SCHOOL QUALITY

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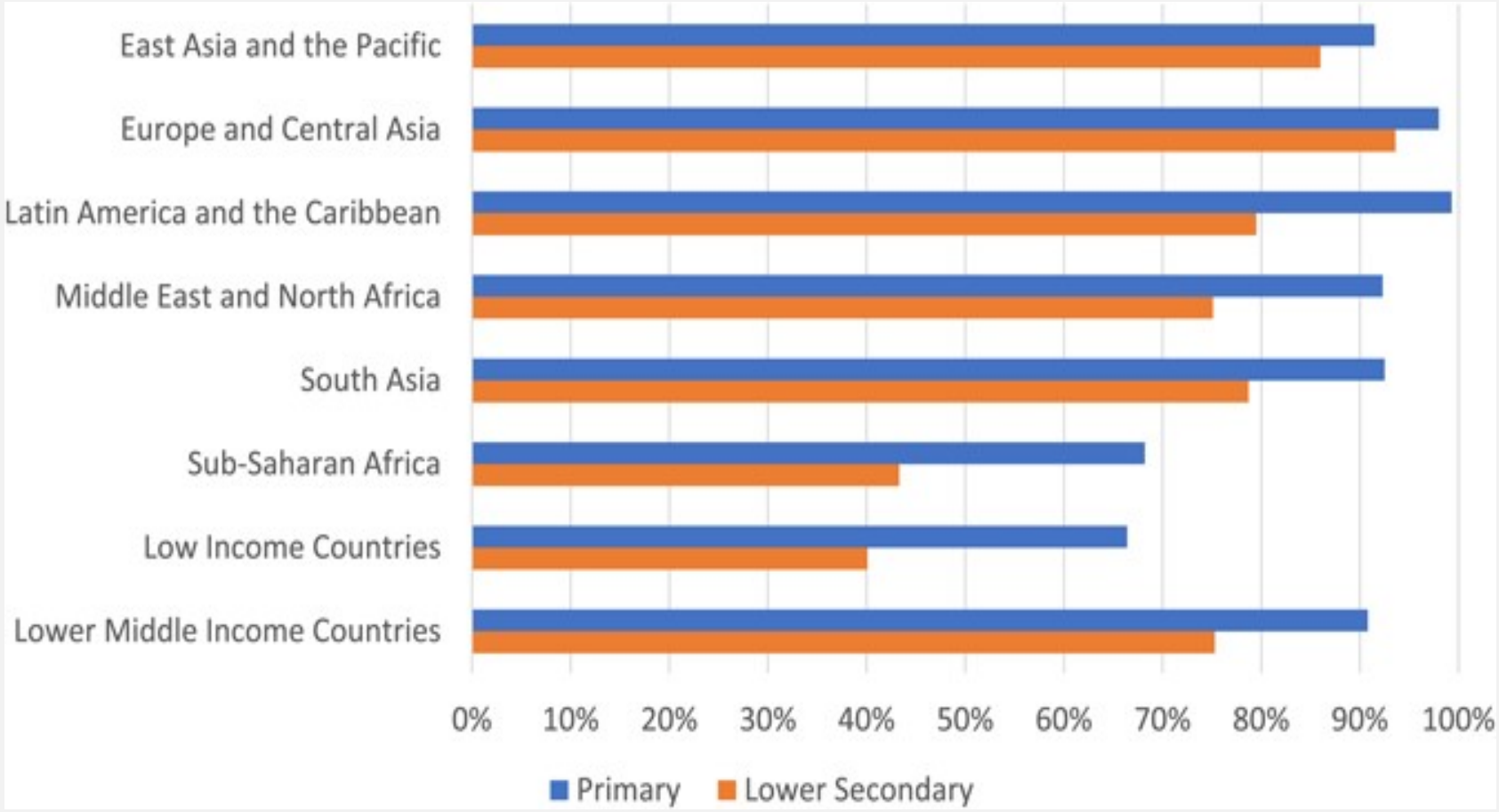
AGENDA

- State of schooling
- Theory -Education Production Functions (EPF)
- Empirical example – Lucas and Mbiti 2014
- More Theory on EPF
- Empirical example – Pop-Eleches and Urquiola (2013)
- What is School Quality
- Can you improve Quality through inputs?
  - Resources– Mbiti et al 2019
  - Class Size– Angrist 1999
- Can you improve Quality through information? Cilliers, Mbiti, and Zeitlin (2021)

LEARNING OBJECTIVES

- Understand patterns /trends in learning in developing countries
- Develop an understanding of the theoretical frameworks used and their predictions /implications
- Develop an understanding of the empirical approaches used by education researchers and some of the main challenges faced

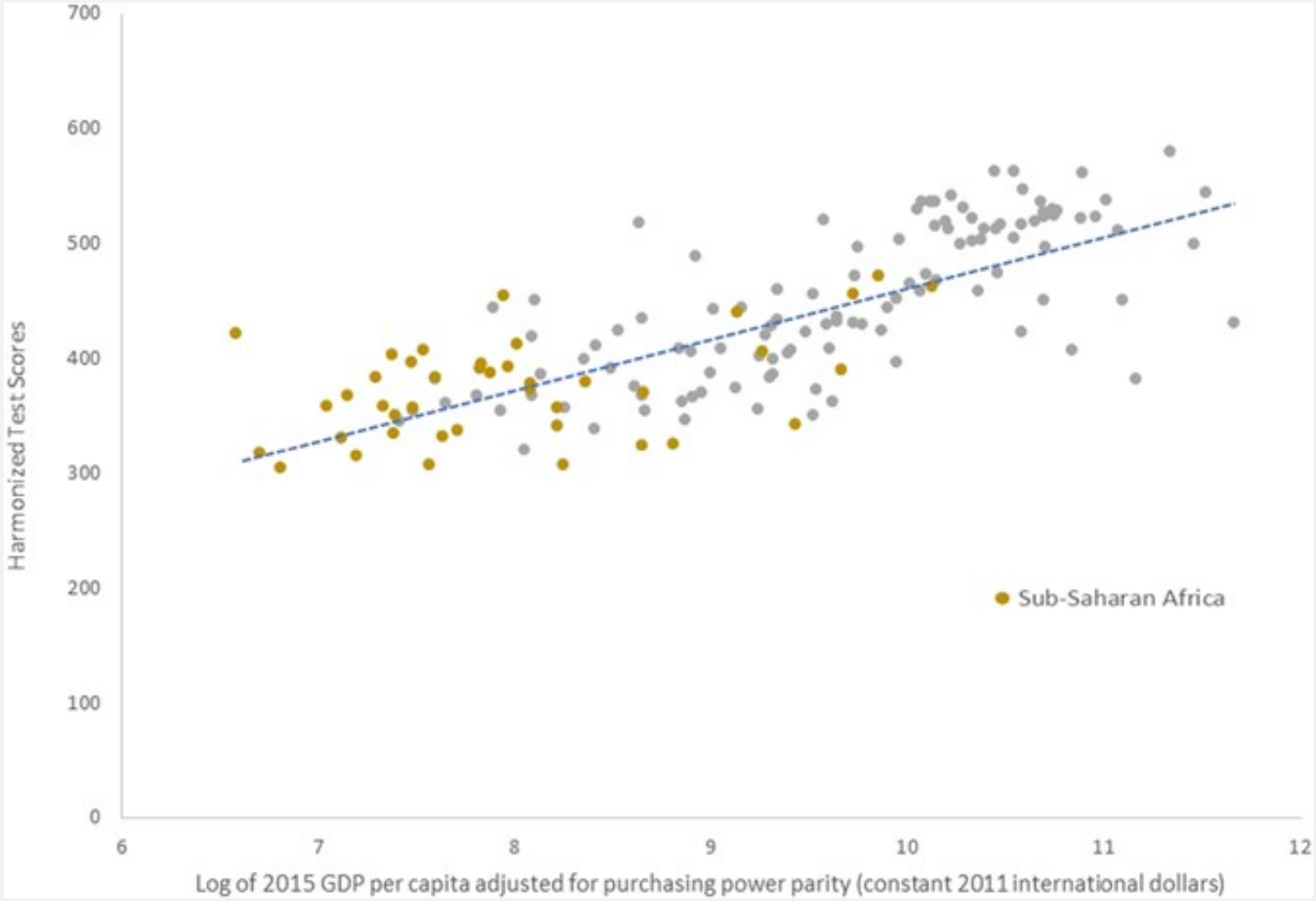
ACCESS TO EDUCATION HAS BEEN INCREASING OVER TIME



WB Data on Primary and Lower Secondary Completion Rates

Sources: Evans and Acosta, 2021

LEARNING LEVELS IN POORER COUNTRIES ARE LOW



WB data on Harmonized Test scores vs GDP/ Capita

Sources: Evans and Acosta, 2021

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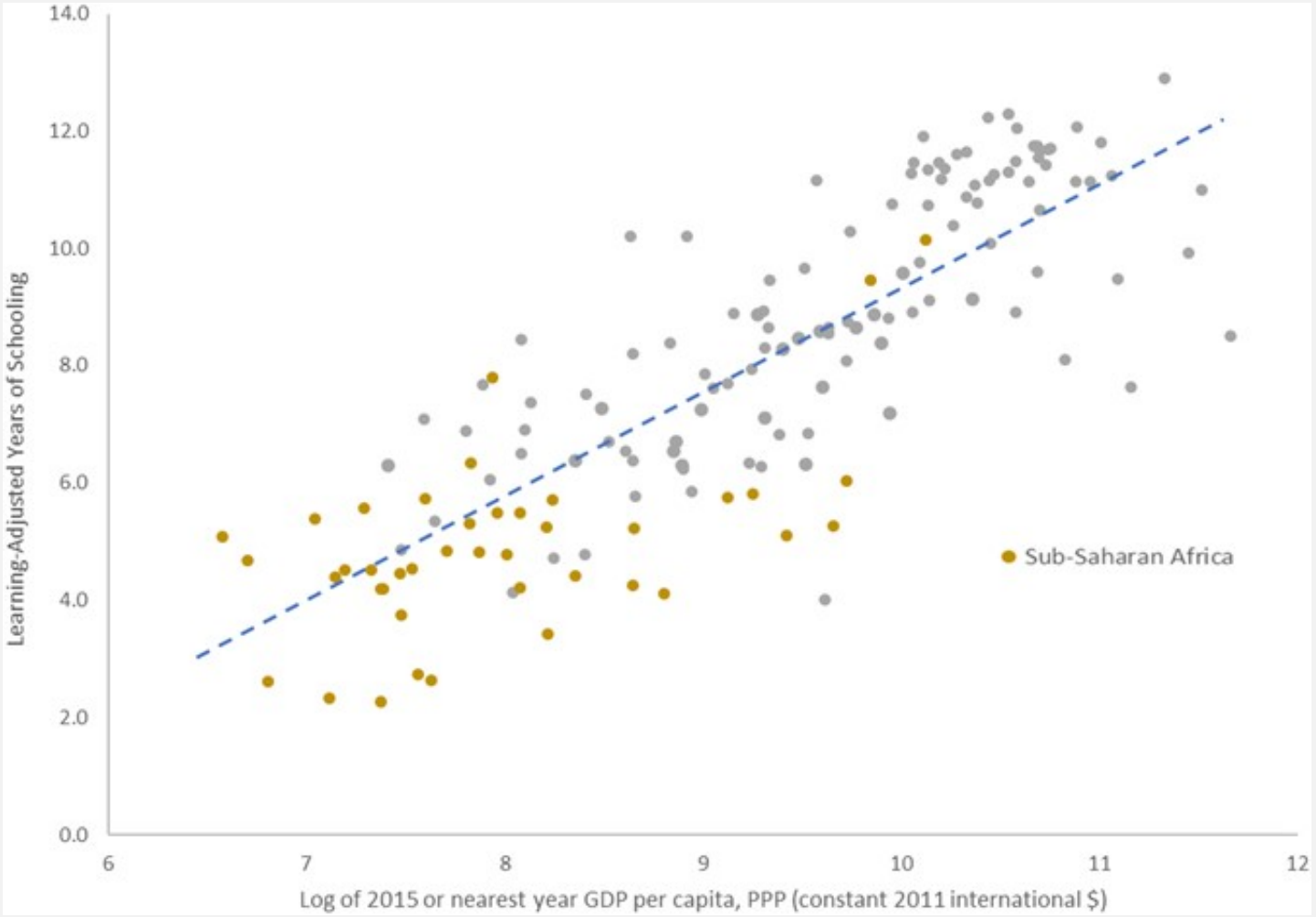
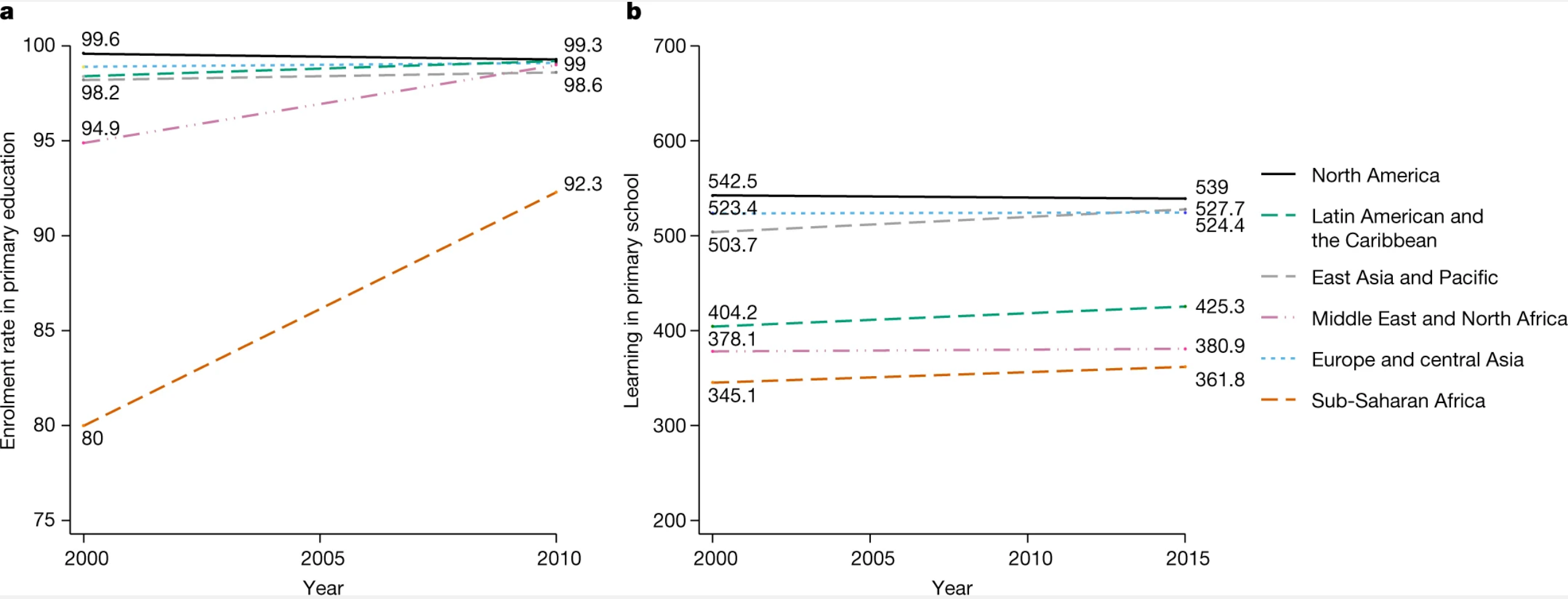


WB data on Learning Adjusted Yrs of Schooling vs GDP/ Capita

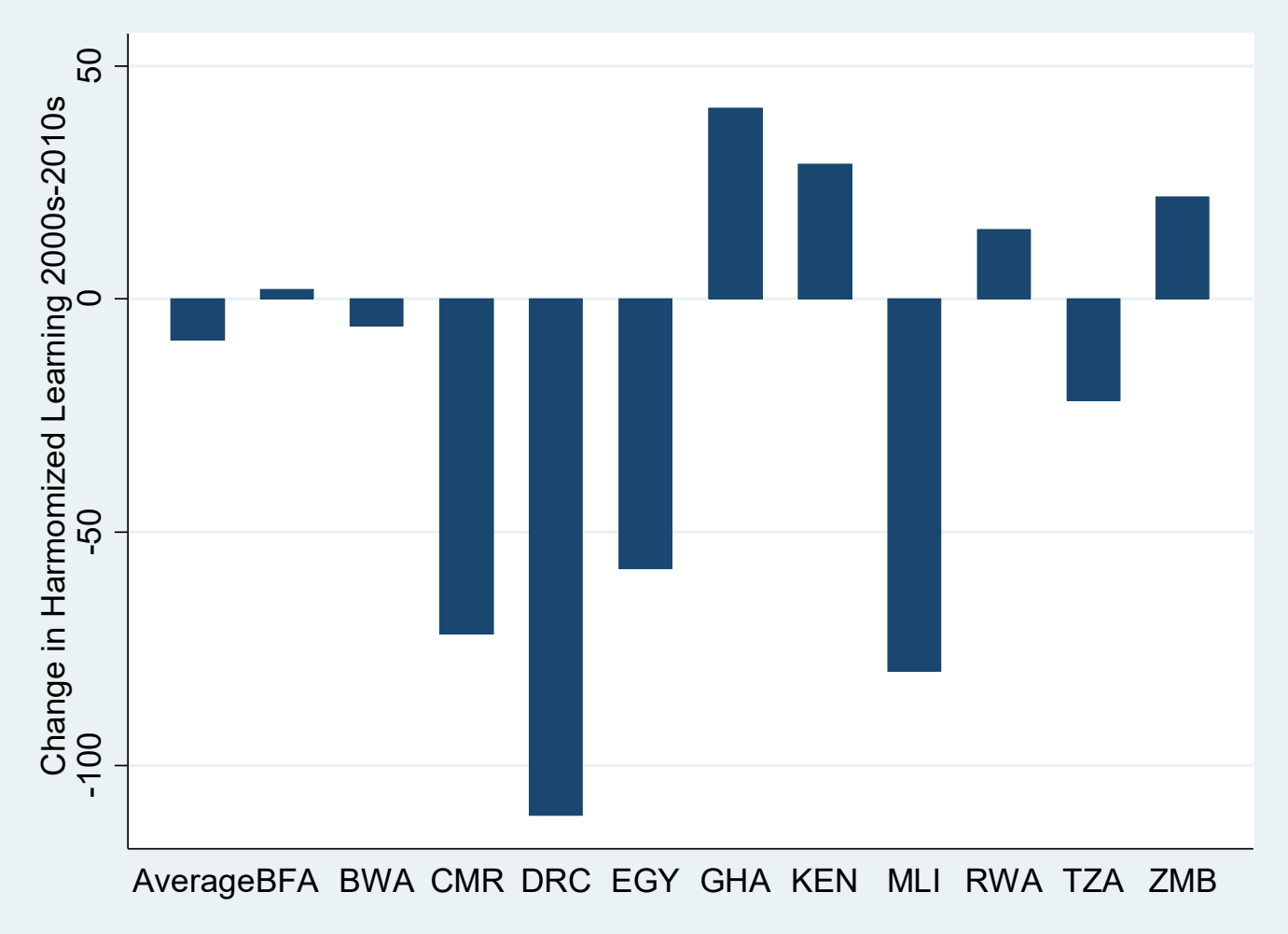
Sources: Evans and Acosta, 2021

ACCESS VS LEARNING LEVELS ACROSS THE WORLD



Angrist et al 2020

LEARNING LEVELS IN (SOME) AFRICAN COUNTRIES HAVE FALLEN OVER TIME

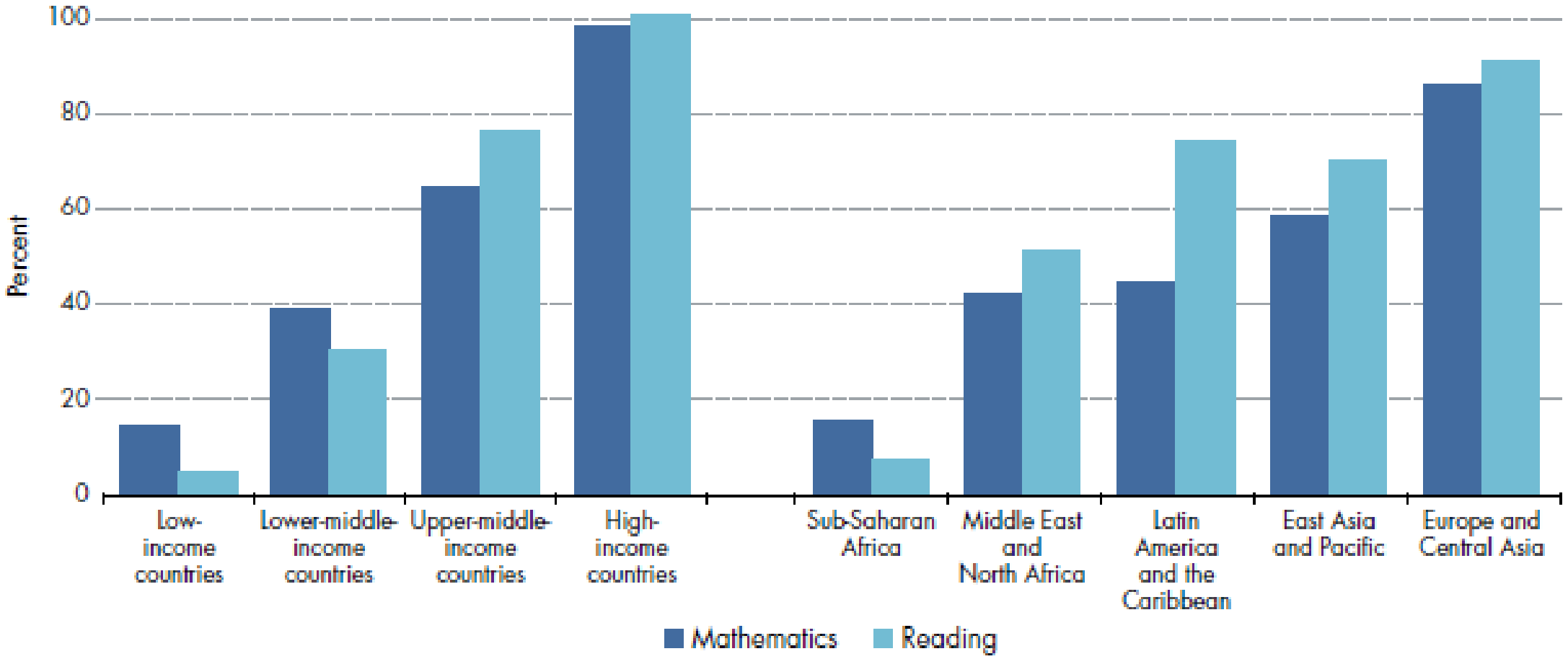


Harmonized Test Scores in 2000 vs 2010s for selected African Countries

Sources: Evans and Acosta, 2021

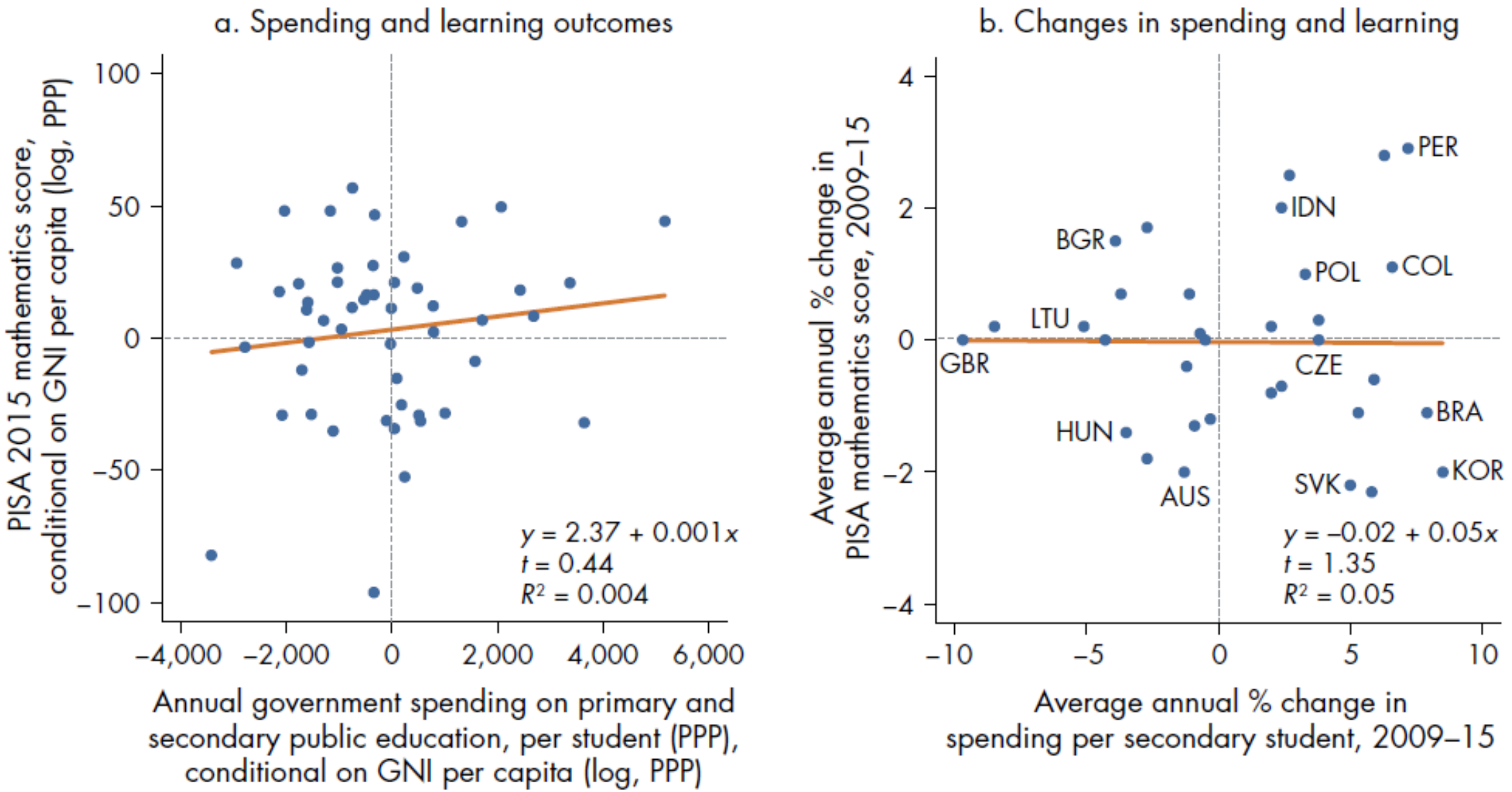
Figure O.5 The percentage of primary school students who pass a minimum proficiency threshold is often low

Median percentage of students in late primary school who score above a minimum proficiency level on a learning assessment, by income group and region



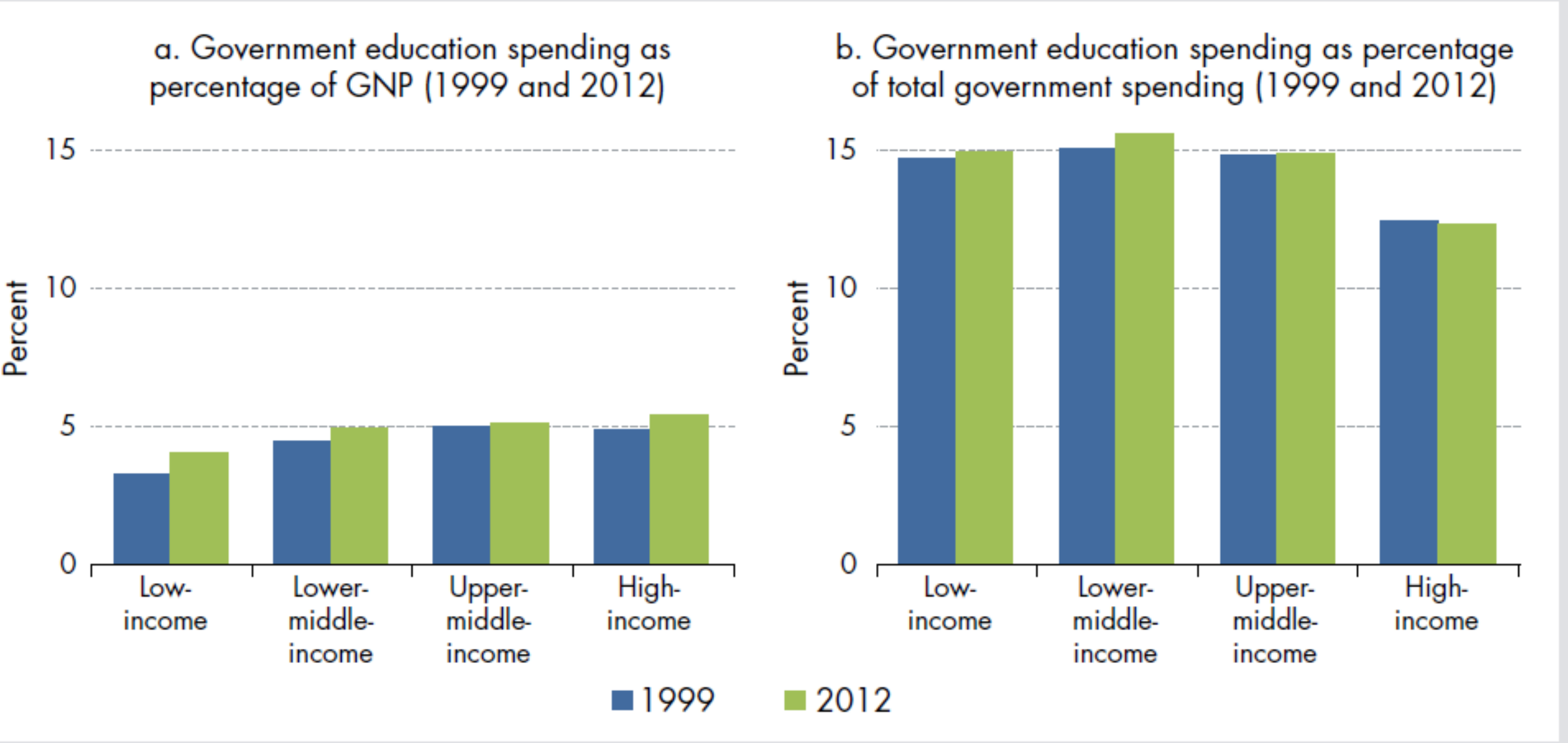
Source: WDR 2018 team, using "A Global Data Set on Education Quality" (2017), made available to the team by Nadir Altinok, Noam Angrist, and Harry Anthony Patrinos. Data at http://bit.do/WDR2018-Fig_O-5.

Figure 9.2 Simple associations between education spending and learning are weak



Sources: WDR 2018 team, using data from OECD (2016); UIS (2017); World Bank (2017a). Data at http://bit.do/WDR2018-Fig_9-2.

igure S6.1 Governments devote a large share of their budgets to education



urce: UNESCO (2015). Data at http://bit.do/WDR2018-Fig_S6-1.

igure O.1 Shortfalls in learning start early

rcentage of grade 2 students who could not perform simple reading or math tasks, selected countries

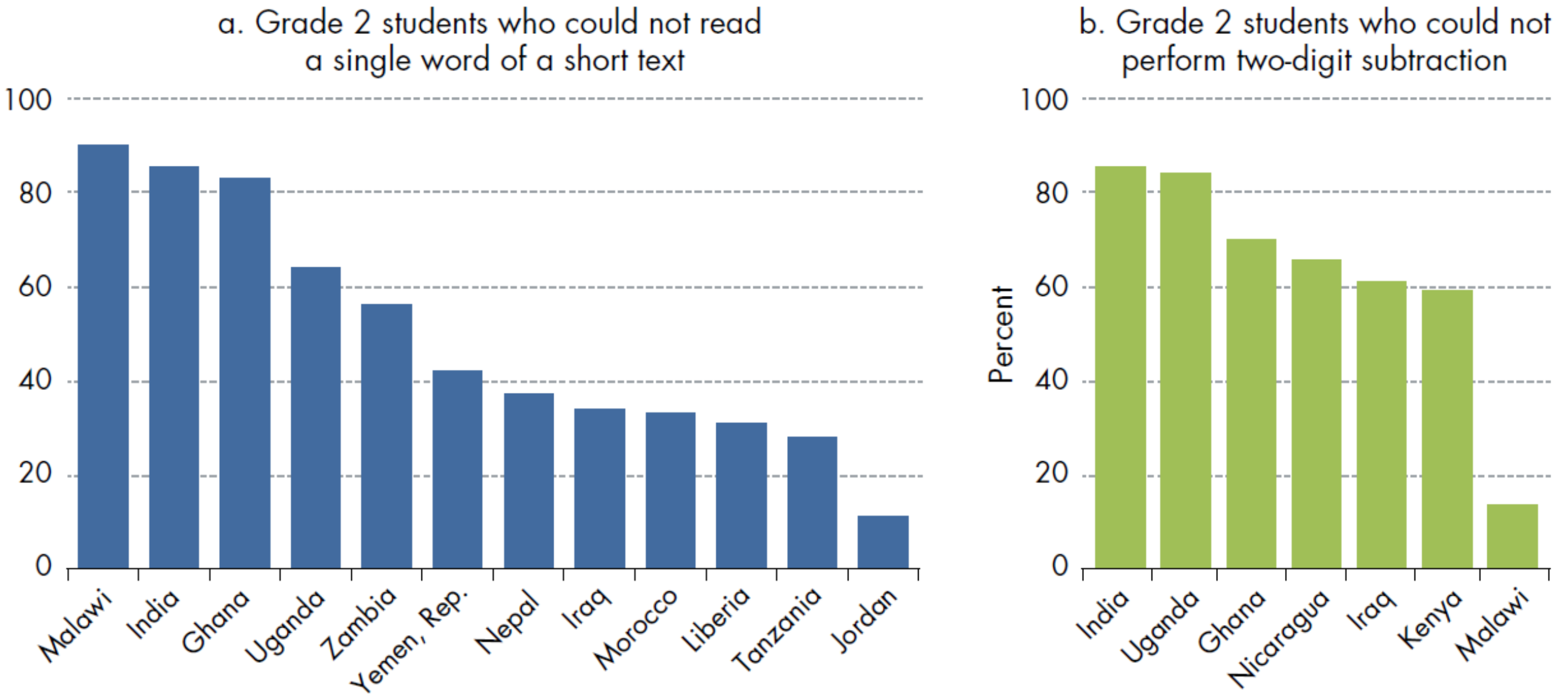
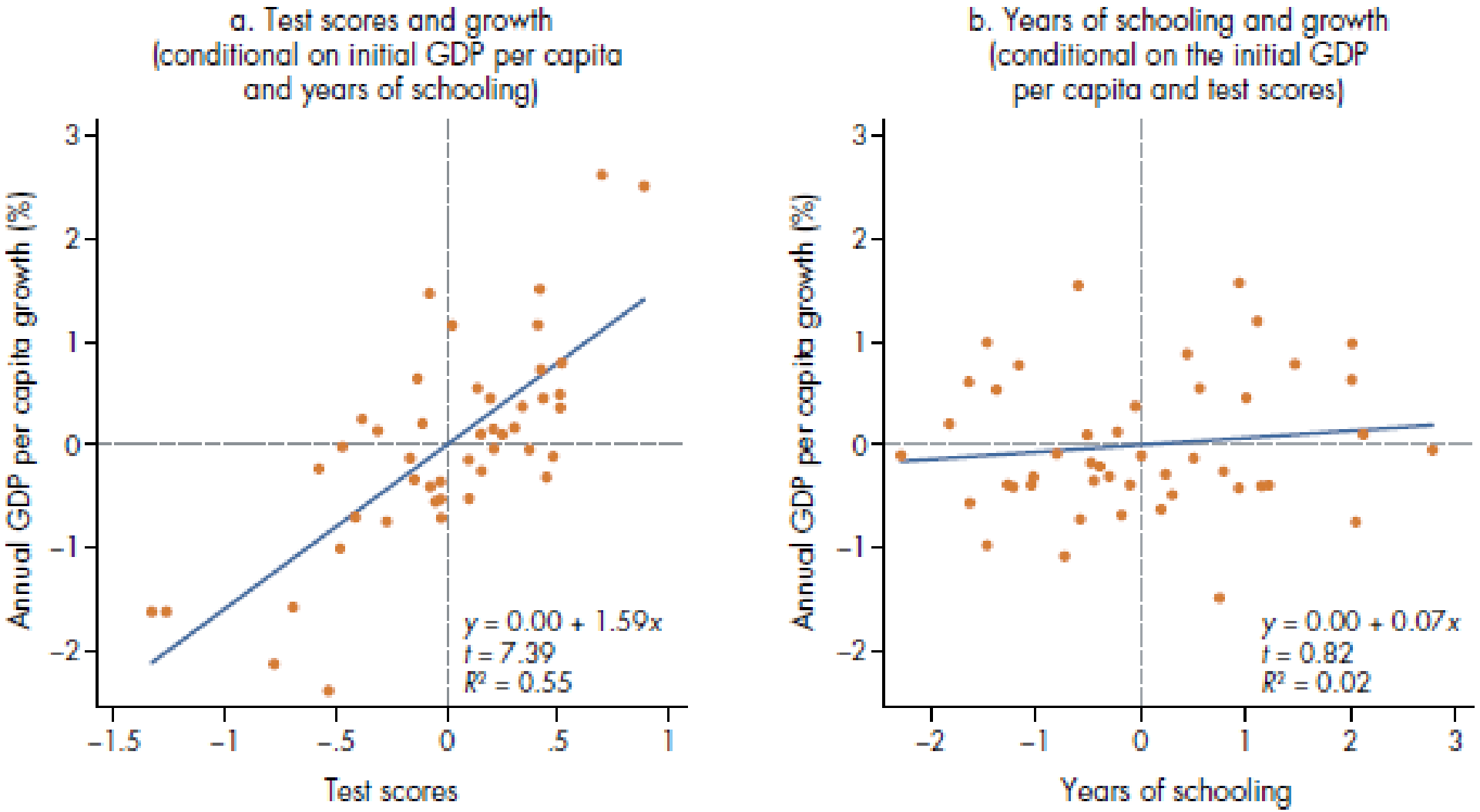


Figure 1.5 What matters for growth is learning

Annual average per capita growth in GDP, 1970–2015, conditional on test scores, years of schooling completed, and initial GDP per capita



Source: WDR 2018 team, using data on test scores from Hanushek and Woessmann (2012) and data on years of schooling and GDP from the World Bank's World Development Indicators (database), 2017. Data at http://bit.do/WDR2018-Fig_1-5.

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WHAT IS SCHOOL QUALITY?

- Structure – the Education Production Function (following Todd and Wolpin 2003)
- $A = F(S, F, \mu)$ (suppressing time subscripts)
- A =achievement (test-score), S = school inputs, F = Family inputs, μ= unobserved "ability", F is the "Technology"
- MP of all inputs in production fn is +ve
- Examples of school inputs – resources, class size, # teachers, teacher skills, textbooks, peer quality, school management
- Examples of family inputs– books at home, parental encouragement/ help,
- Education policy typical focuses on school inputs

EDUCATION PRODUCTION

- $A = F(S, F, \mu)$
- Measuring the variables in the production function is not trivial
- A : typically measured by test scores. BUT
  - Which subjects (or domains of learning)? What about "non-cognitive skills" (e.g. grit, creativity etc.)?
  - Scaling and psychometrics (Classical test theory and Item Response Theory)
  - Measurement error
  - Student test-taking effort matters e.g. Mbiti et al 2019
  - Do schools/teachers/ students have an incentive to game/manipulate the test?

EDUCATION PRODUCTION

- $A = F(S, F, \mu)$
- Measuring the variables in the production function is not trivial
- S and F are also hard to measure– we use surveys, admin data.
  - Hawthorne effects and logistics/practical constraints can be important impediments
    - Example collecting teaching observations or teacher content knowledge
    - Technology e.g. video recording of teachers in the classroom can be useful (more innocuous).
- Ability is unobserved– try to proxy with measures such as Raven's matrices, or differenced out when we have panel data

EDUCATION PRODUCTION

Input data from World Bank SDI Data (2011-2016) from selected African Countries

- Textbooks per student:
- 2-3 students per textbook in Togo, Kenya, Nigeria. Almost 14 per textbook in Uganda
- School has "Min school infrastructure" (electricity, water, sanitation)
  - 23% in Togo, 17% in Nigeria, 40% in Tanzania, ~56% in Uganda and Kenya
- School has "Min Teaching Equip" (blackboard with chalk, pencils and notebooks)
  - 28% in Togo, 49% in Nigeria, 61% in Tanzania, ~95% in Uganda and Kenya
- Grade 4 Pupil teacher ratio (PTR)
  - ~19 in Madagascar and Nigeria, ~ 30 in Senegal and Kenya,, ~ 45 in Uganda and Tanzania
- Teacher absence
  - From school: ~15% in Kenya, Nigeria and TZ; 18% in Togo and Senegal; 24% in Uganda
  - From the class: 22% in Nigeria, ~ 30 to 33 in Togo and Senegal, ~45% in Kenya, TZ; over 50% in Uganda &Morocco

EDUCATION PRODUCTION

Teachers' Content Knowledge: Minimum Thresholds

	All	*Min*	*Max*
Subject knowledge: Language			
Teachers with …			
80% of knowledge equivalent to a 4th grader	66%	26% (Nigeria)	94% (Kenya)
Minimum knowledge for teaching	7%	0% (Mozambique, Nigeria, Tanzania survey I, Togo)	34% (Kenya)
Number of teachers	3,770		
Subject knowledge: Mathematics			
Teachers with …			
Minimum knowledge for teaching	68%	49% (Togo)	93% (Kenya)
Number of teachers	3,957		

Source: Bold et al 2019

EDUCATION PRODUCTION

- With the basic Education PF we might be tempted to think that we can focus on policies that increase input levels in order to improve learning outcomes.
  - Challenges
    - Which input is the binding constraint?
    - What if more than one input is binding?
    - Some constraints might be very difficult to alleviate e.g. Teacher content knowledge
  - Suggest that understanding the structure of Education PF is important
    - But difficult to get good empirical estimates from observational data
      - Unobserved ability (μ) likely correlated with school inputs (sorting)

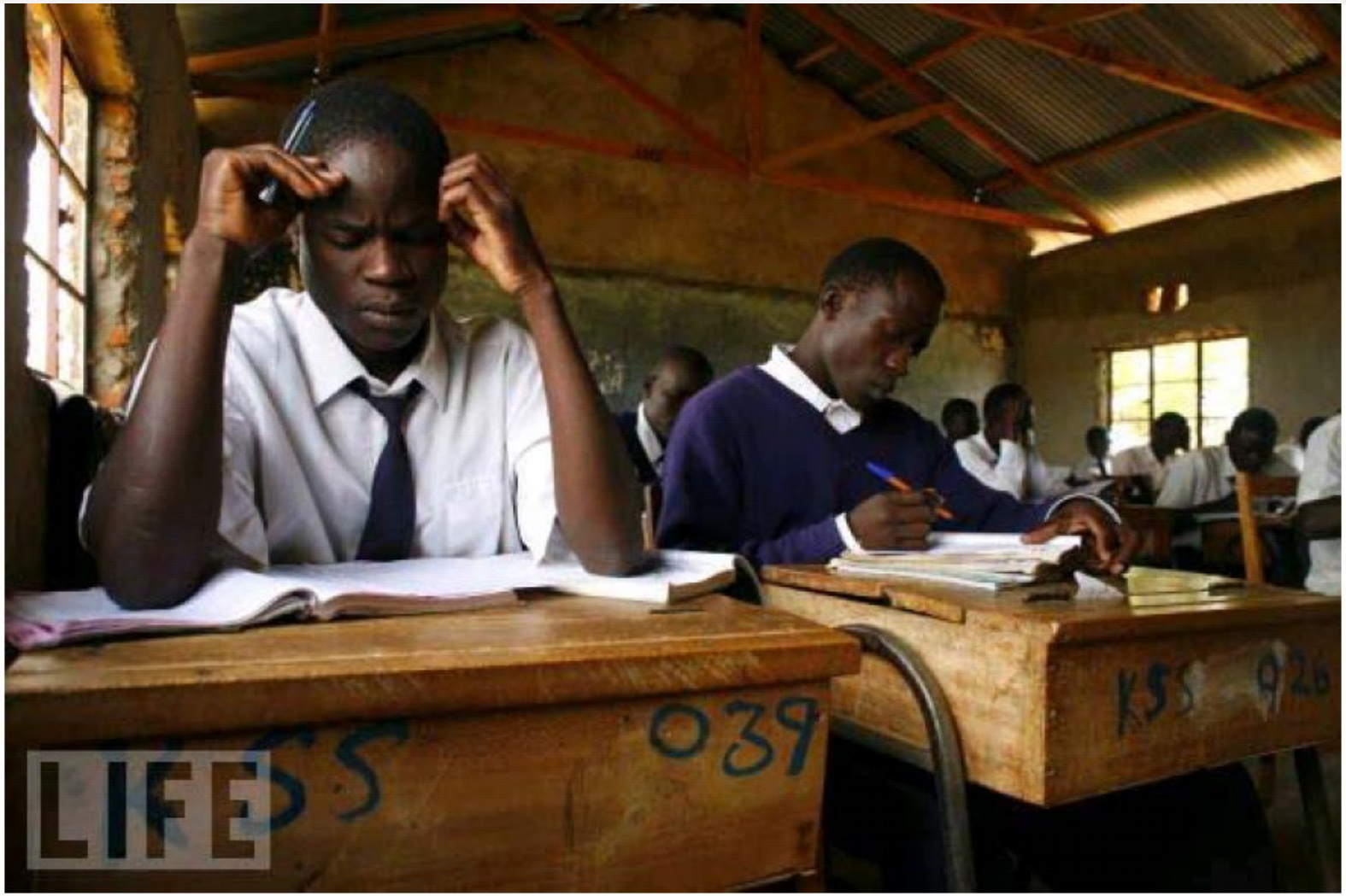
DOES GOING TO A "BETTER" SCHOOL MATTER?

- Lets examine the impact of going to a "Better" school in terms of inputs – peer test scores (or avg test scores), teachers, resources.
- Lucas and Mbiti 2014 "Effects of School Quality on Student Achievement: Discontinuity Evidence from Kenya" AEJ Applied
- Context Kenya secondary schools in the mid 2000's
- Set-up: to transition from primary to secondary school students have to take an exit exam. (KCPE)
- There are different tiers of school--- "Elite schools", good schools, ok schools
- Students assigned to secondary schools, based on choices and "serial dictator" algorithm – top student gets their first choice, then second ranked students gets their first choice (if not full), if full the get second choice… etc

THE THREE TIERS OF SCHOOLS

- **National (ELITE) schools**:
  - 18 of these- all single sex boarding schools
  - Admit the top students from all over the country based on ranking and choices
- **Provincial Schools**:
  - Approximately 1000
  - Admit best remaining students from Province based on ranking and choices
- **District Schools**:
  - Approximately 3000
  - Admit remainder from District only
- **Private Schools**:
  - Mainly a "safety net" for richer low performing students

DISTRICT SCHOOL



The Senator Obama Kogelo Secondary School

PROVINCIAL SCHOOL

Compared with District schools: better facilities, more buildings with electricity and 2/3 of teachers were college graduates (NCKEF, 2004)

NATIONAL SCHOOL

Description of National School:

"… Boasts a large, bright dining hall and assembly building, faculty housing, a computer center and a several storied library with large plate glass windows" (NCKEF, 2004)

NATIONAL SCHOOL FACILITIES

NATIONAL SCHOOL CHARACTERISTICS

	National	Provincial	District
% Teachers with college degree	73.5	67.3	69.6
% Teachers with advanced degree	7.0	4.1	3.3
Teacher experience (yrs)	14.8	13.6	12.1
No. of KCSE subjects offered	16.4	12.2	10.8

SECONDARY SCHOOL ASSIGNMENT PROCESS

- We can examine the differences in test score outcomes of students who just qualify for the best schools to students who just missed a place
- Identification assumption --Students who just missed a place often miss by one or two points on the exam thus they are very similar to students who just scored above the qualification mark.
- This approach is known as a Regression-Discontinuity Design (RDD)

ESTIMATING EQUATIONS

IV Approach

Second Stage :

$$KCSE_i = \alpha + \beta gradN_i + f(KCPE_i - c_{sj}) + X_{isj}'\Gamma + \varepsilon_i$$

First Stage :

$$gradN_i = \gamma_0 + \gamma_1 1[KCPE_i \geq c_{sj}] + f(KCPE_i - c_{sj}) + X_{isj}'\Gamma + \eta_i$$

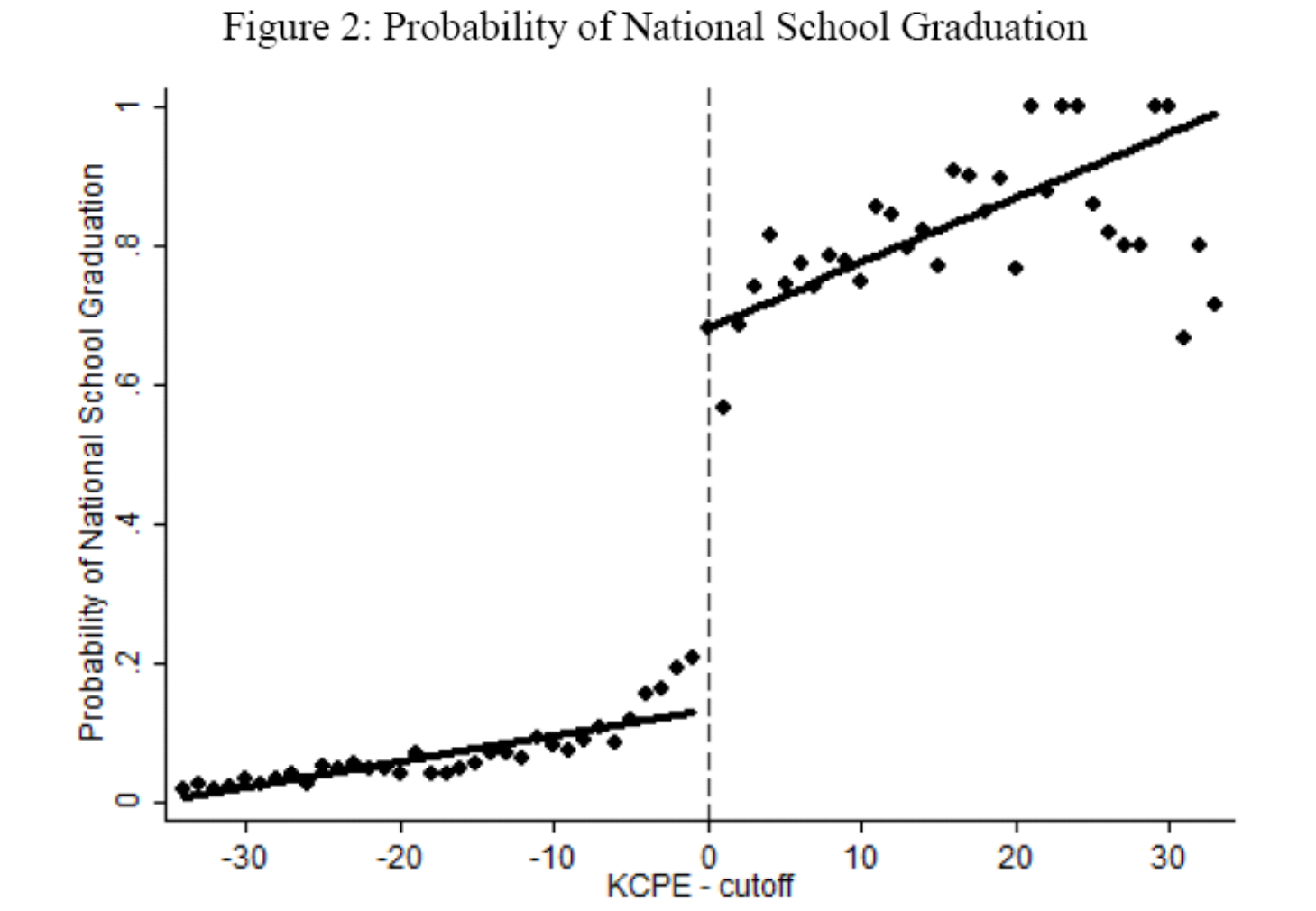
Reduced Form :

$$gradN_i = \lambda_0 + \lambda_1 1[KCPE_i \geq c_{sj}] + f(KCPE_i - c_{sj}) + X_{isj}'\Gamma + \nu_i$$

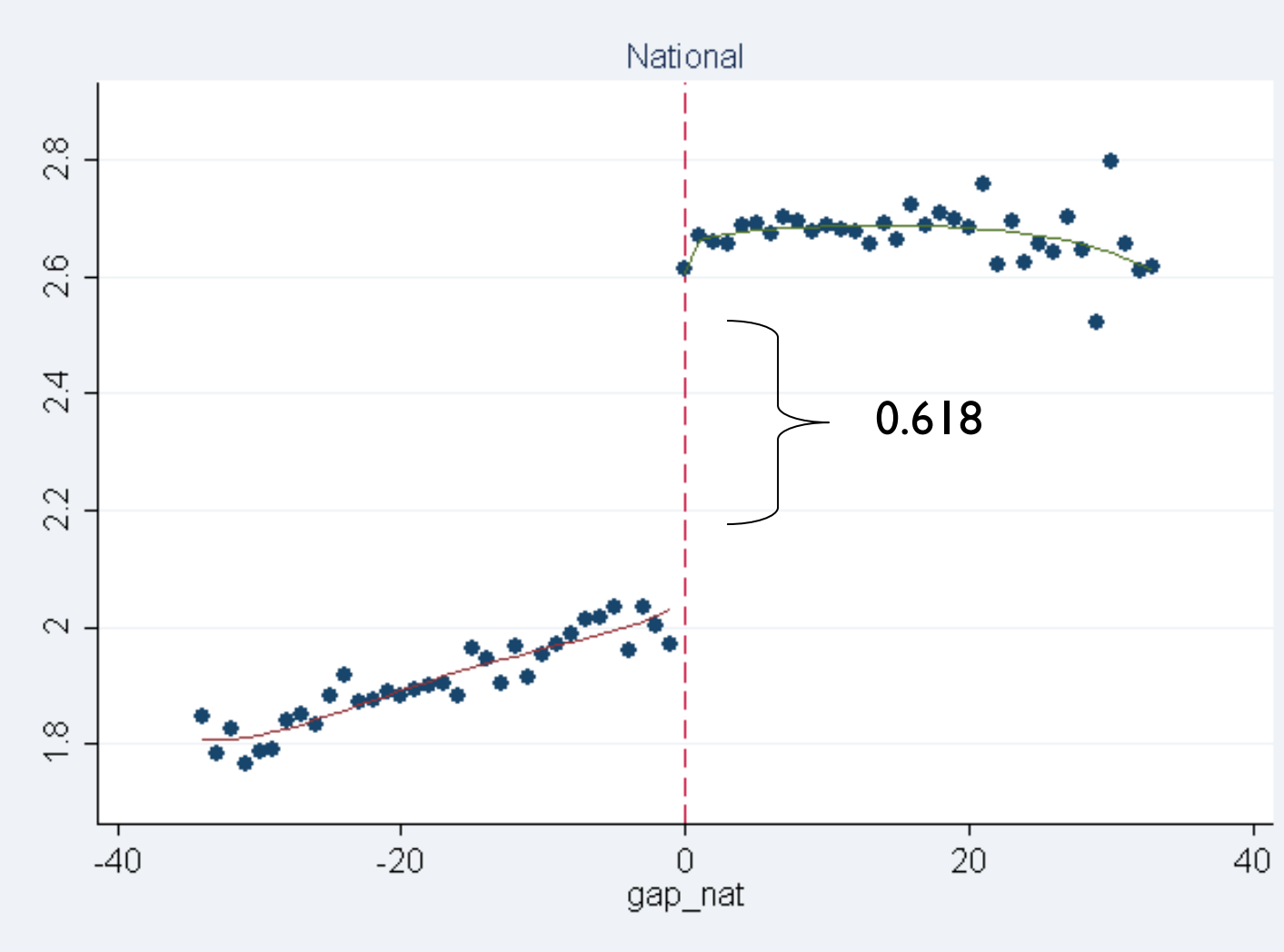
c_{sj} is cutoff (by school x district), gradN = graduate from Nat School

X are controls : sex, district, public primary school, school choice dummies and school choice x district dummies

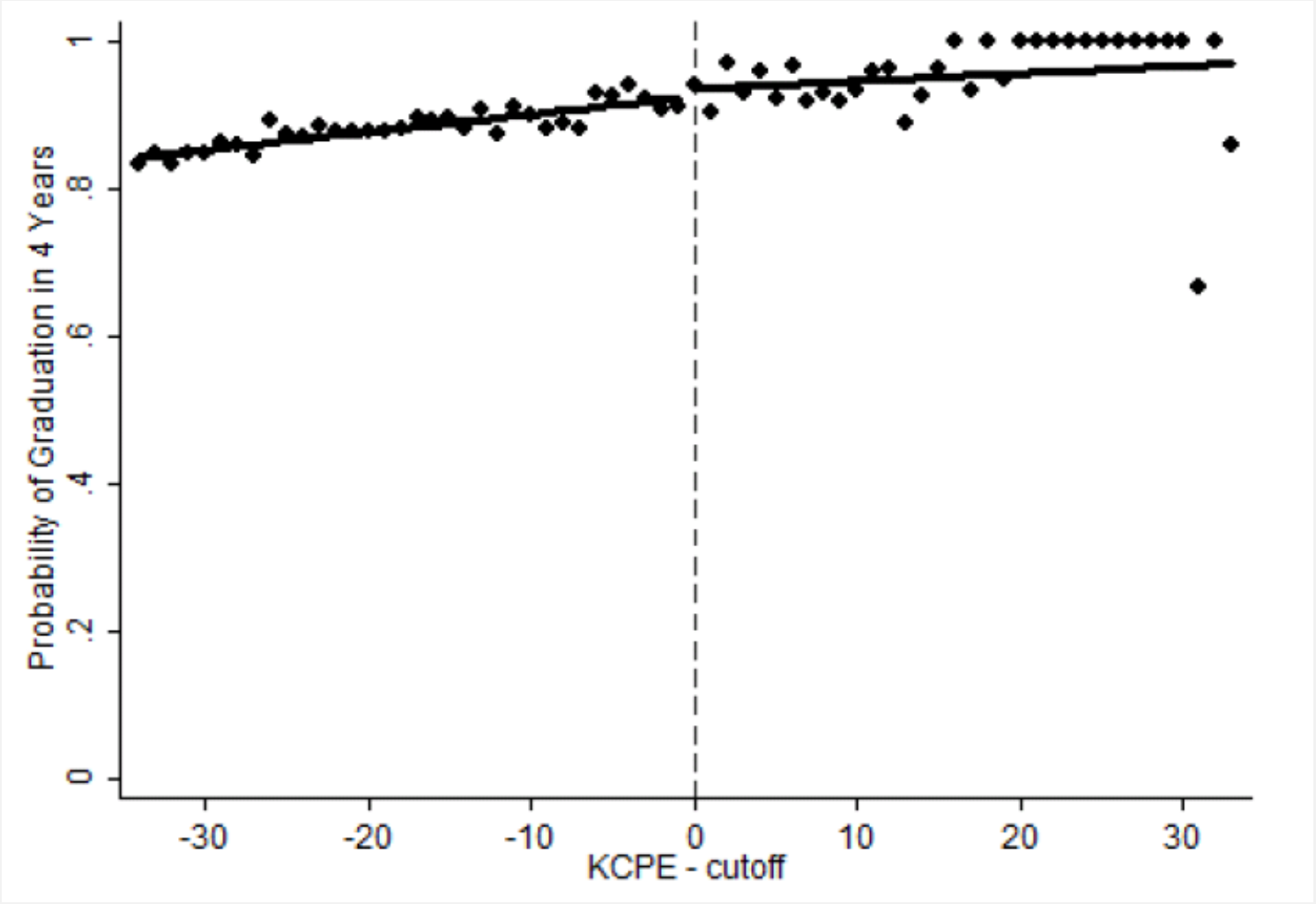
FIRST STAGE: NATIONAL SCHOOLS



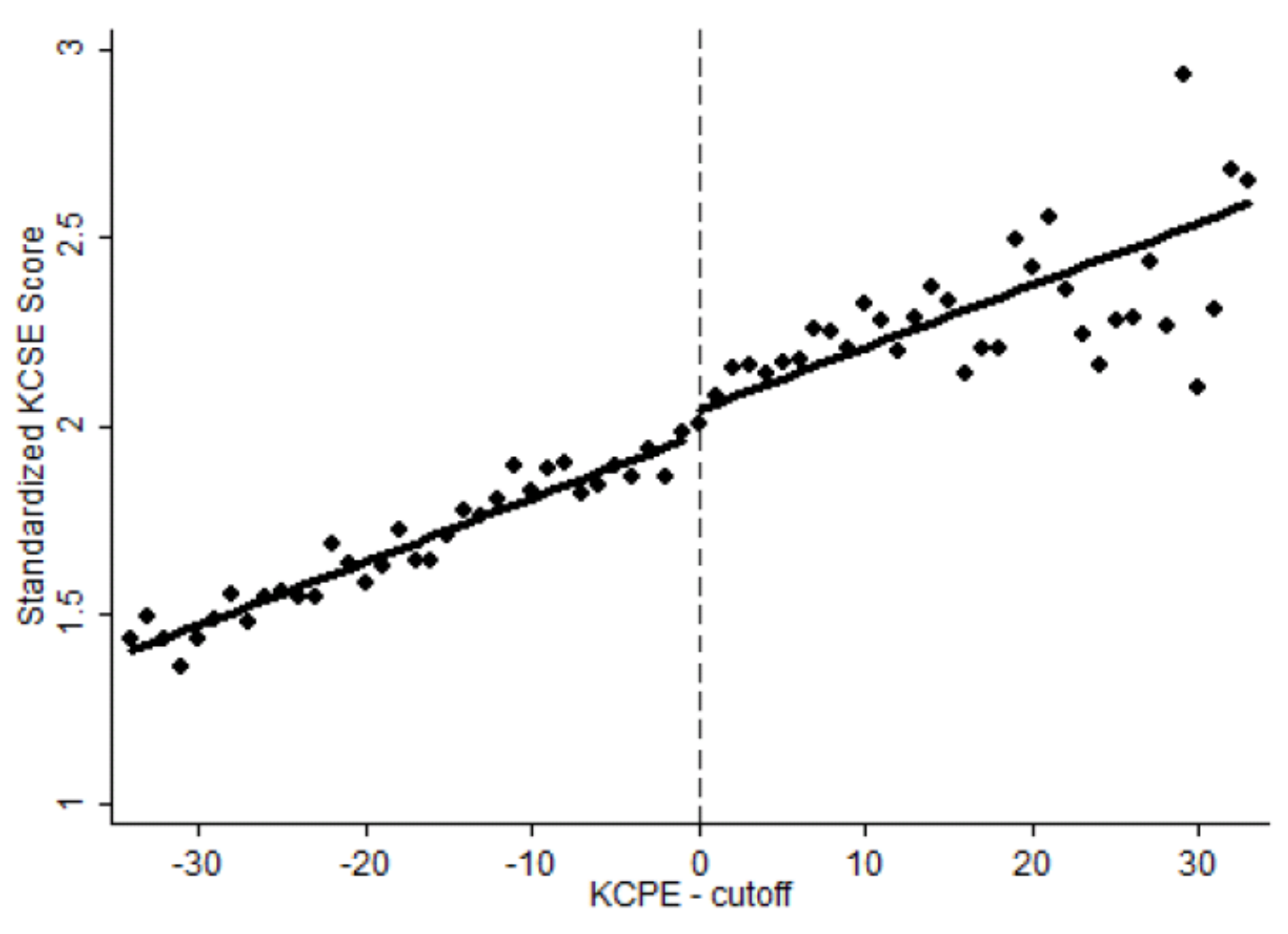
CHANGE IN PEER QUALITY AROUND THE NATIONAL SCHOOL CUTOFF



SELECTION INTO TEST TAKING?



EFFECT OF ATTENDING NATIONAL SCHOOL



EFFECT OF ATTENDING NATIONAL SCHOOL

Table 3: Achievement

Dependent Variable:	Standardized KCSE Score			
	OLS		Reduced Form	IV Estimation
	(1)	(2)	(3)	(4)
Graduate From National School	0.294***	0.046*		0.015
	(0.0261)	(0.0270)		(0.053)
Admitted to a National School			0.008	
			(0.028)	
Window	all	+/- 34	+/- 34	+/- 34
Observations	211,937	12,467	12,467	12,467
Rsquared	0.64	0.36	0.36	0.36

WHY NO TEST SCORE GAINS?

- Inputs don't matter in this context?
- Elite schools are considered "good" because of sorting
  - Their reputations are based on who they attract rather than how well they teach.
- Measurement issue– wrong outcome? Perhaps we should look at earnings?
- Maybe we need to look closer at what our estimate is uncovering.
- At first glance we might think that our RDD estimate is telling us what is the effect of improving school inputs
  - To simplify the discussion just think of one input e.g. peer quality.
- But there may be other behavioral responses at play.

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PRODUCTION FUNCTIONS AND BEHAVIORAL EFFECTS

- Todd and Wolpin (2003) and Pop-Eleches and Urquiola (2013)

- Three periods: t- 0 (before child starts school), t =1 and t=2 are the (start of) first and second years of school

$$A_1 = g_0(F_0, \mu)$$

$$A_2 = g_1(S_1, F_1, F_0, \mu)$$

At is child's achievement at the start of period t,

St is school inputs in period t

Ft are family/household investments in period t

μ is child's (unobserved) "ability", W is family wealth

PRODUCTION FUNCTIONS AND BEHAVIORAL EFFECTS

- Parents "expect" child to review this level of inputs (or that is what they would like the child to receive)

$$\overline{S_1} = \theta(A_1, W, \mu)$$

- However, schools ultimately decide what inputs a child gets (i.e. parents can't fully control what goes on in classroom/school). The actual level of inputs actually received by child is:

$$S_1 = \Psi(A_1, \mu)$$

- The difference between the two is $(S_1 - \overline{S_1})$
- Households observe this and then decide how much to invest (F)

$$F_1 = \phi(A_1, W, \mu, S_1 - \overline{S_1})$$

PRODUCTION FUNCTIONS AND BEHAVIORAL EFFECTS

- Insights from Todd and Wolpin (2003)
- What is the effect of an exogenously change one input in period 1 (S_1) holding all others constant.

$$\frac{\partial A_2}{\partial (S_1 - \overline{S}_1)} = \frac{\partial A_2}{\partial S_1} = \frac{\partial g_1}{\partial S_1}$$

- This effect is driven solely the production function→ if you know the production function you can answer this
- **<u>However, experiments /quasi-experiments do not (typically) estimate this parameter</u>**
- If you exogenously change inputs, parents are likely to respond
  - Teachers, students, etc can also respond.

PRODUCTION FUNCTIONS AND BEHAVIORAL EFFECTS

- Insights from Todd and Wolpin (2003)
- Experiments answer what is the TOTAL EFFECT of an exogenous change in one input in period 1 (S_1), not holding all others constant.
- The total effect includes direct effects (from prod fn) holding all other inputs constant and the indirect effects that operate through changes in other inputs.

$$\frac{dA_2}{d(S_1 - \overline{S}_1)} = \frac{dA_2}{dS_1} = \frac{\partial g_1}{\partial S_1} + \frac{\partial g_1}{\partial F_1}\frac{\partial F_1}{\partial (S_1 - \overline{S}_1)}$$

- The last term is the behavioral effect from households/parents
- Can extend this idea to account for multiple inputs

PRODUCTION FUNCTIONS AND BEHAVIORAL EFFECTS

- Insights from Todd and Wolpin (2003)

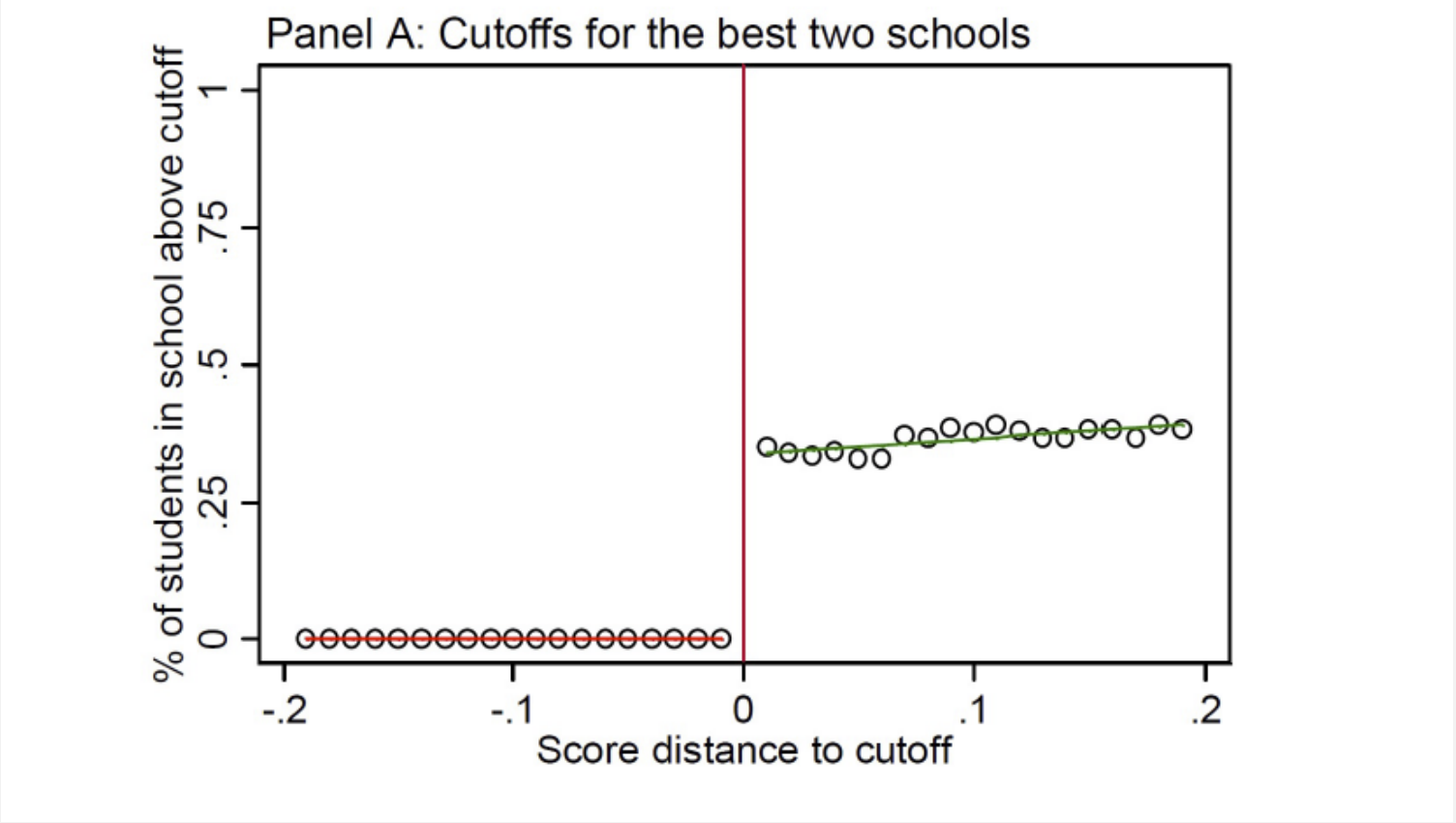
$$\frac{dA_2}{d(S_1 - \overline{S}_1)} = \frac{dA_2}{dS_1} = \frac{\partial g_1}{\partial S_1} + \frac{\partial g_1}{\partial F_1}\frac{\partial F_1}{\partial (S_1 - \overline{S}_1)}$$

- If experiments do not uncover production function parameters, are they still useful?
- YES! The experiment is recovering a "policy effect" – the Treatment on the Treated (TOT), i.e. what is the avg (total) effect of changing an input on children participating in the experiment. Quasi-experiments (IVs) estimate a local average treatment effect (LATE) (it is local because it applies to compliers)
- This structure also makes clear the assumptions needed to justify external validity of results across multiple settings
  - Production function is similar across settings
  - The behavioral effect is similar on average

GOING TO A "BETTER SCHOOL" PART II

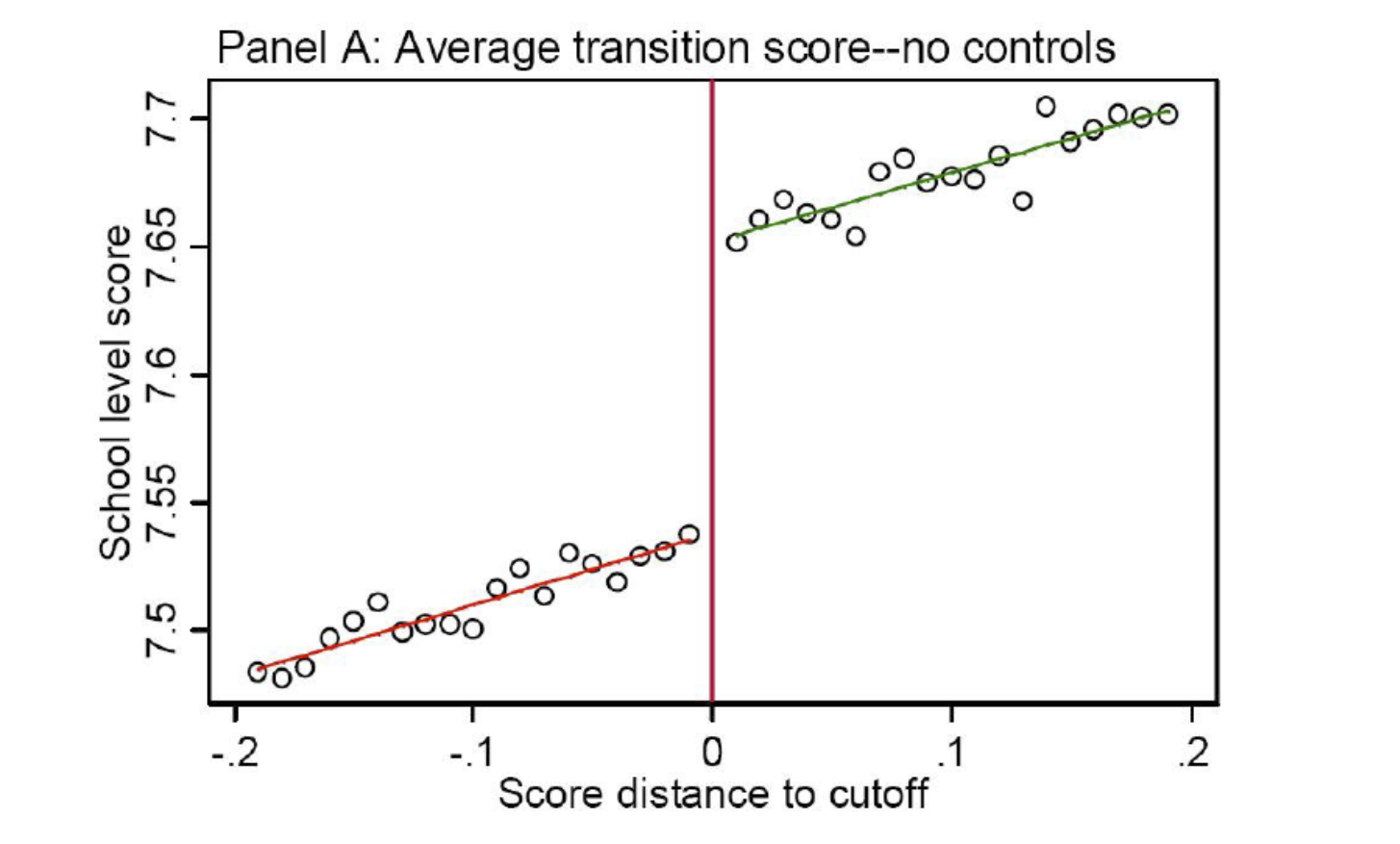
- Let's revisit our discussion on "going to a better school".
- In Kenya, Lucas and Mbiti (2014) do not find any test score benefits of attending a "Better school"
- Let's examine a similar study by Pop-Eleches and Urquiola (2014) in Romania
  - RDD design with test-scores and test score based cutoffs for gaining admission to "Better schools"

GOING TO A "BETTER SCHOOL" PART II



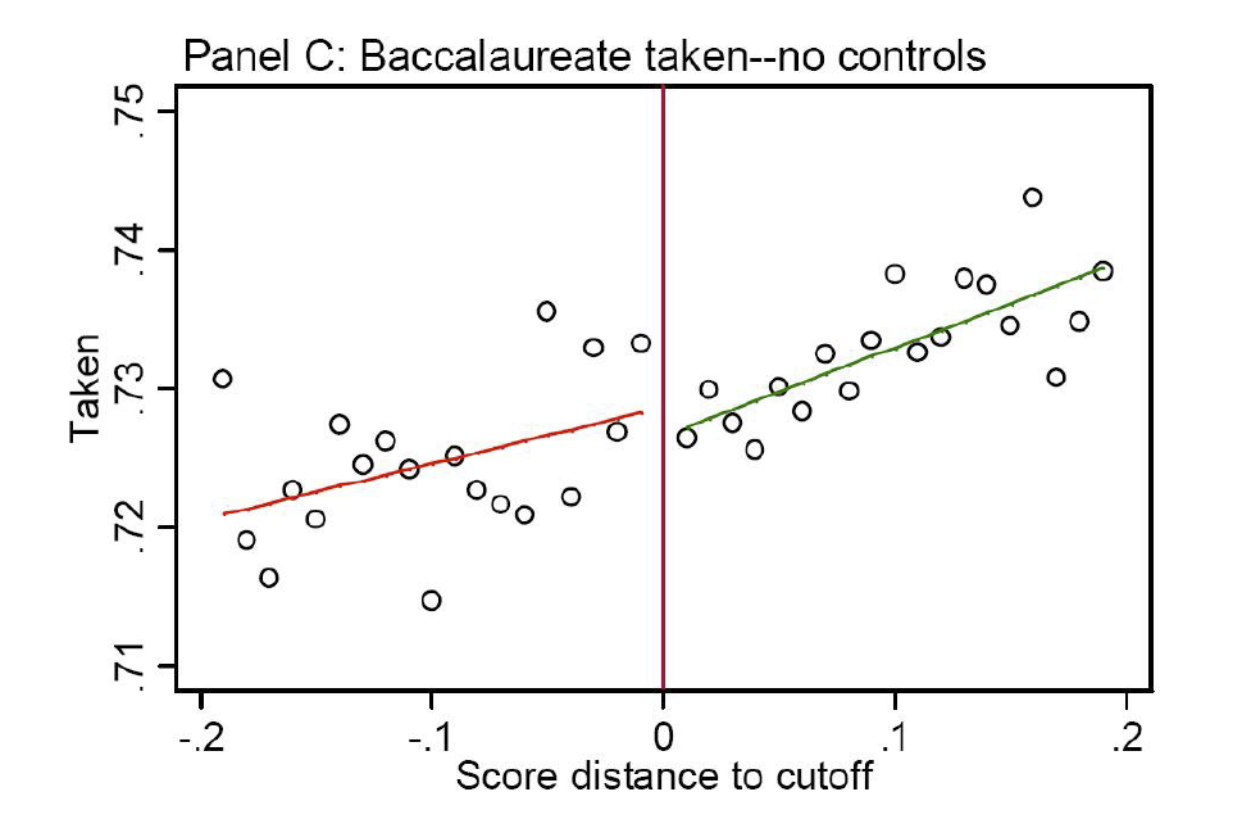
- Students who score above cutoff are more likely to attend a better schools

GOING TO A "BETTER SCHOOL" PART II



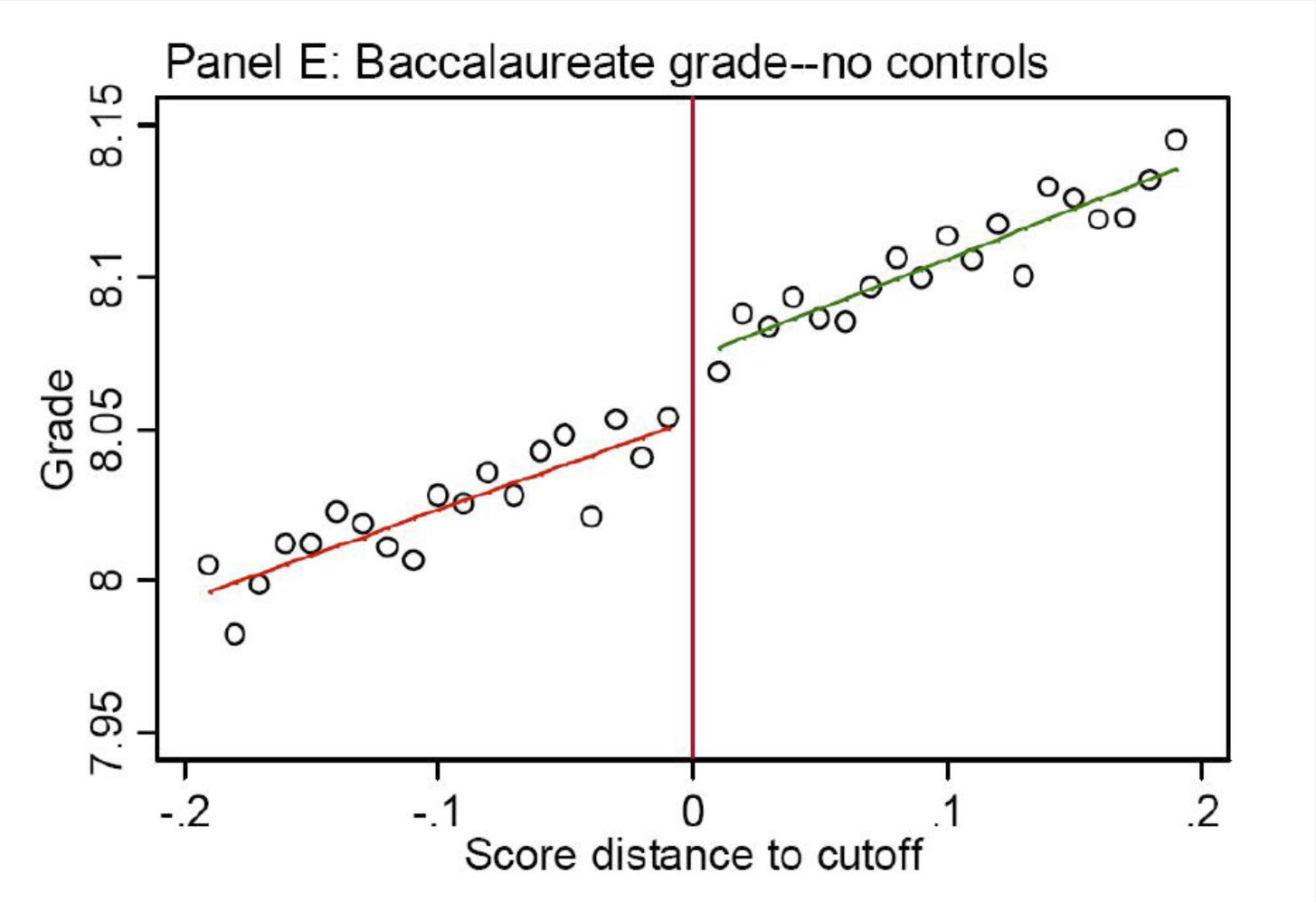
- Students who score above cutoff attend schools with better peers

GOING TO A "BETTER SCHOOL" PART II



- No selection into test-taking at end of school

GOING TO A "BETTER SCHOOL" PART II



- Statistically significant increase in Baccalaureate (high stakes exam) grade (0.02- 0.1 SD)

GOING TO A "BETTER SCHOOL" PART II

- Pop- Eleches and Urquiola (2013) conduct a survey to capture behavioral effects
- Parents of children just above cutoff cut back on helping children with hwk
  - "your teachers are good. you don't need mama/papa"
- Students who score just above cutoff perceived themselves to be weaker than their peers. They also report more negative social interactions with peers.
- The estimates of the reductions in parental help and negative social interactions experienced by students diminish over time.
- Back to the Kenya example– perhaps another possibility is the behavioral effects in that context completely offset any positive test-score effects from going to an a "Elite school"

ASIDE – ESTIMATION

- In our "Theory" we have not put any structure on production functions.
- In practice we tend to linearize things. For example

$$A_{it} = \alpha + F'_{it}\beta + \delta A_{it-1} + \varepsilon_{it}$$

A is measured achievement (test-score), F is measures family inputs, t is time period.

Although lagged test scores control for a lot, estimation is still complicated by the possibility of omitted variables and even non-random sorting within schools (to classes or teachers).

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WHAT IS SCHOOL QUALITY?

- Average test score are not a great measure of quality--- they likely reflect sorting by SES (or perhaps μ)
- Best approach is to focus on "Value Added"
- If you have two schools, we can determine the better-quality school by holding inputs in F() fixed across both and observing which school produces greater A.
- However, VA is hard to observe so policymakers, parents, etc.
- The data might not exist to support its computation
  - Need at least one "cohort" of students where you observe their current test scores and their previous test scores.
  - Ideally you want more cohorts to get more reliable estimates.
    - VA estimates using one cohort might get thrown off by "shock" (eg many kids got sick around exam time)
    - Averaging over several cohorts you will get a more reliable estimate

ASIDE #2- VALUE ADDED MODELLING

- Recall A_1, A_2 are achievement in first and second period respectively.
- A_1 is arguably a sufficient statistic for cumulative inputs, SES, and μ
  - You can get a lot out of 2 test scores over time!
- To estimate a school's value added
  - compute each student's predicted test-score in period 2 ($\hat{A}_2$) using all the data you have including A_1.
  - The schools value-added estimate is the average of the differences between the actual and predicted scores of the students
- The same idea can be applied used to calculate teacher VA (or classroom VA)
- Debate about potential for these to be biased. Depends on data availability, context, etc
- See Todd Wolpin 2003, Koedel et al (2015) for more details

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EXPERIMENTAL EVIDENCE ON SCHOOL INPUTS

- Thus far we have focused on RDD evidence on going to a "better school"
- What about changing one input?
  - Resources – Mbiti et al 2019 shows that only increasing resources does not lead to better learning
  - Class size– Mixed evidence here.
  - Peers– Mixed

SCHOOL RESOURCES

- Mbiti et al 2019
- Large and representative 350 school RCT in Tanzania with four arms
  - Capitation grant schools (extra resources)
  - Teacher incentive schools
  - Combo schools (incentives + grants)
  - Control schools (business as usual)
- You will cover this more next week but today I will focus on the results from the capitation grant intervention

SCHOOL RESOURCES

- At the time CG policy was TZS 10,000 per pupil per year
- Schools had autonomy on how they could spend money (with some guidelines)
  - Couldn't pay teachers, couldn't use funds for new construction
- Funds from central govt transferred to schools via multiple steps. Resulted in "37% leakage rate" (World Bank 2012)
- Disbursement schedule was not predictable
- The treatment gave schools fuil amount of CG for two years.
- Large increase in resources: 3x mean (pre-treatment) school expenditure (excluding teacher salaries)

SCHOOL RESOURCES

How much are schools and households spending per pupil?

	(1) Grant exp.	(2) Other school exp.	(3) Total school [(1)+(2)]	(4) Household exp.	(5) Total exp. [(3)+(4)]
Panel A: Year 1					
Grants	8,070.68***	-2,407.92***	5,662.75***	-1,014.96	4,647.79***
	(314.09)	(813.88)	(848.58)	(1,579.79)	(1,724.64)
N. of obs.	350	350	350	350	350
Mean control	0.00	5,959.67	5,959.67	28,821.01	34,780.68
Panel B: Year 2					
Grants	6,033.08***	-2,317.74**	3,715.34***	-2,164.18*	1,585.75
	(336.95)	(1,096.16)	(1,122.60)	(1,201.53)	(1,548.42)
N. of obs.	349	349	349	350	349
Mean control	0.00	4,524.03	4,524.03	27,362.34	31,886.37
Panel C: Year 1 + Year 2					
Grants	7,059.29***	-2,367.94***	4,688.04***	-1,589.57	3,133.33**
	(230.64)	(688.89)	(724.91)	(1,053.64)	(1,241.09)
N. of obs.	699	699	699	700	699
Mean control	0.00	5,241.85	5,241.85	28,091.68	33,333.53

SCHOOL RESOURCES– NOTE THE BEHAVIORAL EFFECT

How much are schools and households spending per pupil?

	(1) Grant exp.	(2) Other school exp.	(3) Total school [(1)+(2)]	(4) Household exp.	(5) Total exp. [(3)+(4)]
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N. of obs.	699	699	699	700	699
Mean control	0.00	5,241.85	5,241.85	28,091.68	33,333.53

Yr 1 is unanticipated so no HH response

Yr 2 is expected so HH cut back on spending

Despite this still a large increase in resources

SCHOOL RESOURCES

Do Grants Increase Test scores?

	(1)	(2)	(3)	(4)
Panel A: Year 1				
	Math	Swahili	English	Combined (PCA)
Inputs	-0.05	-0.01	-0.02	-0.03
	(0.04)	(0.04)	(0.04)	(0.03)
N. of obs.	9,142	9,142	9,142	9,142
Panel B: Year 2				
	Math	Swahili	English	Combined (PCA)
Inputs	0.01	-0.00	0.02	0.01
	(0.05)	(0.05)	(0.05)	(0.05)
N. of obs.	9,439	9,439	9,439	9,439

Can rule out effects > 0.11SD in yr 2

Inputs = grants treatment

SCHOOL RESOURCES

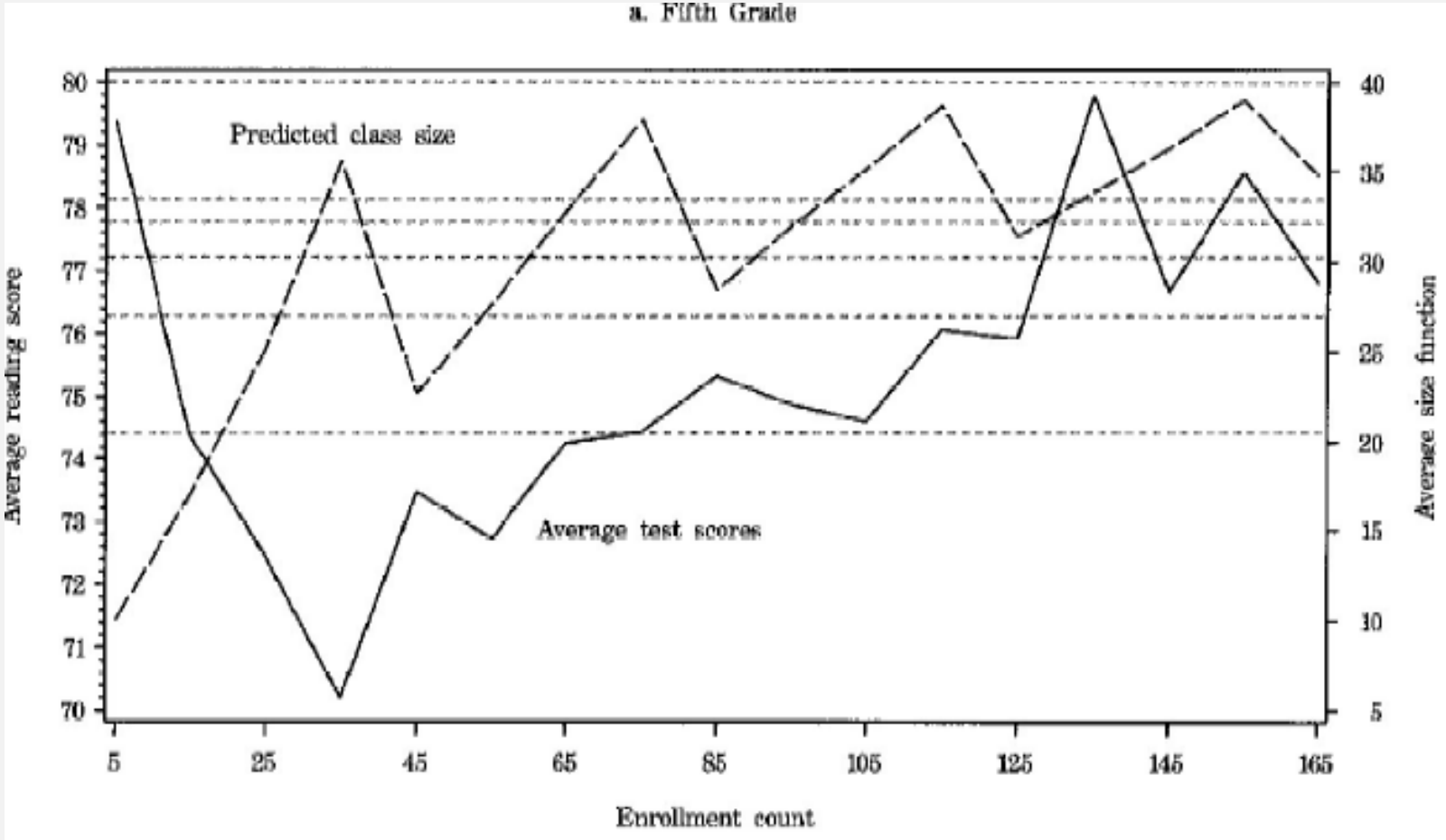
- Why don't resources improve learning?
- Muted by behavioral effects (but not completely offset)
- Muted by "precautionary savings"
  - This saving behavior also documented in Sabarwal et al. 2014) where schools stored textbooks rather let students use them
- They don't fundamentally change the process of learning (no change in "productivity of school")
- Mbiti et al 2019 argue that Tanzanian schools may face multiple binding constraints. Thus alleviating one binding constraint will not improve outcomes because the other constraint is still binding
- Better outcomes in schools that receive both grants and incentives
- Grants are effective when teachers are motivated and have resources to support them.
- The argue that resources and teacher incentives are complements in the production function
- These two ideas- multiple constraints and behavioral effects can help us understand why many input based policies fail to improve outcomes.

CLASS SIZE

- Policy makers, parent, and stakeholders advocate for smaller class sizes
  - better individual attention
- Classic paper on this is Angrist and Lavy (1999)
- Maimonides rule caps class size at max of 40
- Cohorts sized 1–40 are in a single class, but cohort sized 41–80 are split into two classes with average size 20.5–40, and so on…

CLASS SIZE

Does Lower class Size improve learning?



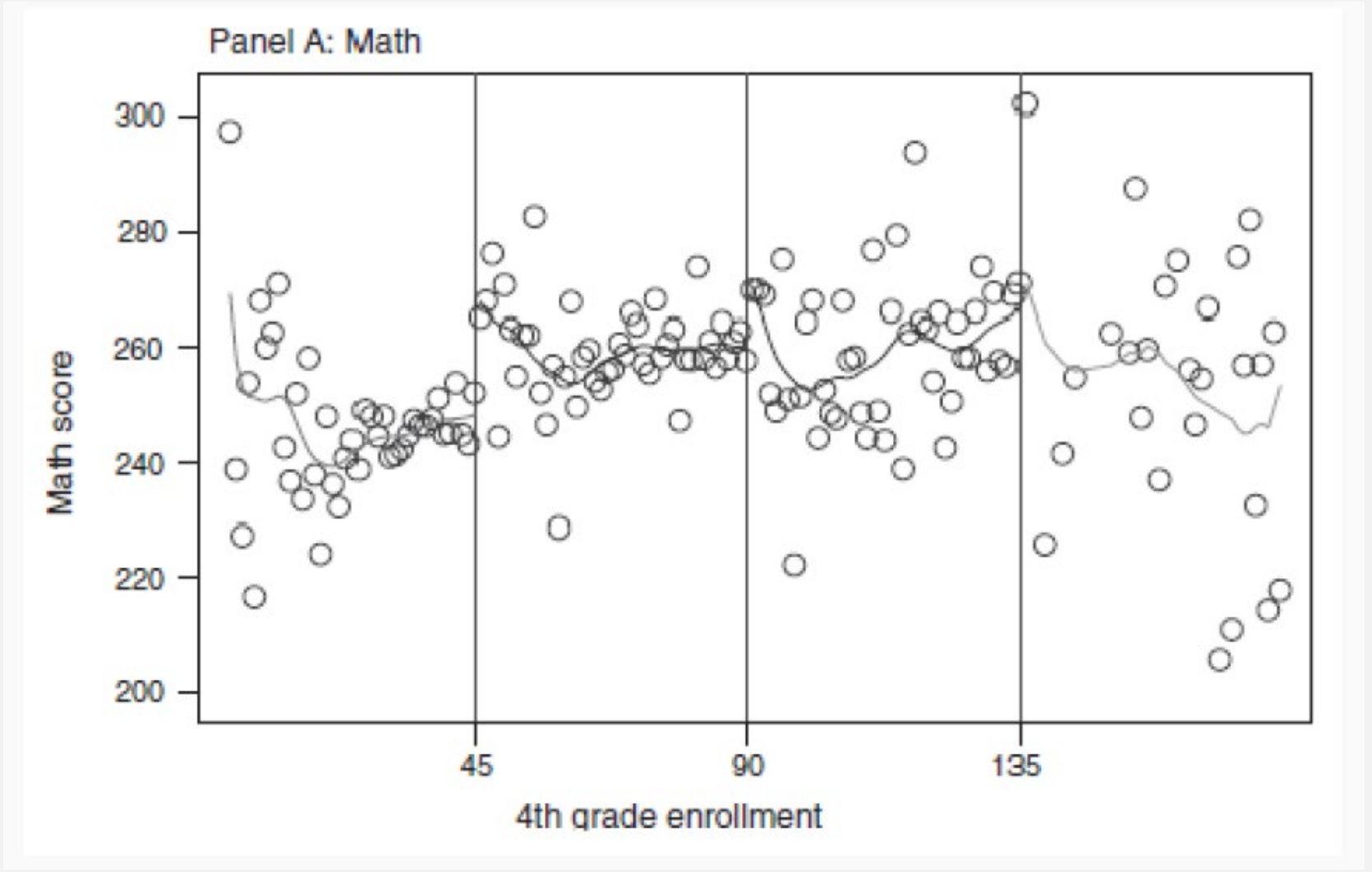
Reducing class size by ten pupils increases test scores on average by 0.25 standard deviations – a large effect

Can rule out effects > 0.11SD in yr 2

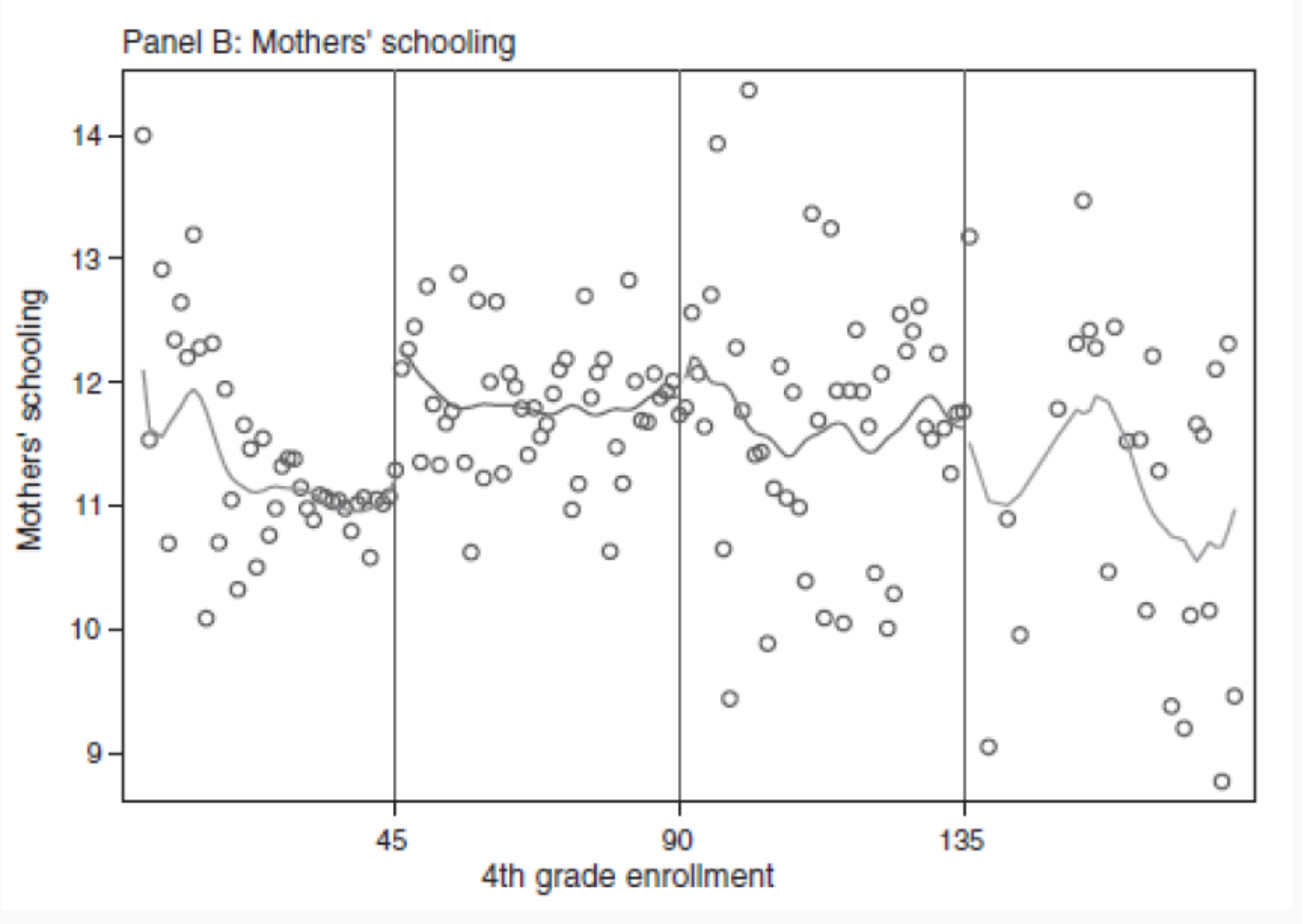
CLASS SIZE-- SORTING

- Urquiola and Verhoogen (2009) apply Angrist and Lavy's approach to study the impact of class sizes in Chile.
- Exploit class-size cap of 45 students in schools that accept government vouchers.
- As in the Israeli case, average achievement jumps at the discontinuity.
- But parental characteristics `jump', too, suggesting that sorting may drive these results.
- Manipulation around the RD cutoff are a major threat to identification
  - Check for jumps in RD on characteristics, and also use McCary (2008) test.
  - Potential to use "Donut" RD to fix this. See Barreca, Lindo, and Wadell (2011) for an example

CLASS SIZE-- SORTING



CLASS SIZE-- SORTING



TEACHERS

- Spending on teachers accounts for the majority of education budgets in developing countries
- The average teacher in a sub-Saharan African country earns almost four times GDP per capita, compared
- to OECD teachers who earn 1.3 times GDP per capita (OECD, 2017; World Bank, 2017).
- Yet, absence is high and teacher content knowledge is low (World Bank, 2018).
- Well designed teacher incentives can improve their motivation (next weeks lecture)
- How can we improve teacher effectiveness?
- Evidence that supporting teachers with mentoring /coaching can improve outcomes
- Evidence that detailed teacher guides can also have big impacts
- See Piper et al (2018) for evidence from PRIMR program in Kenya which combined coaching, and teacher guides and let to large increases in learning

INFORMATION ON SCHOOL QUALITY

- In 2013, Tanzania introduced a series of reforms aimed at improving education outcomes "Big Results Now in Education" (BRN).
- A key initiative was publication of nationwide and within-district school rankings based on previous year test scores on primary school exit exam (NOT value added)
- No monetary rewards or punishments
- Limited school choice so there is limited scope for parents to react
- But publication put pressure on officials throughout the education system.
  - Perhaps motivated by career incentives
- Can this simple system do anything?
- Cilliers, Mbiti and Zeitlin (2021) use a Diff-in-Diff approach to examine this.

INFORMATION ON SCHOOL QUALITY

Impacts of the Reform on School Exam Performance

	Marks		Pass Rate		Number Passed	
	(1)	(2)	(3)	(4)	(5)	(6)
0–10th percentile in previous year	4.406*** (1.004)	6.147*** (0.849)	0.058*** (0.012)	0.079*** (0.011)	1.828* (1.026)	2.180*** (0.754)
10–20th percentile in previous year	2.049*** (0.563)	2.382*** (0.578)	0.024*** (0.006)	0.030*** (0.007)	0.930 (0.845)	0.852** (0.379)
Diff-diff	Yes	Yes	Yes	Yes	Yes	Yes
School fixed effects	No	Yes	No	Yes	No	Yes
Control lagged exam score	Yes	Yes	Yes	Yes	Yes	Yes
Control mean, post BRN	109.46	109.46	0.58	0.58	30.82	30.82
Observations	77,731	77,431	77,731	77,431	77,731	77,431
R^2	0.655	0.801	0.607	0.763	0.425	0.912

Test scores in bottom ranked schools improved ~ a 0.25SD increase relative to pre reform

INFORMATION ON SCHOOL QUALITY

Number of Test-Takers and Enrollment

	PSLE Data—Exam-Sitters	
	All years (1)	2015 and 2016 (2)
0–10th percentile in previous year	−2.039*** (0.763)	−1.676*** (0.589)
10–20th percentile in previous year	−1.846*** (0.635)	−1.068** (0.423)
Diff-diff	Yes	No
Control lagged exam score	Yes	Yes
Fixed effects	Yes	Yes
Control mean	52.01	50.07
Observations	77,431	31,520
R^2	0.910	0.953

BUT….
Part of the improvements are because schools are gaming the system by excluding certain students.
NOT just excluded from the Test, they are pushed out of school!

WRAPPING UP

- Education production function is a key framework
- Specify the relationship between inputs, the "technology" and learning outcomes.
- Test scores are not great measures of school quality
- Value Added approaches are better
- The framework also helps us understand what we parameters we estimate in research
- Highlights the importance of behavioral effects