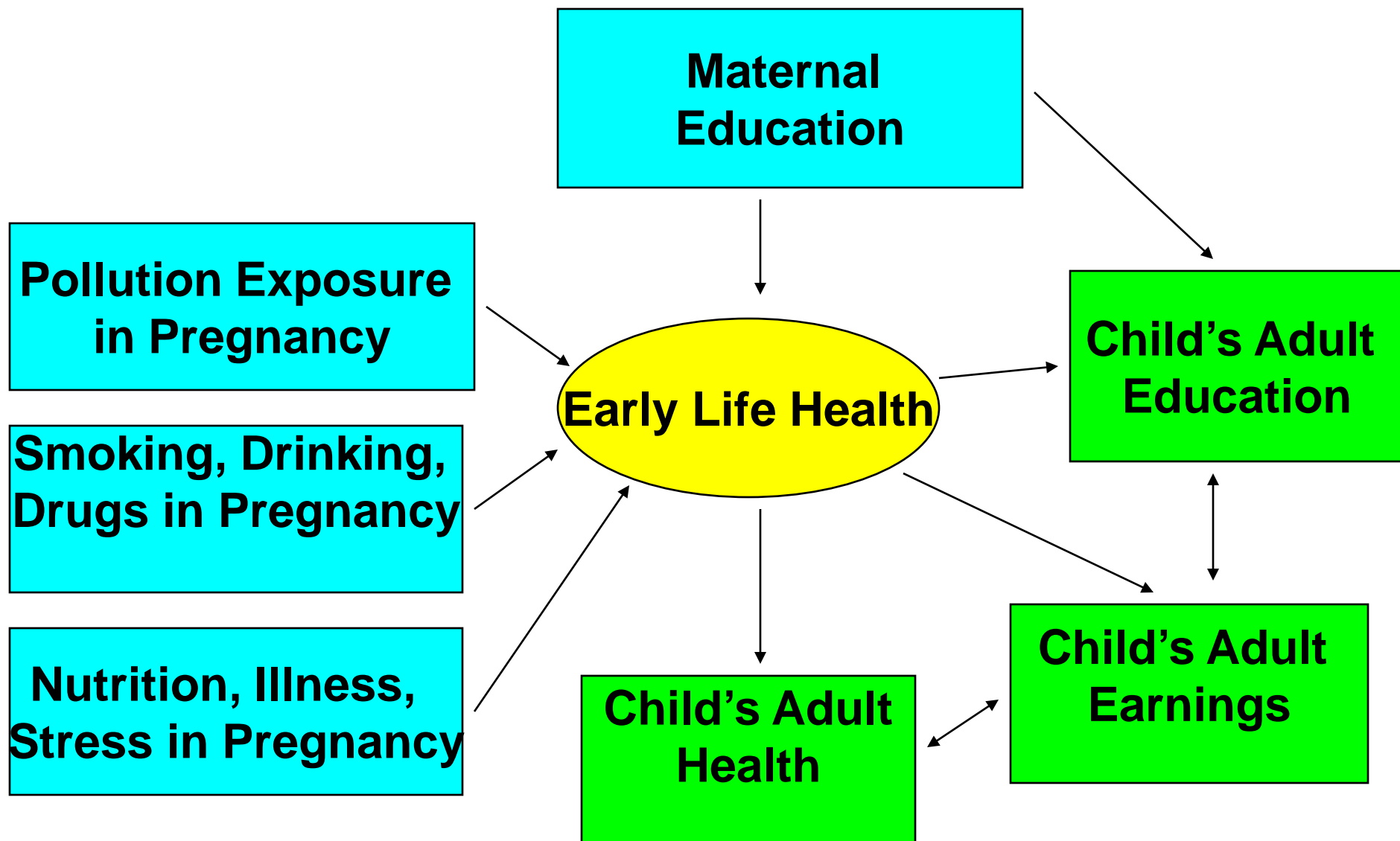
Long term effects of Low Birth Weight are smaller for children of well off parents

- E.g. Currie and Moretti (2007) compare California mothers who were sisters.
- Women who were LBW got less education and were more likely to be low income (measured as living in a high poverty postal codes) at the time of her own infant's birth.
- But effects smaller for women born in high income postal codes.

Effect of Maternal LBW on Mother's Adult Outcomes



Early Life Health and the Child's Adult Outcomes



Birth Weight is the most commonly available measure of fetal health

- But birth weight is not a comprehensive measure of fetal health (Almond, Chay, and Lee, 2005).
- Best to think of it as a noisy indicator of health in utero, and one that may miss many aspects of fetal health damage.

Alternative Measures:

- 1) Infant Mortality – a large share of infant death is due to conditions present at birth.
- 2) Height for age – reflects both in utero and early life conditions more generally.
- 3) Cohort comparisons looking at future outcomes (education, wages, disability) of cohorts affected by large shocks. E.g. A famine or a war.

Much of the Development Literature Focuses on Mortality

- Mortality is obviously important.
- Here I am focusing on health of survivors.
- Comparisons of health of survivors between rich and poor countries may be biased by differences in selection.
- E.g. Bozzoli, Deaton, Quintana-Domeque (2009) find that in poor countries are healthier than average while in rich countries survivors are “scarred”.

Comparisons between rich and poor countries

- Most of what we know about longer-term effects of early health shocks comes from rich countries.
- Cross-country comparisons hampered by lack of standardization in both shocks and outcome measures.
- Growing numbers of studies in poor countries, but still relatively few using natural experiment or cohort-based methodology.

Might effects be larger in poor countries?

- Health shocks themselves might be more frequent and larger.
- Health shocks might interact with other shocks.
- Children might begin at a steeper point on a human capital production function.
- Possibilities for ex post mitigation might be fewer.

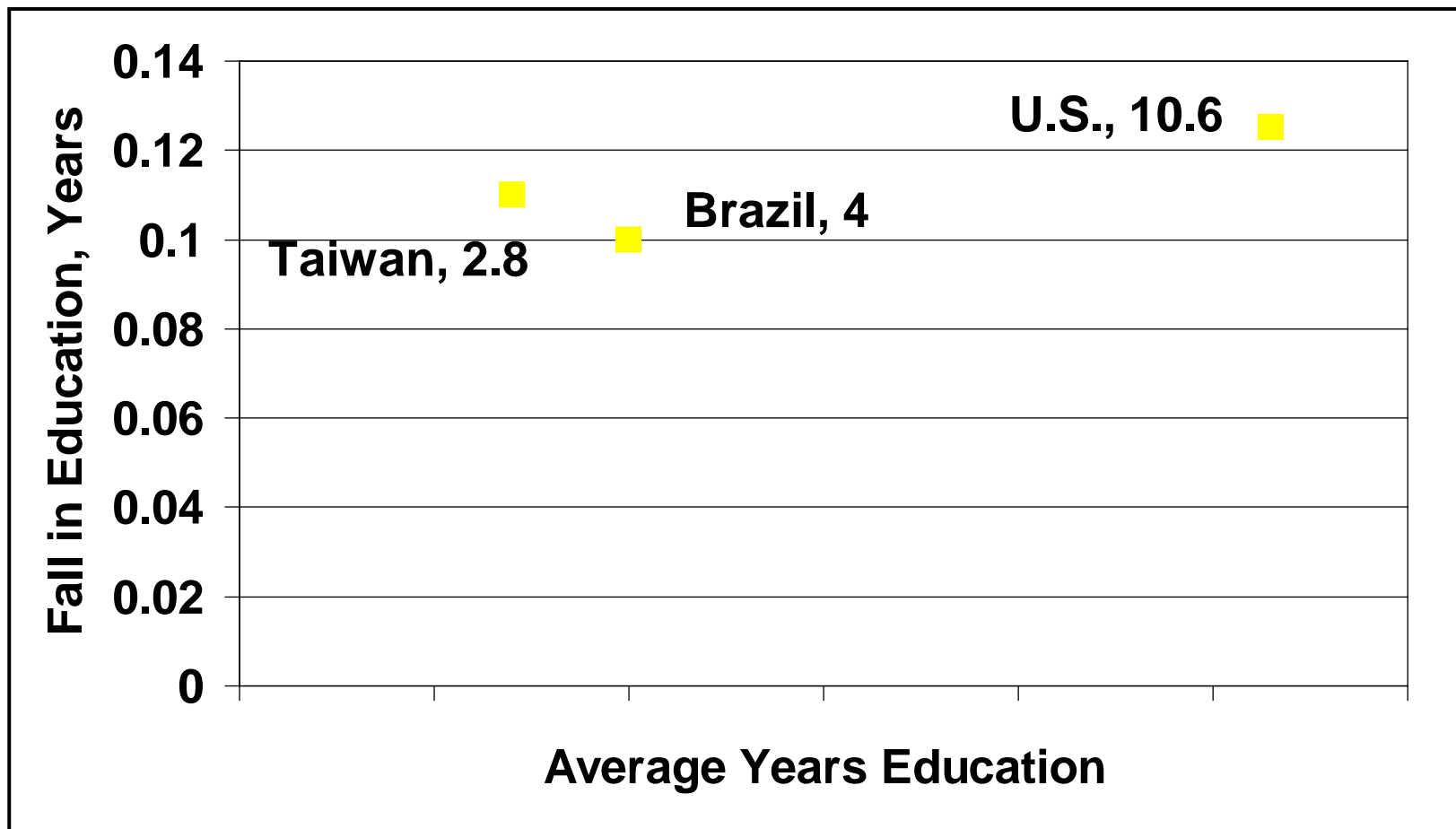
Is it possible that long-term effects could be smaller?

- The effect of a particular shock could be muted if individual is also subject to many other shocks. i.e. if potential is limited by other factors.

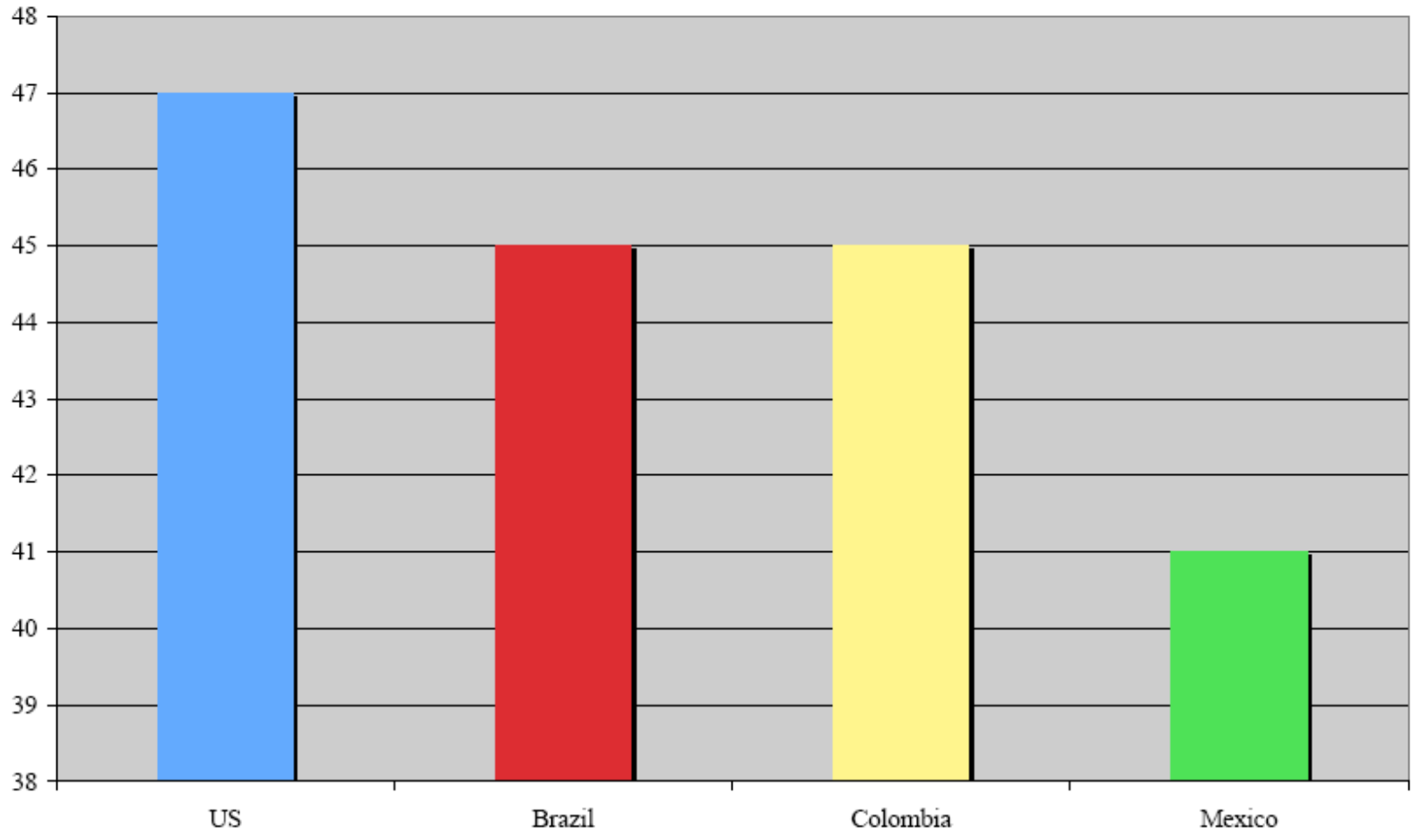
Example comparisons:

- Prenatal exposure to 1919 flu
- Malaria eradication
- Exposure to violence in utero
- Exposure to famine in utero or early childhood.

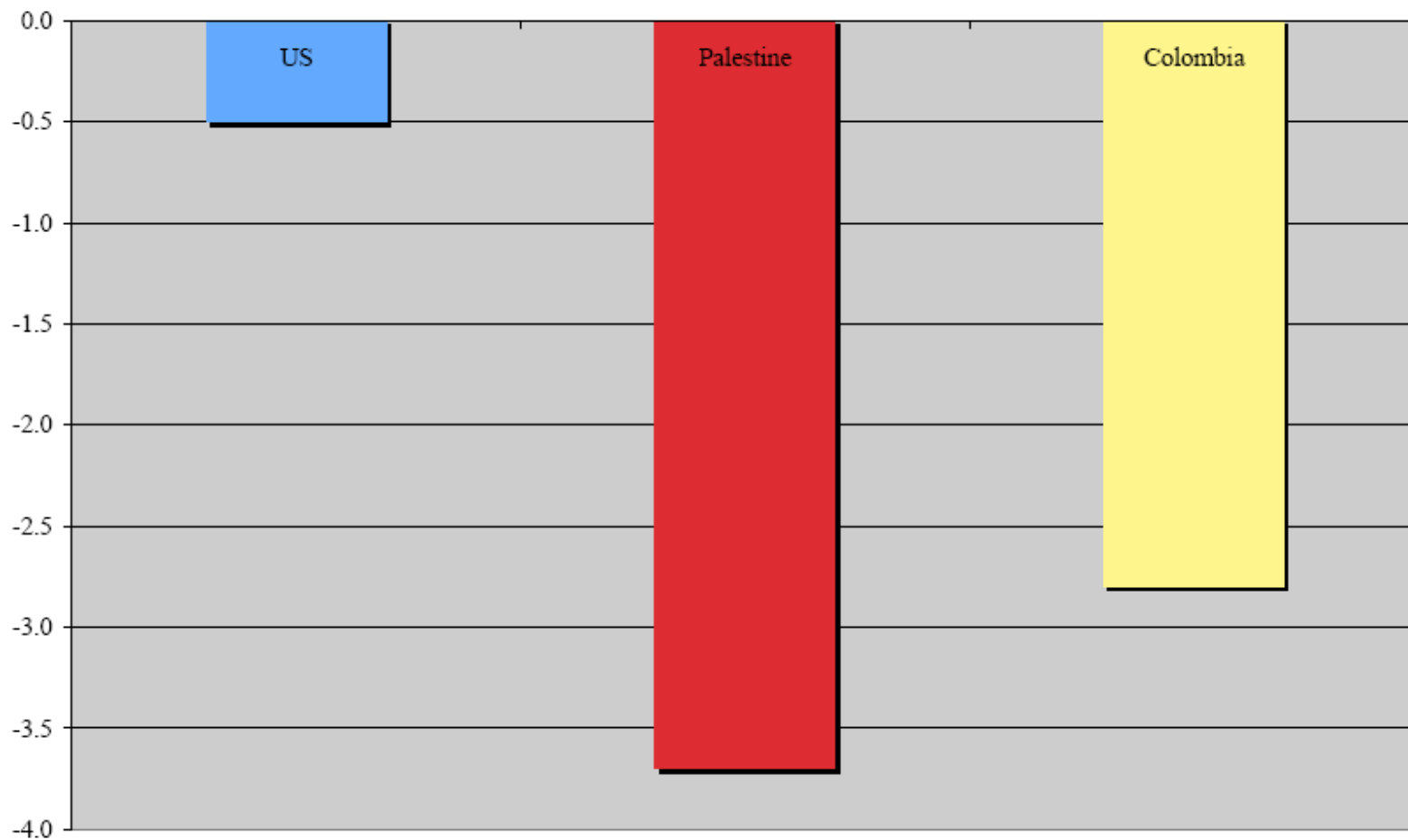
Decline in Years of Education with Prenatal 1919 Flu



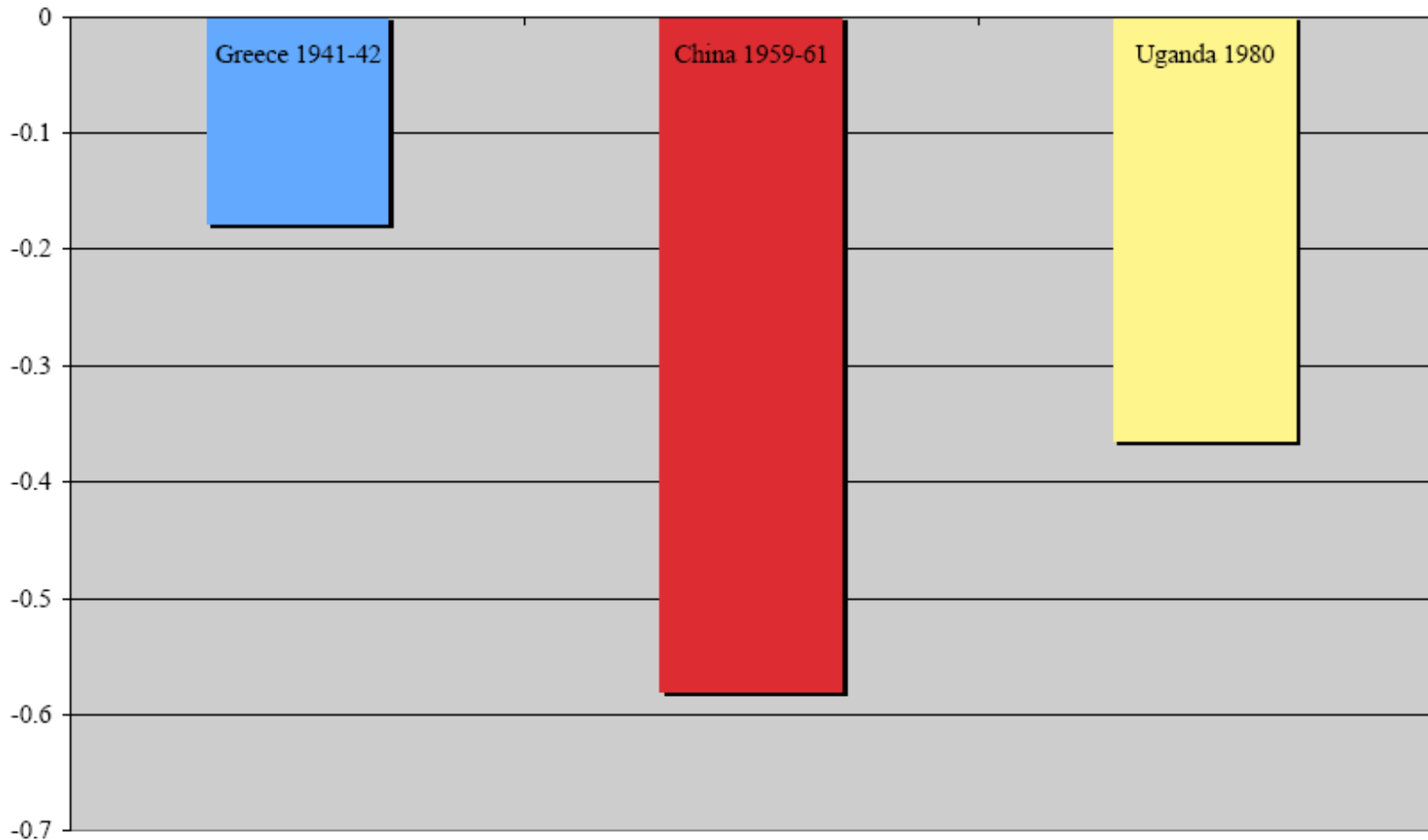
Effect of Malaria Eradication: Estimated Increase in Income with a 100% Reduction in the Probability of Infection (Bleakley, 2010)



Reductions in mean birth weight (grams per death) associated with 9/11, Intifada, Land mines



Decline in years of schooling for famine-exposed cohorts



Initial Tentative Observations:

- Estimated effects of early life shocks are not uniformly larger in poor countries.
- May suggest limited possibilities for mitigation even in rich countries.
- Investigation of this question may shed more light on mechanisms underlying long run effects of early life shocks.

We Need Better Data

- Agreement on more subtle and uniform measures of health at birth and in early childhood.
- Data linking adults to conditions in early life (though cohort level data is increasingly available).

Questions for Future Research

- Documenting the consequences of inequality in health at birth, including an understanding of mechanisms and trajectories.
- Investigating the effects of policy, including possible countervailing actions of economic agents and distributional consequences.

This research agenda is still in its infancy!

