Estimating the Impact of Women's Education on Fertility, Child Mortality, and Empowerment when Schooling Ain't Learning

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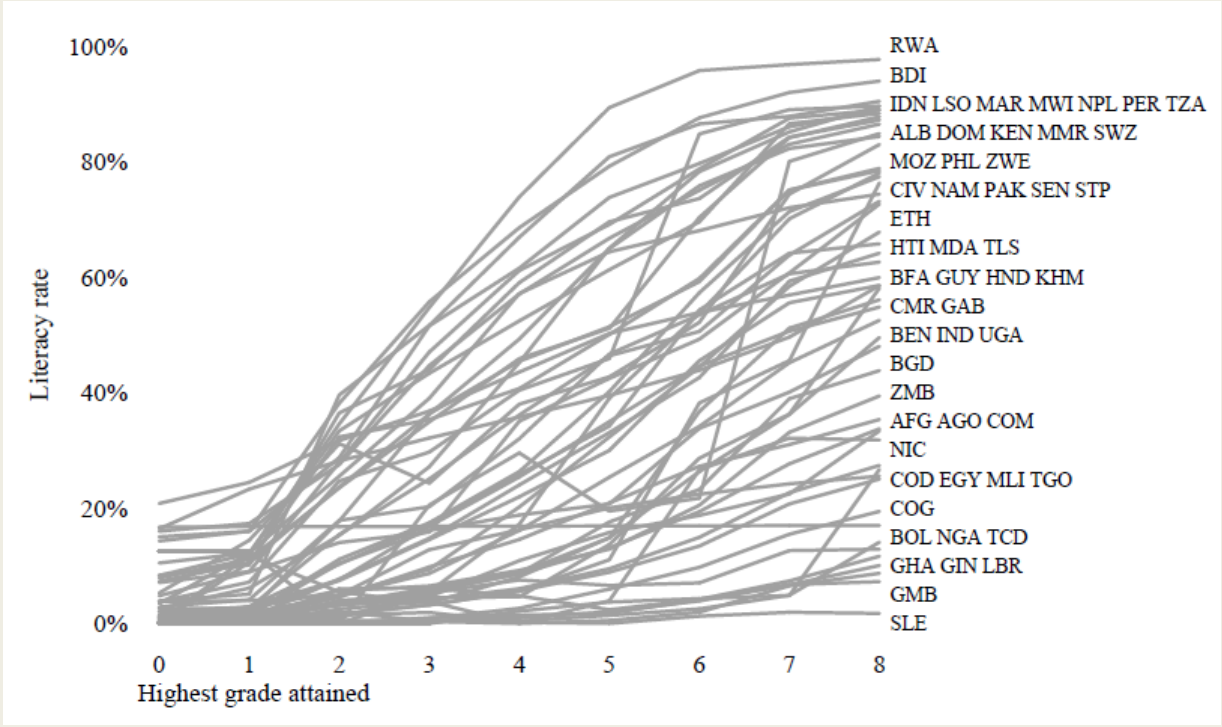
Schooling isn't always learning

Abundant evidence that *schooling* is good for outcomes…

- Broad consensus that women's *education* is one of the most powerful forces for improving well-being in the developing world with positive impacts in the labor market and also on child health, fertility, and empowerment
- However, nearly all of the evidence for such claims, at the household and economy wide level, uses exclusively data on *schooling* (time served) not *learning* (capabilities acquired)

…but schooling and literacy are weakly linked, with massive differences across countries in learning per year of schooling.

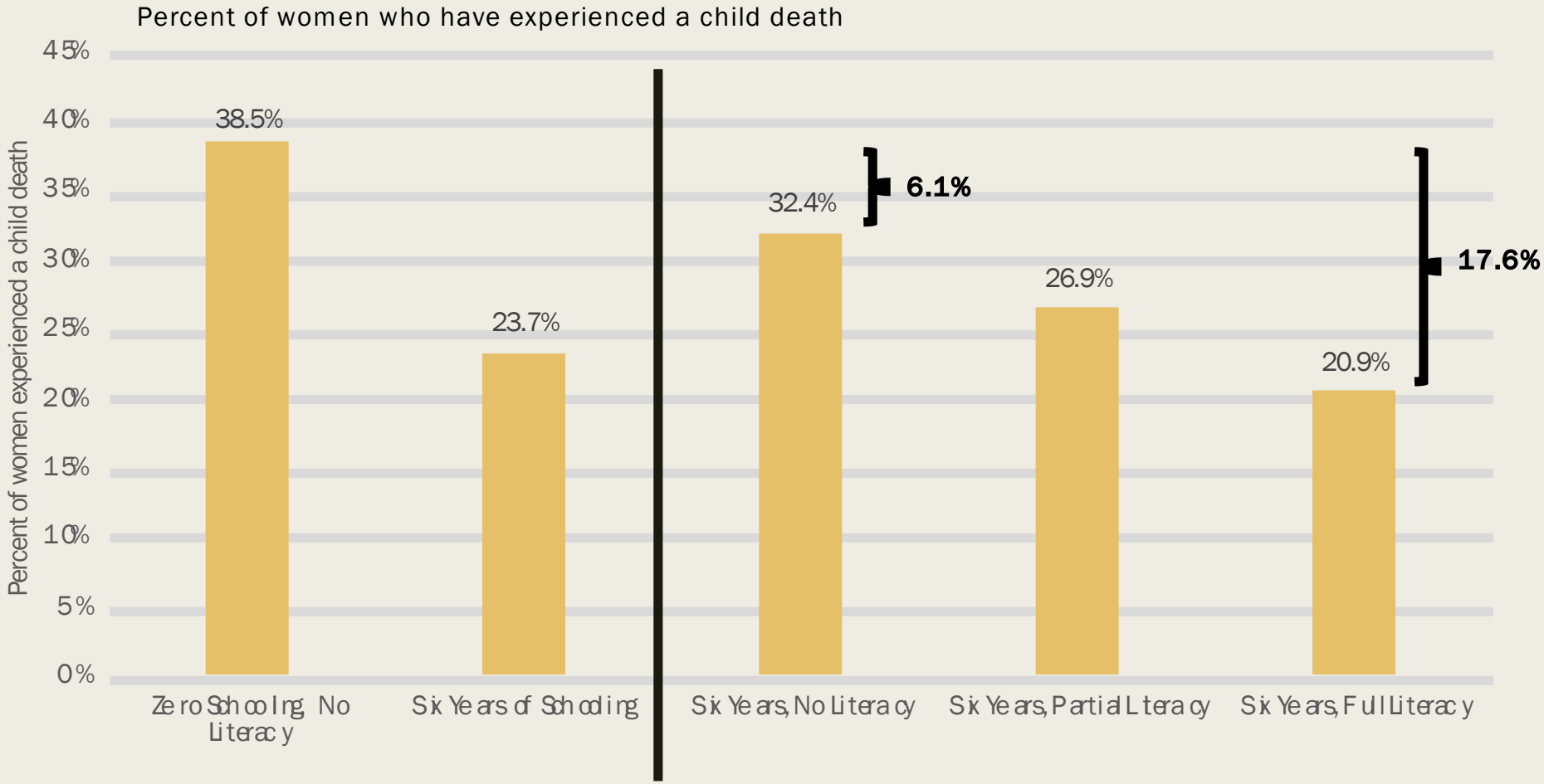


Source: Authors' analysis of DHS microdata from 54 countries.

A vast literature documents the association between *schooling* (grade attainment) and outcomes for women—we improve on these using the DHS data on literacy in three ways:

1. Studies using only a measure of schooling cannot decompose the pathways of schooling and learning, and cannot give information on the relative benefits of increasing learning versus expanding years of schooling
2. Using schooling only will consistently *overestimate* impact of schooling conditional on learning (the partial impact of schooling) but *underestimate* the impact of *education* – schooling plus learning – due to omitted variables bias
3. Household survey data produce empirical proxies with substantial measurement error relative to the true concepts and this produces *attenuation bias* so that typical estimates (e.g. cross tabs, OLS) *underestimate* the impact of both (partial and total) schooling and (partial) learning and hence *underestimate* the benefits of education.

Figure 1. A simple illustration with cross-tabs: the observed reduction in percent of women with a child death associated with *education* – schooling with literacy – on child mortality is nearly three times that of schooling without literacy



Source: Authors' analysis of DHS microdata, including N=854,766 women who have ever given birth, from 54 countries.

Descriptive decompositions of associations between education (schooling and learning), and outcomes

$$Y_i = \alpha + \beta_S S_i + \beta_L L_i + \theta Z + \epsilon_i$$

Partial Impact of Schooling:

$$\Delta Y = \left({}^{\Delta Y}/_{\Delta S}\right)\Big|_{L=L,Z=Z} * \Delta S = \beta_S * \Delta S$$

Partial impact of schooling conditional on learning: The impact of schooling itself, conditional on impacts through mechanisms such as learning

Total Impact of Schooling:

$$\Delta Y = \beta_S * \Delta S + \beta_L * \left({}^{\Delta L}/_{\Delta S}\right) * \Delta S$$

Total impact of schooling (at given learning profile): The impact of schooling including both the partial impact of schooling itself and the impact of schooling through its mechanisms such as learning at the existing gain in learning from schooling

Impact of basic education:

$$\Delta Y = \beta_S * \Delta S + \beta_L * \Delta L$$
$$\Delta L = (L_{Basic} - 0)$$

Impact of education: The partial impact of schooling plus the impact of achieving a target level of learning

Data

- Demographic and Health Surveys from 54 countries some with multiple rounds so 129 total country/rounds
- **Schooling:** self-reported years of schooling
- **Literacy:** enumerator-administered literacy test
- **Other controls**: Age, age squared, age cubed, rural/urban dummy, regional dummies, wealth index included in DHS
- **Outcome variables**:
  - Child mortality (children who have died divided by total births)
  - Fertility (total reported births)
  - Women's empowerment (standardized index created with principal components/factor analysis using 10 variables from DHS empowerment module (limits the number of countries)
- Aggregate the estimates across the country/rounds using standard meta-analysis techniques (weight coefficients by inverse of variance assuming random effects)

Estimating partial and total impact of schooling and impact of education

1. "Typical" approach of using schooling as proxy for education (with no measure of learning).

$$Y_i = \alpha + \beta_S S_i + \theta Z_i + \epsilon_i$$

Total impact of schooling (through omitted variables bias):

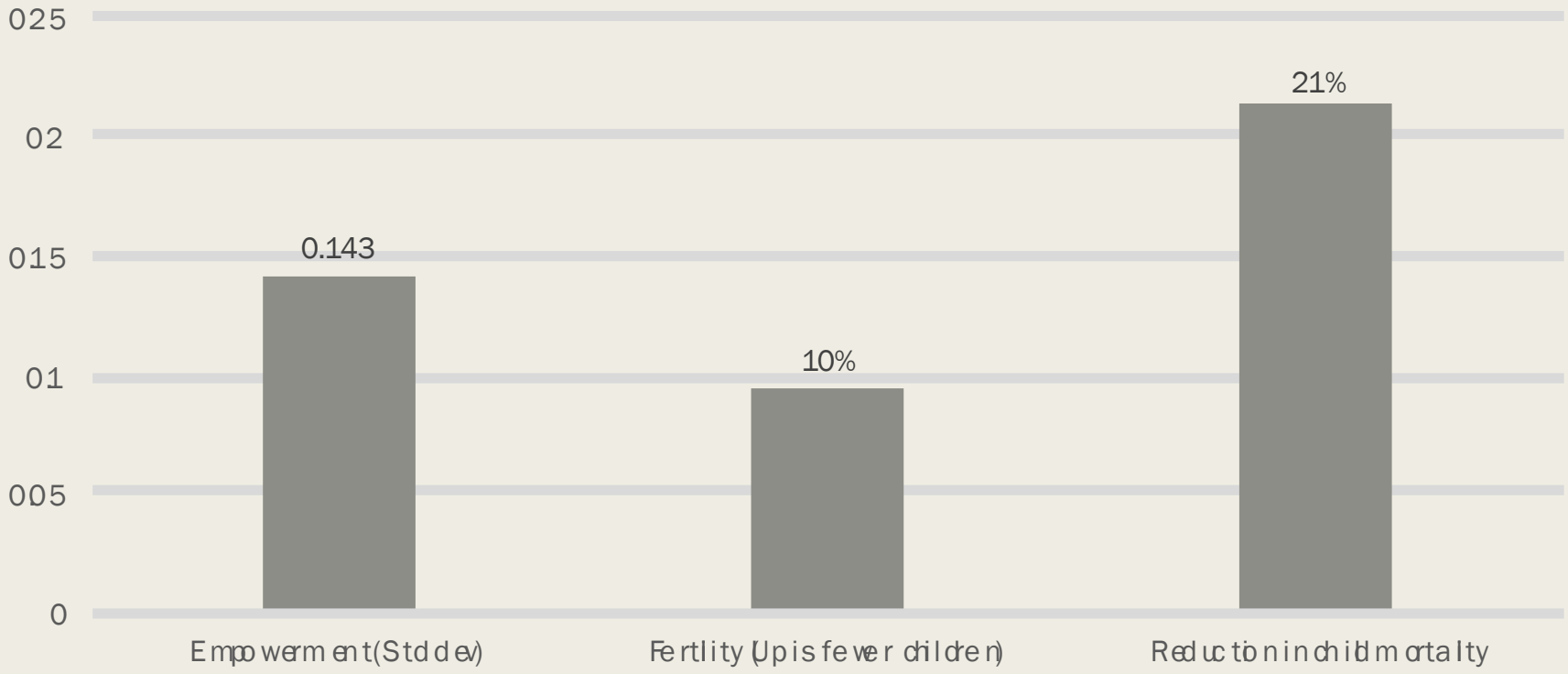
$$\Delta Y = \beta_S * \Delta S$$

Total impact of "primary schooling" (defined as 6 years):

$$\Delta Y = \beta_S * 6$$

This is what the standard OLS regression approach would produce

Figure 2. Six years of schooling, at given learning profiles, is associated with improvements in all three outcomes; no information on impact of schooling vs. learning



Source: Authors' analysis of DHS microdata from 54 countries.

Estimating partial and total impact of schooling and impact of education

Add measure of literacy to OLS regression - obtain separate estimates of partial impact of schooling (β_S) and the impact of learning (β_L)

$$Y_i = \alpha + \beta_S S_i + B_L L_i + \theta Z + \epsilon_i$$

"Impact of education":

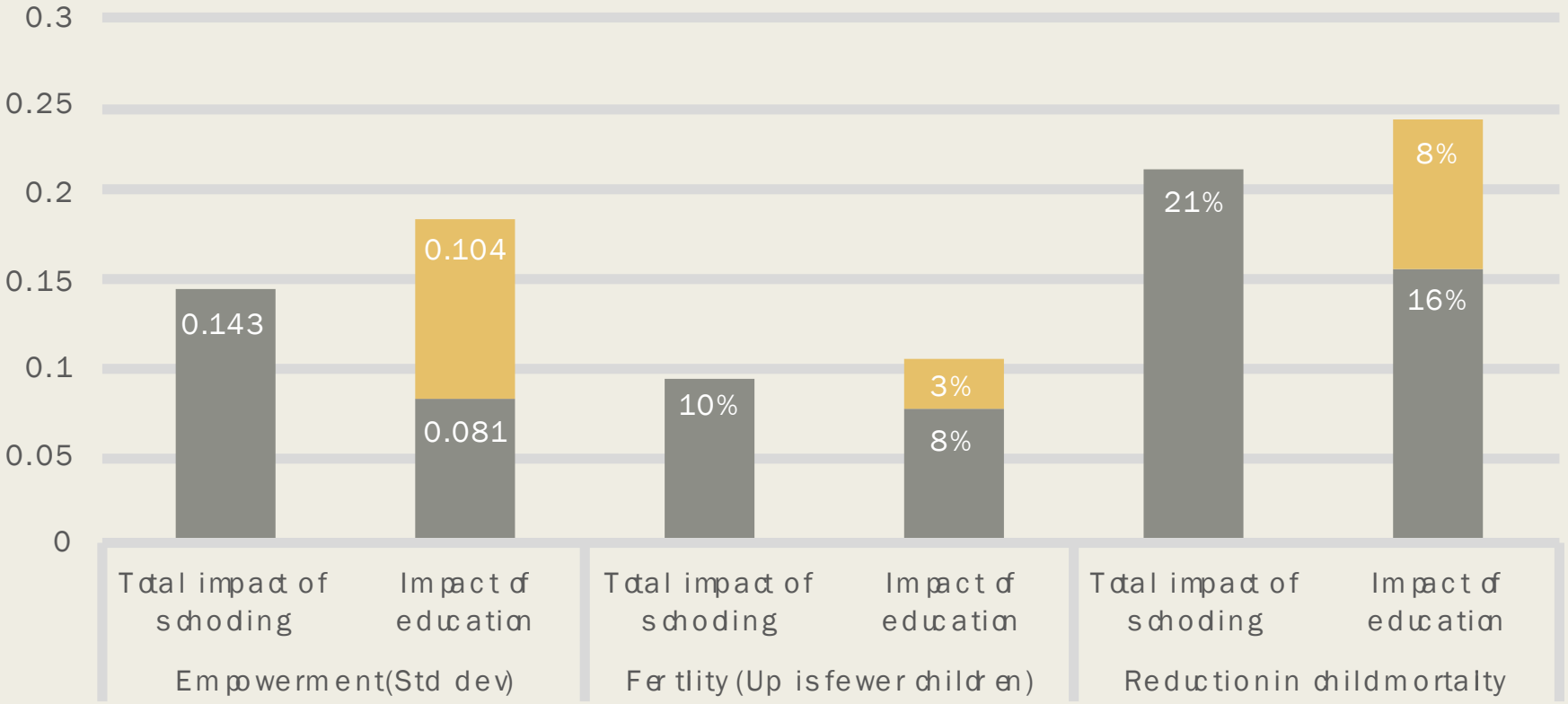
$$\Delta Y = \beta_S * \Delta S + \beta_L * \Delta L$$

Illustrative "Impact of basic education" (defined as six years schooling and achieving basic literacy):

$$\Delta Y = \beta_S * 6 + \beta_L * 2$$

“Total impact of schooling” vs. “Impact of education” with OLS

Figure 3. Adding literacy to regressions reduces schooling coefficients 20-45%; learning produces 30-50% of education’s impact



Source: Authors’ analysis of DHS microdata from 54 countries.

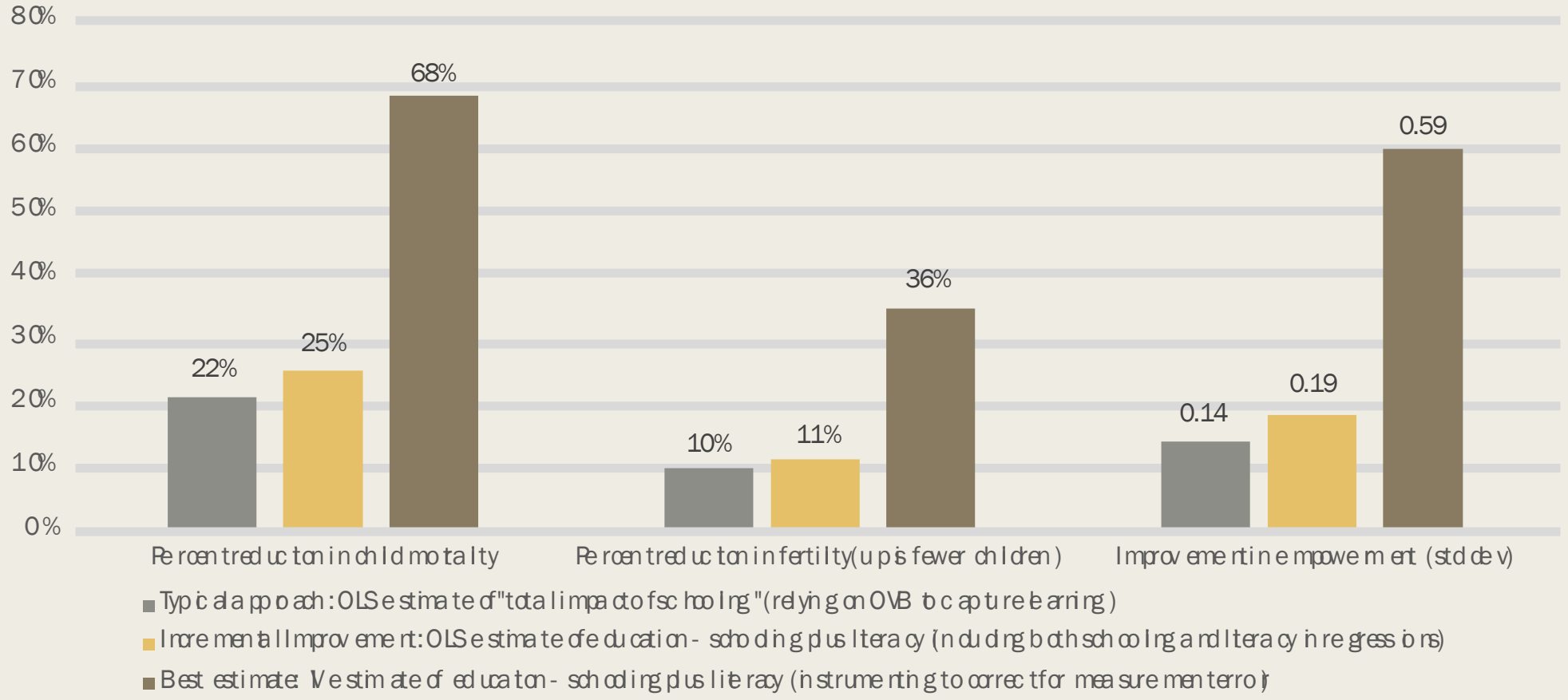
Instrumenting schooling and literacy with cluster averages

Goal: correct for measurement error

- Measurement error common in household surveys, causes attenuation bias
- Attenuation bias strongest for variables with greatest error – important for decompositions
- Create literacy and schooling cluster leave-out-mean for each woman and use that as instrument for women's own values:
  - *Passes "inclusion" criteria (in most countries) with high F-tests*
  - *"Exclusion" restriction impossible to test as "just identified"*
  - *IV estimates have (much) higher standard errors for each country and so only precision in aggregated results*

Correcting for error increases estimates by factor of three

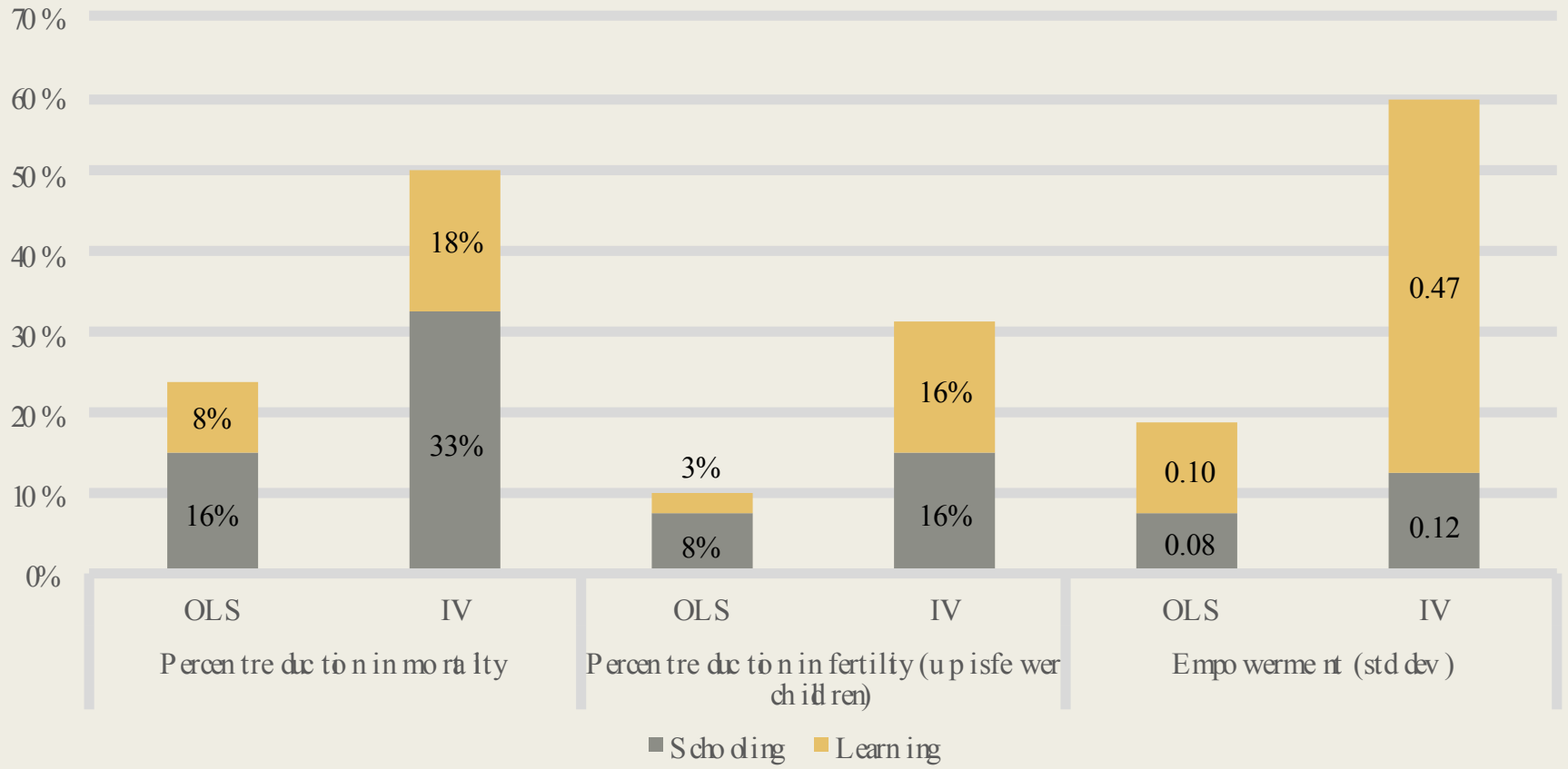
Figure 4. Method matters: Instrumenting for schooling and learning yields estimated “impact of education” (schooling + learning) 3 times higher than that estimated by OLS



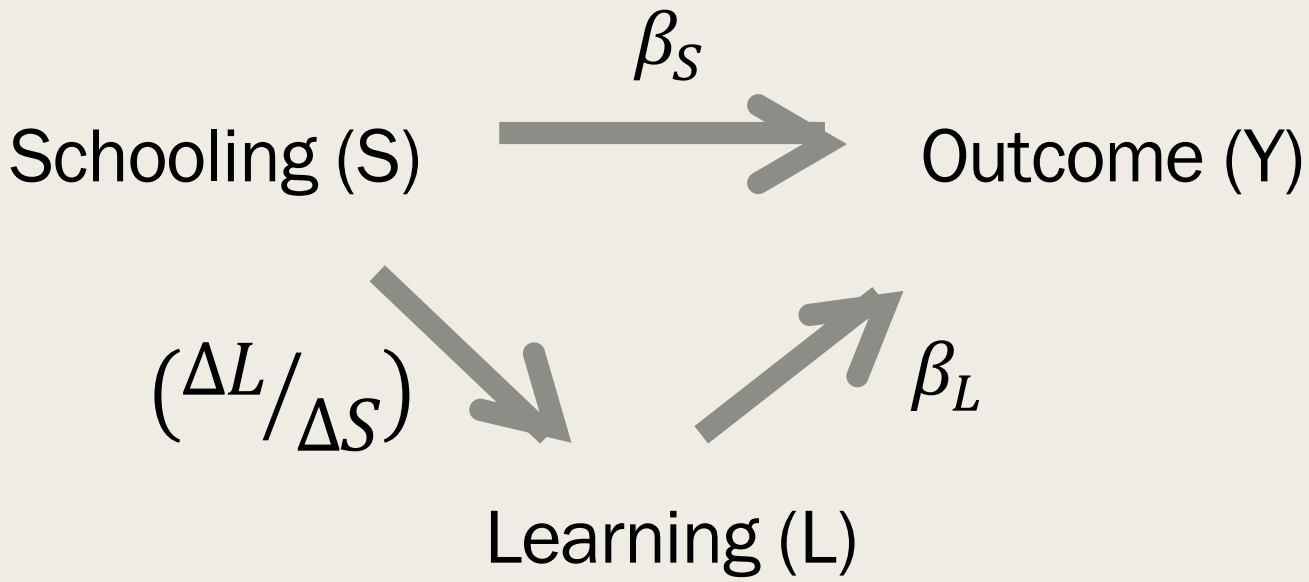
Source: Authors’ analysis of DHS microdata from 54 countries.

Decomposing “Impact of education” with OLS and IV

Figure 5. With IV, the learning pathway is a larger portion of education’s impact: 50% for fertility, 80% for empowerment

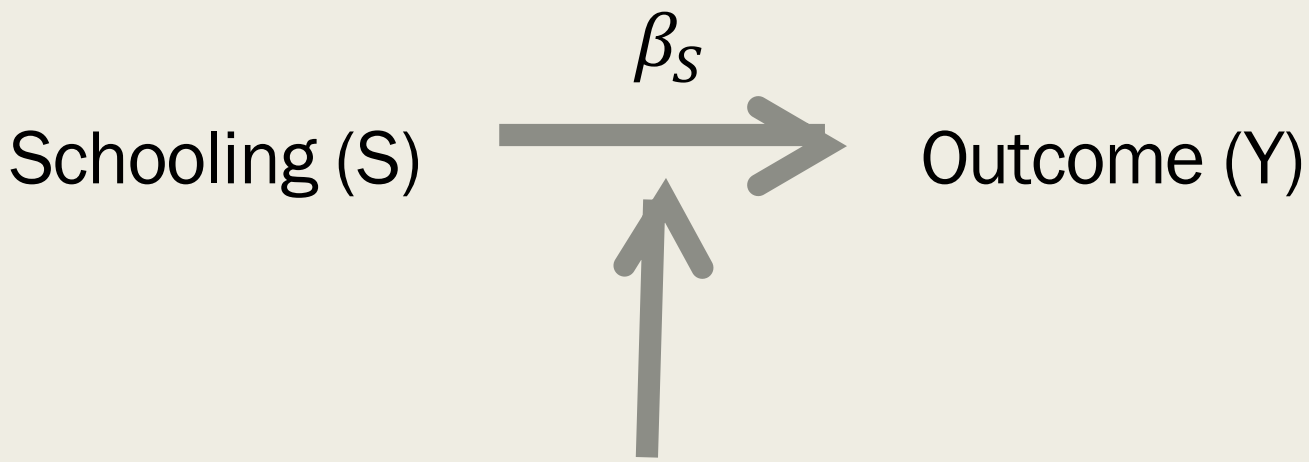


Learning as a **mediator**:
Estimate schooling's direct (non-learning mediated) and learning-mediated (L) impacts on outcomes (Y)

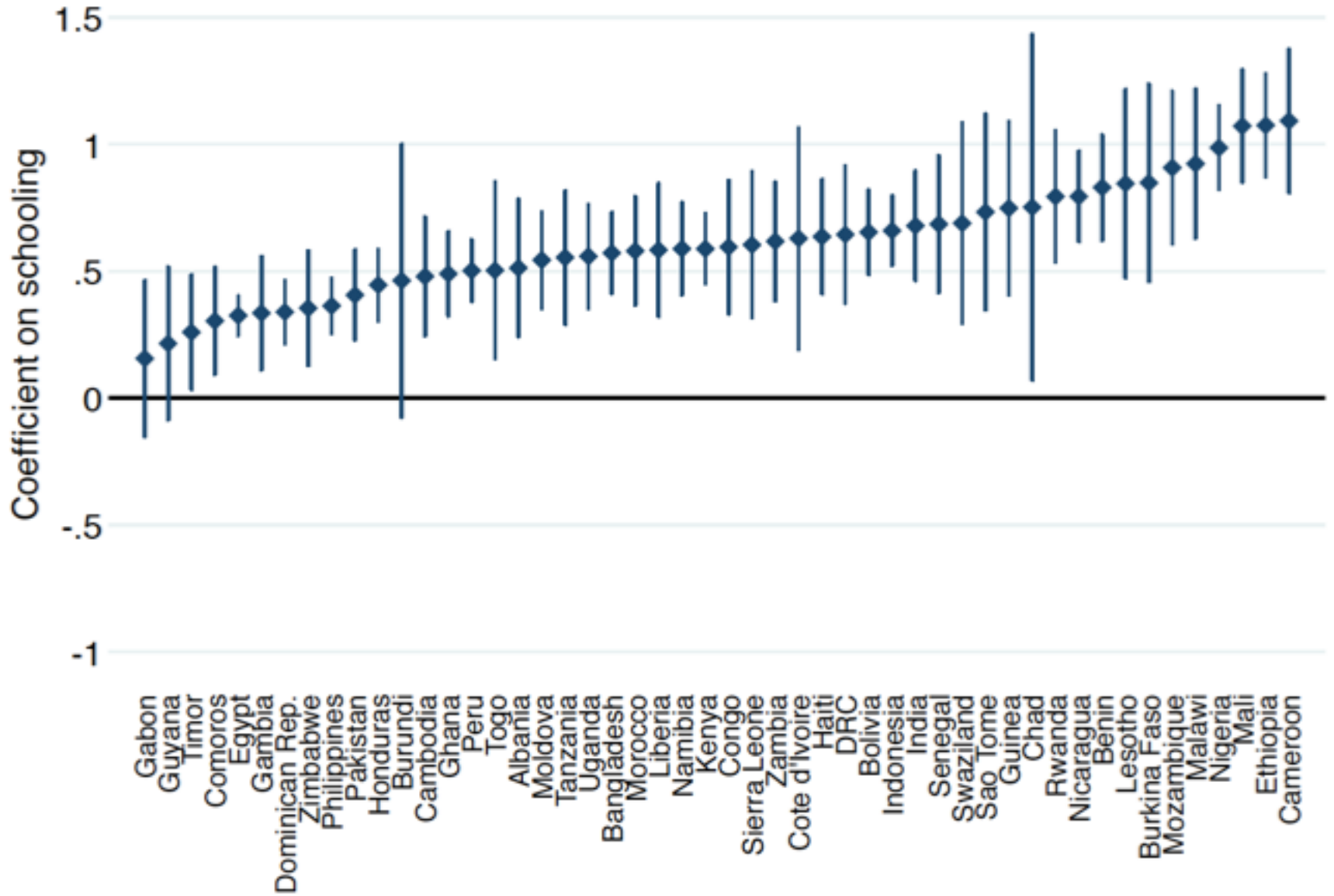


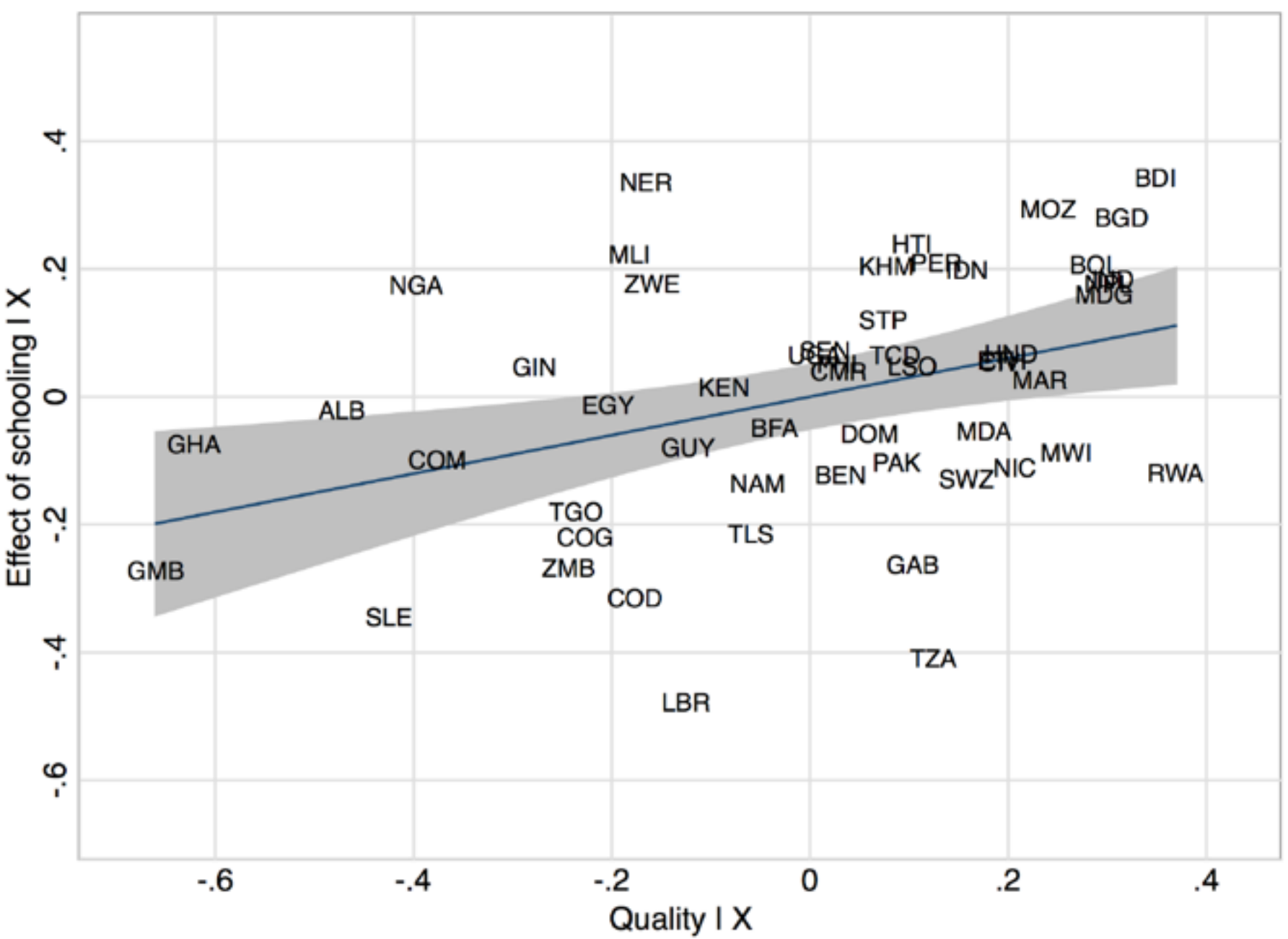
Learning as a **moderator**:

Test whether association between schooling and outcomes is higher where school quality is higher



β on schooling in child survival regression




Effect of schooling I X
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-.2
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Quality I X
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MOZ
BGD
HTI
MLI
KHM
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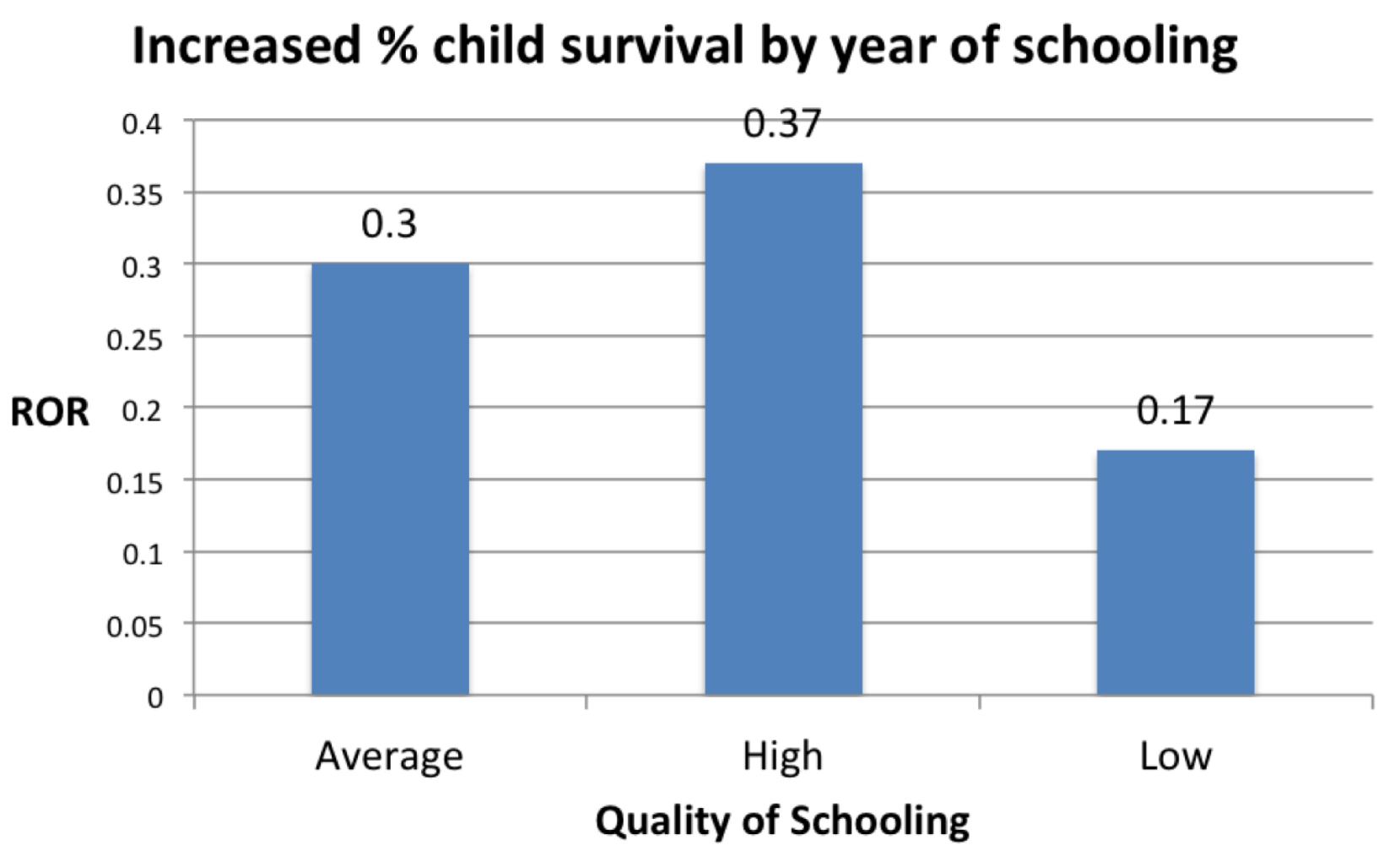
Learning as a moderator



Takeaways

- Typical estimates – whether from observational data, RCTs, etc. – which use years of schooling as a proxy for education *overestimate* the impact of schooling conditional on learning, and *underestimate* the impact of education. They also give no guidance on whether policymakers should invest in additional schooling or higher quality education
- Three simple descriptive facts from DHS suggest high returns to quality improvement:
  1. Including a measure of learning and correcting for measurement error increases the estimated impact of education by a factor of 3
  2. A simple measure of literacy explains most of the relationship between schooling and female empowerment, about ½ the relationship with fertility, and 1/3 of the relationship with child mortality
  3. The relationship between schooling and these outcomes is significantly stronger where school quality (i.e. average literacy at given schooling level) is higher
- Next phase of this work will extend existing literature on natural experiments in schooling expansion – e.g. FPE in sub-Saharan Africa – to address some endogeneity concerns

A complicated graph to illustrate the fundamental trade-off with IV: higher estimates, much bigger standard errors