Education

EDUCATION

HALFTIME
FOR THE SUSTAINABLE
DEVELOPMENT GOALS



BEST INVESTMENTS FOR THE SDGs

EXCELLENT BENEFIT COST RATIO: 65

Investment

Structured pedagogy, a coherent package of textbooks, lesson plans, and teacher training and coaching that work together to improve in-class teaching. **Teaching according to learning level rather than age** or grade, either technology-assisted learning with tablets, or teaching assistants by deploying 'teaching-at-the-right level'.

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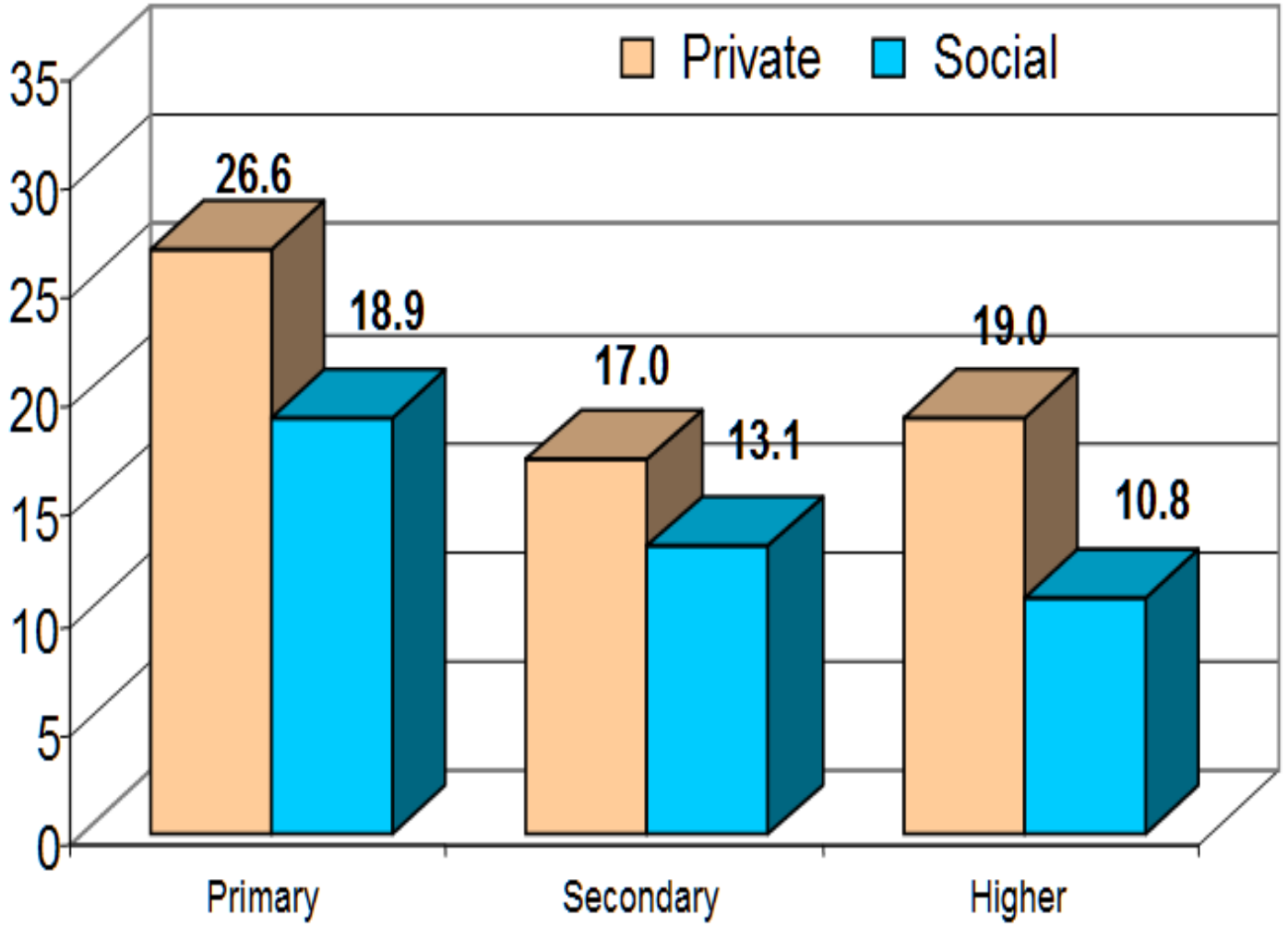
What does cost-benefit analysis say about education?

Background

Education improves productivity

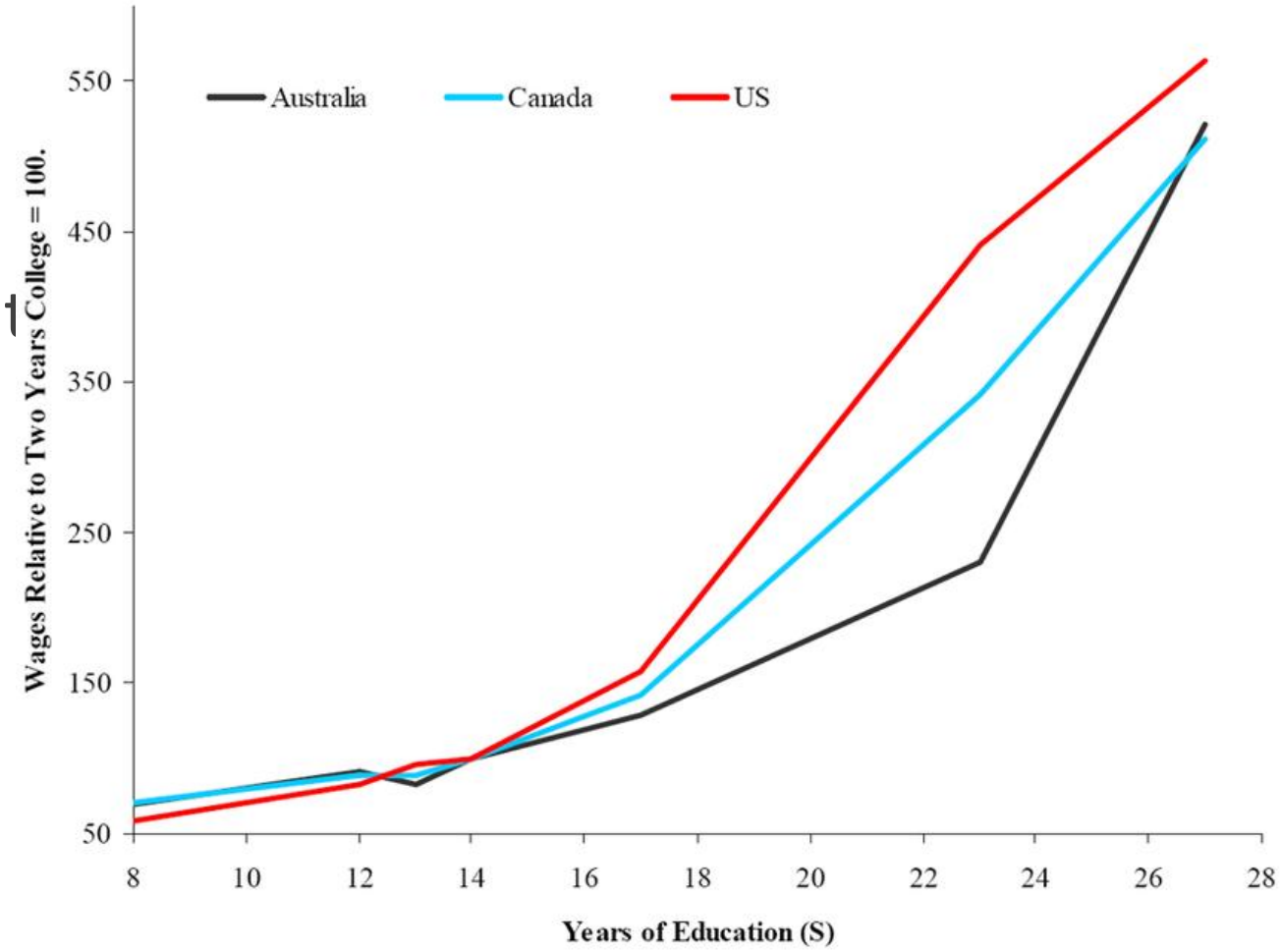
- Psacharopoulos (1973, 1985) conducted comprehensive studies
  - **across various countries**
  - **quantify precisely how much an additional year of schooling would increase wages**
  - **establishing a cornerstone of modern educational economics**
- Extra year of education increases private future wages by 9%
  - **1120 estimates in 139 countries from 1950 to 2014**
  - **relatively stable over time (Psacharopoulos & Patrinos, 2018)**

Psacharopoulos: Returns to education by level



Mincerian Earnings Function Method

- Log(wages) = f(years of schooling, experience)
- Most common method in recent research
- Allows cross-country comparisons



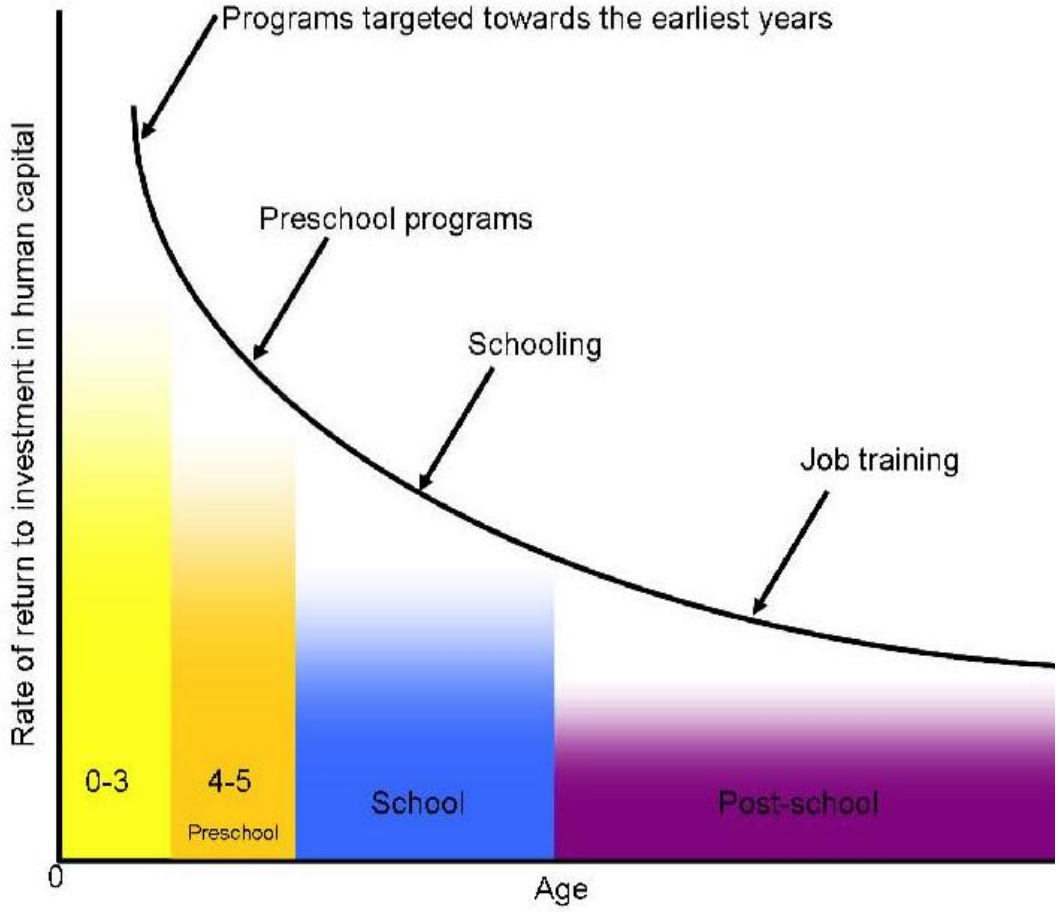
Education costs

- Typical costs in educational BCAs include
  - **school infrastructure**
  - **teacher salaries**
  - **classroom inputs, all relatively simple to estimate.**
  - **opportunity cost of attending school (only for older students, who study instead of working and earning money).**

- For younger students (early childhood through junior secondary)
  - **opportunity costs set to zero (in reality, minimal or often negative, as their alternative is typically supervision by an adult caregiver)**
- For older students attending upper secondary, tertiary education, or technical and vocational training (TVET)
  - **opportunity costs can be substantial, often equaling or exceeding direct schooling expenses (Psacharopoulos & Patrinos, 2018)**

Heckman Curve

- Empirically, education investments follow Nobel Laureate James Heckman's "Heckman curve"
- Earlier educational interventions offer higher returns due to lower direct and opportunity costs (Heckman, 2006)
- Highest returns in early childhood
- Declining marginal returns over time



Global Learning Crisis

Many children attend school but learn very little

Huge inequality in learning

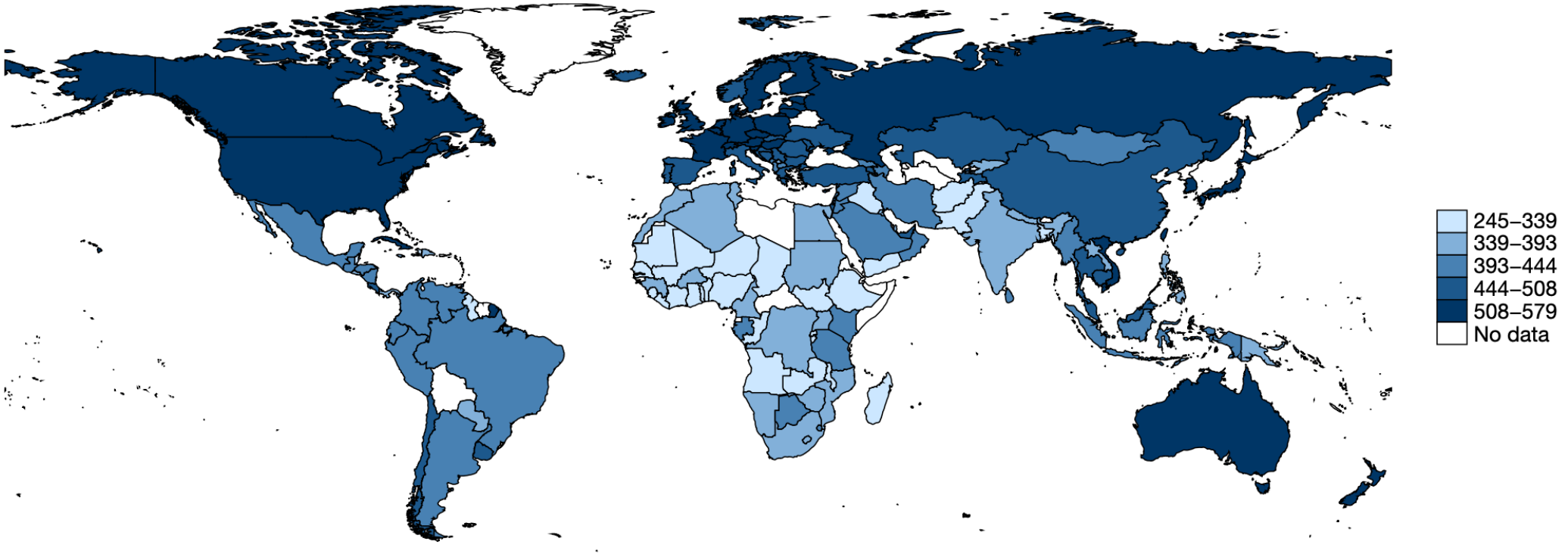


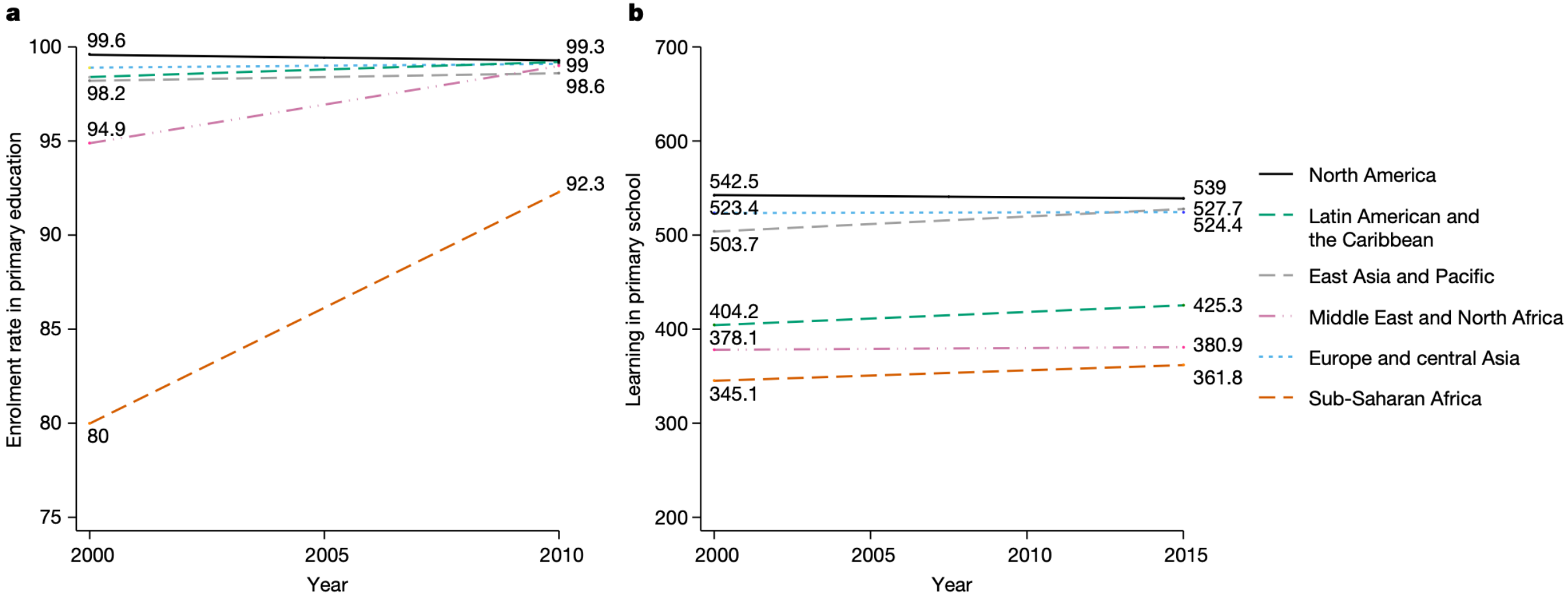
Fig. 1 | Average learning (2000–2017). Learning scores are calculated from our HLO database as averages for a given country across subjects and levels over the time period 2000–2017. The numbers in the legend are the lowest and highest average HLO learning scores when averaged over the time period 2000–2017. Average scores by region are as follows: East Asia and Pacific (445), Europe and Central Asia (489), Latin America and the Caribbean (402), Middle East and North Africa (399), North America (529), sub-Saharan Africa (342) and South Asia (335). A few trends emerge: sub-Saharan African regions lag behind all regions apart from South Asia, with countries such as India (368) performing on par with lower-performing sub-Saharan African countries such as Uganda (369); within sub-Saharan Africa, a few countries such as Kenya (444) and Tanzania (416) lead, on par with many countries in Latin America such as Mexico (435); within Latin America, a few countries such as Chile (449) lead compared with some European counterparts such as Georgia (437); the Middle East performs similarly or worse than Latin America (as shown in summarized scores by region); many Asian countries outperform North American and European regions (for example, Japan (553) relative to the United States (521)).

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The learning crisis

- Children are now in school, but not learning
- World's poorer half doubled per-student spending
  - **Virtually no impact**

All in school, but little quality improvement

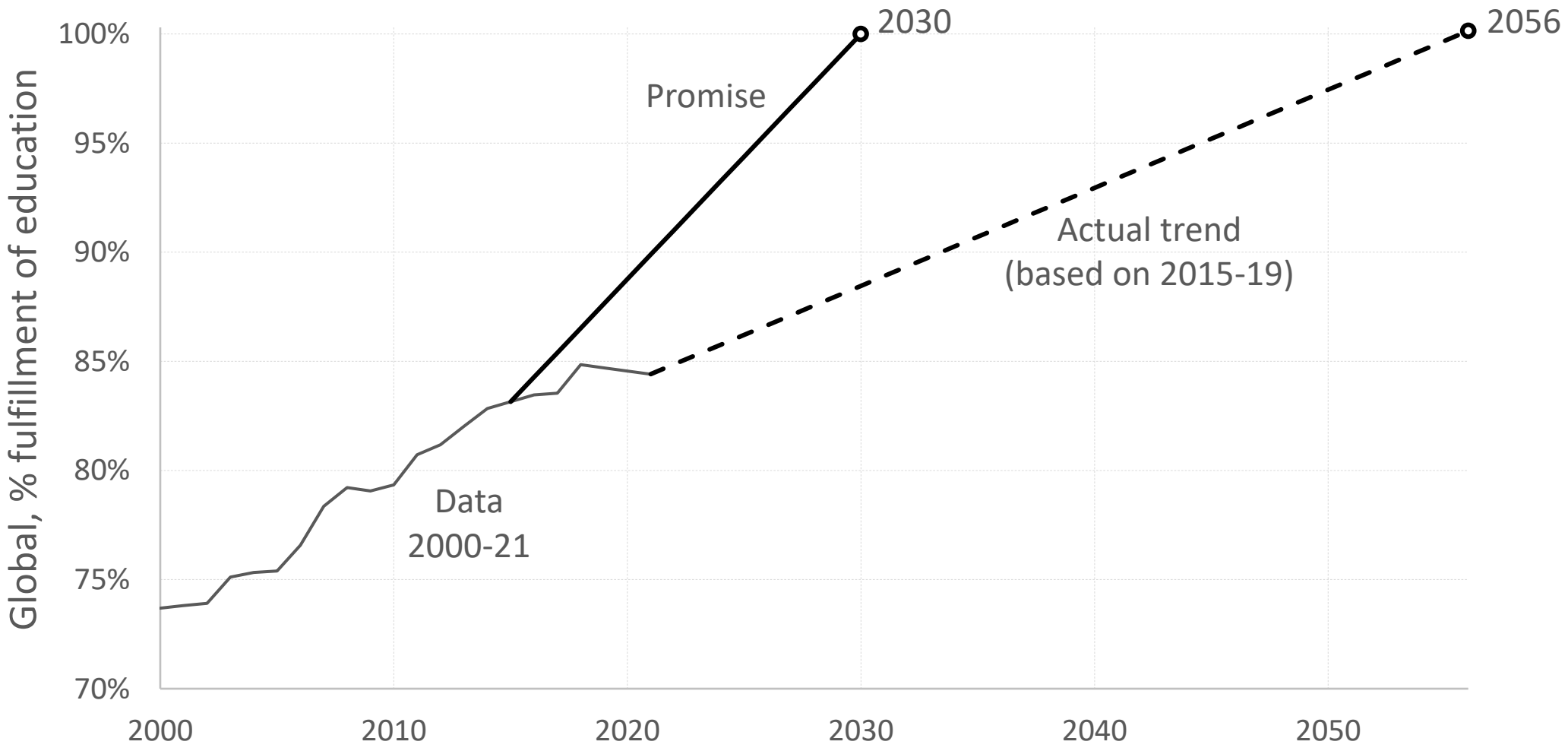


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The learning crisis

- Children are now in school, but not learning
- World's poorer half doubled per-student spending
  - **Virtually no impact**
- Third of a billion: literate, but no understanding
  - **Vijay has a red hat, a blue coat, and yellow socks**
    - What color is the hat?
  - **Two people share six pieces of cheese equally**
    - How many pieces do each get?

Global fulfillment of SDG 4, Education



Learning: what doesn't work?

- World Bank
  - **150 possible education policies**
  - **Half delivered no learning whatsoever**
- One laptop per child
  - **"no impacts on academic achievement or cognitive skills"**
  - **Children less likely to make an effort at school**
- Free education in India 2009
  - **10-15m more students enrolled, with more teachers**
  - **Lower test scores**
- Dramatically increase teacher pay in Indonesia
  - **2.7 to 3.8 million teachers, paid twice as much**
  - **No impact on learning**

Angrist: What works and doesn't work

World Bank and Global Education Evidence Advisory Panel

Improves learning outcomes

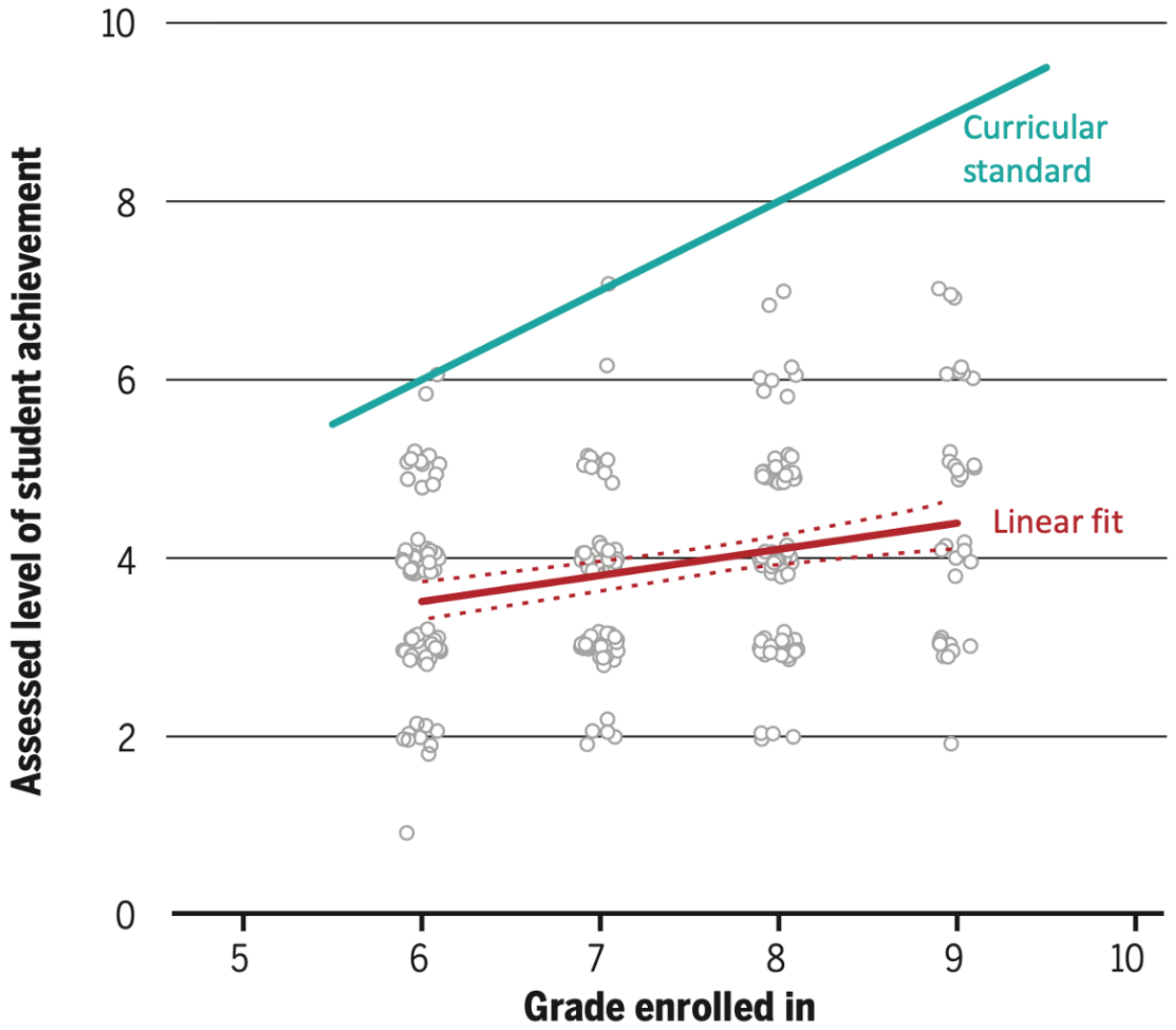
- Teaching at the Right Level (TaRL)
- Structured pedagogy with materials
- Technology for personalized learning
- Preschool
- Teacher coaching & ongoing support
- Accountability mechanisms
  - **Teacher attendance monitoring**
  - **Performance-based incentives**
  - **Low-cost administrative changes**
- Information on education returns
- Health-treatment like deworming, preventative malaria treatment, etc.

No learning improvements

- Buildings, books, class sizes, libraries, and grants alone without quality focus
- General skills teacher training
- Conditional cash transfers
  - **Can improve access, but not learning**
- Community involvement in school management

"How to Improve Education Outcomes Most Efficiently? A Comparison of 150 Interventions Using the New Learning-Adjusted Years of Schooling Metric"

Learning: the challenge



Muralidharan & Singh 2021

Two incredible education investments

- Children learn more
  - **Learn according to level**
    - With or without technology
- Teachers teach better
  - **Structured pedagogy – make teachers better**
    - Semi-scripted lesson plans for whole year
    - 3 annual workshops, total one week
    - Weekly text messages

BCR calculation: Structured Pedagogy

- Estimate learning gains
  - **Use impact evaluations: structured pedagogy yields +0.13 SD in test scores over 1 year**
- Convert learning gains to lifetime earnings
  - **0.1 SD ≈ 2% higher wages**
  - **Expected working-life earnings of a student (present value of lifetime earnings = US$43,000)**
  - **Learning gain = 0.13 SD**
  - **Wage gain = 0.13 / 0.1 × 2% ≈ 2.6%**
  - **Benefit per student = 2.6% × US$43,000 = US$1,100 (PV of lifetime earnings increase)**
- Estimate annual cost per student
  - **Program package:**
    - Teacher guides/lesson plans
    - Student materials (textbooks/workbooks)
    - Teacher training
    - Coaching/monitoring
  - **Typical orders of magnitude lower**
    - US$11 per student per year in lower middle-income settings
- Calculate BCR
  - **Benefit per student (PV) = US$1,118**
  - **Cost per student (PV) = US$11**
- BCR = 1,100/11 ≈ 100

BCR calculation: Teaching at the Right Level (TaRL) with streaming of kids

- Estimate learning gains
  - **+ 0.15 SD with teaching assistant**
- Convert learning gains to lifetime earnings
  - **0.1 SD ≈ 2% higher wages**
  - **Expected working-life earnings of a student (present value of lifetime earnings = US$43,000)**
  - **Learning gain = 0.15 SD**
  - **Wage gain = 0.15 / 0.1 × 2% ≈ 3.0%**
  - **Benefit per student = 3.0% × US$43,000 = US$1,290 (PV of lifetime earnings increase)**
- Estimate annual cost per student
  - **Program package:**
    - Teaching assistant (1 hour per day for 22 children per class)
    - More tests
    - Teacher training
    - Coaching/monitoring
  - **Typical orders of magnitude lower**
    - US$29 per student per year in lower middle-income settings
- Calculate BCR
  - **Benefit per student (PV) = US$1,290**
  - **Cost per student (PV) = US$29**
- BCR = 1,290/29 ≈ 44

Adaptive Learning Software

- Personalized learning paths
- Real-time feedback
- + 0.275 SD learning gain from one year one hour per day
  - **translates to 0.275 / 0.1 x 2% ≈ 5.5% wage gain**
- Cost per student $32 (one year in LMC: shared tablet, trainer and maintenance)
- Benefit per student $2,365 = 5.5% x $43,000 (PV of lifetime earnings increase)
- BCR = 2,365 / 32 = 73

Comparing benefits in the future with costs today

Example: Time value of money

- Costs today vs. benefits over many years
- Key concepts:
  - **Present value (PV)**
  - **Discount rate**
- Excel function:
  - **NPV(rate, value1, value2, …)**

Discounting in Practice

- Why discount?
  - **People prefer benefits now**
  - **Costs today hurt more**
  - **Capital has an opportunity cost**

Inflation and Real vs. Nominal Values

- Example:
  - **Inflation: 4.5%**
  - **Nominal interest rate: 10.5%**
- Key distinctions:
  - **Nominal vs. real values**
  - **Real interest rate (1 + 10.5%)/(1 + 4.5%) - 1 = 5.7%**
  - **This is the short term cost of capital**
- Consistency:
  - **Don’t mix nominal and real**

Social discount rate for cost benefit analysis

- CBA is not a financial analysis
  - **We are adding all costs and benefits to the analysis**
- Money, time, health and mortality, the economy / productivity / income, the environment, learning and cognition, gender equality etc.
- The social discount rate should reflect the trade off for everything
  - **World Bank recommends 2x per capita consumption growth rate**
  - **Roughly equivalent to 2x GDP per capita growth rate**
  - **Example 2x 3.0% = 6%**

Annualization (Equivalent Annual Cost)

- What is the yearly cost of an ambulance?
  - **Maintenance, staffing etc**
- Purchase cost $200,000 needs to be discounted
  - **Useful life – say 5 years to avoid major breakdowns**
  - **Residual value – say 25% of purchase price $50,000 in 5 years**
    - Present value (PV) 50,000 / (1.06)^5 ≈ 50,000 / 1.338 ≈ 37,400
    - PV of 5-year cost = 200,000 – 37,400 = $162,600
- Annualization or Equivalent Annual Cost:
  - **An expense today is more costly than in 5 years**
    - Simply dividing $162,600 by 5 ≈ $32,500 underestimate the yearly cost
  - **EAC turns a multi-year investment into a comparable annual figure**
    - EAC = 162,600 * 0.06 / (1 – (1.06)^-5) ≈ $38,600
- Excel: =-PMT(discount_rate, lifetime, -PV)

Annualization helps

- Annualization helps compare cost of capital investments:
  - **Projects with different lifespans**
  - **Equipment vs. outsourcing**
  - **Capital vs. operational spending**

Quantifying benefits

Identifying Learning Impacts

- Standardized test score gains (in SD units)
- Evidence sources
  - **Structured pedagogy median effect: 0.13 SD (Evans & Yuan, 2019) review of 67 effect sizes**
  - **Technology-assisted TaRL: 0.275 SD median from review of 18 studies**
  - **Non-tech TaRL: 0.15 SD corresponds to results from large and medium-scale RCTs and evaluations**

Translating Learning into Income Gains

- 1 SD improvement → 20% higher income (Angrist et al. 2020)
- Therefore, a 0.13 SD gain yields a 2.6% income boost, etc.

Projecting Lifetime Income

- A synthetic lifetime earnings profile for a representative child in LICs/LMCs
  - **Work life: ages 18–64**
  - **Income path: tied to GDP per capita projections**
  - **Conversion from GDP per capita to income per worker uses Penn World Table labor share and labor force participation data**
- Discounting: 8% real discount rate

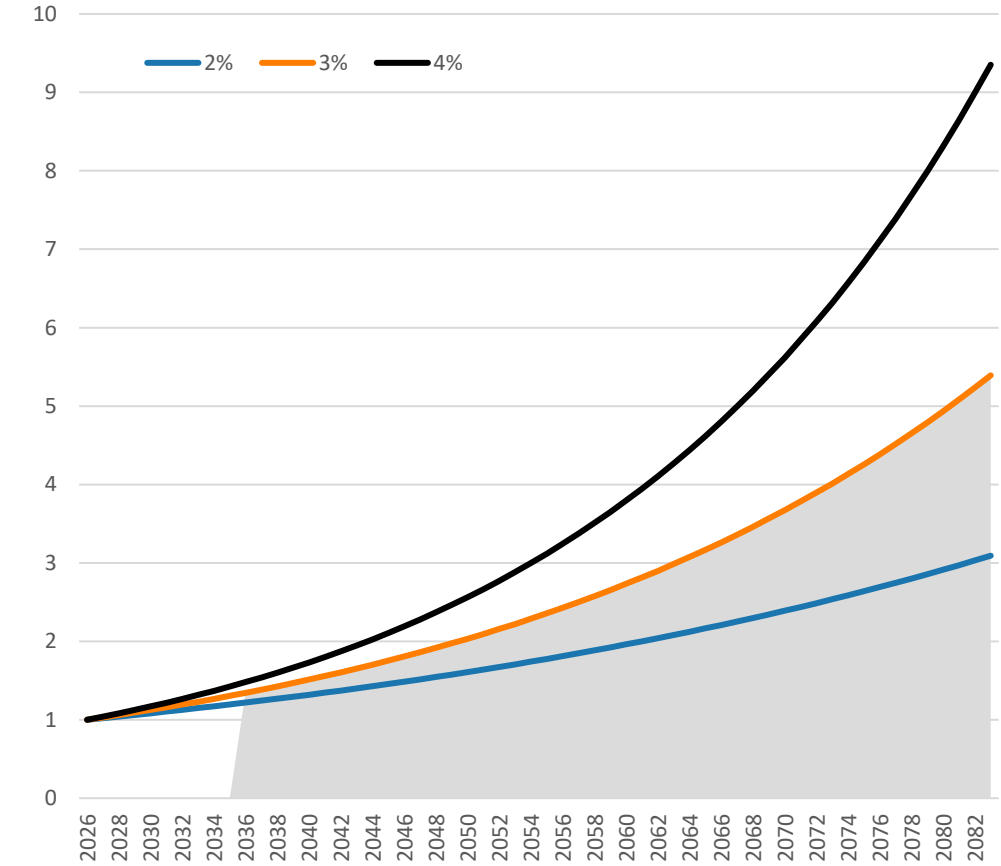
Key modeling choices

- One year of exposure at age 8 (simplifies assumptions about long-term pathways)
- Benefits measured against average primary-level income
- No modeling of dropout or multi-year compounding (to avoid unverifiable assumptions)

Example: Life-time income calculation

- Work life set to 18 to 65
  - **If the education intervention is for an 8-year old then the wage effect starts 10 years from now**
- Yearly income growth is half the discount rate
  - **if following the World Bank recommendation for discount rate**
-

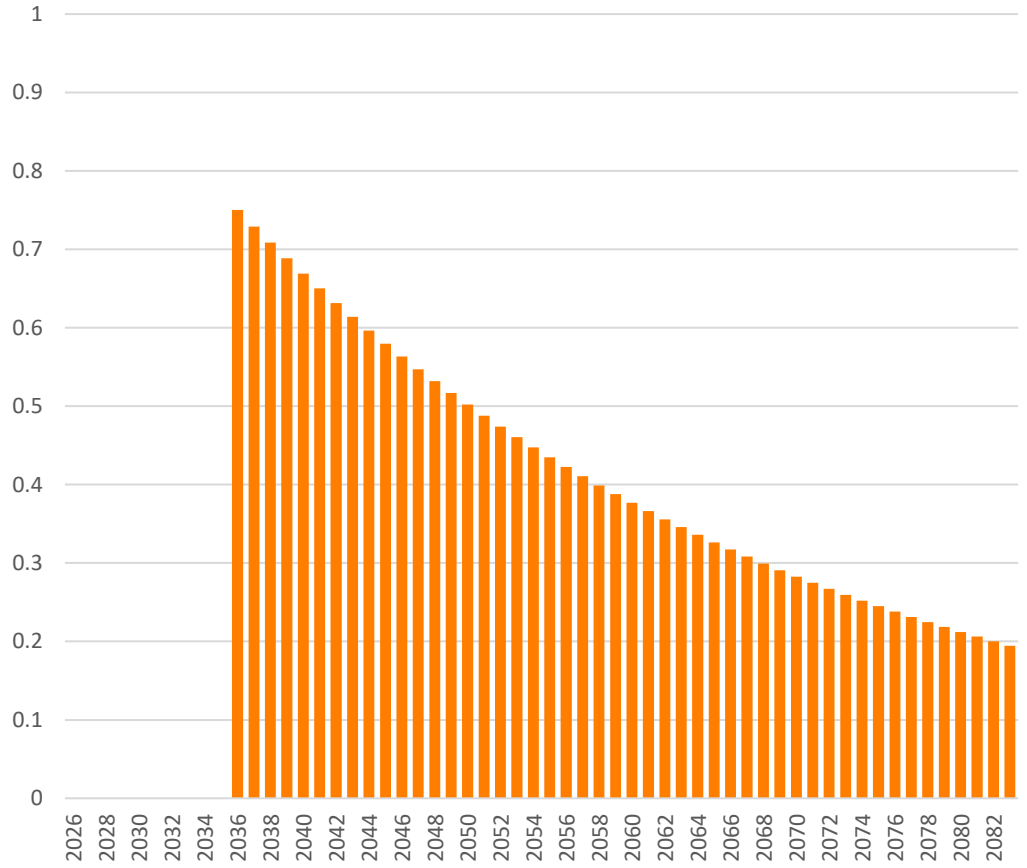
Wage 2026 = 1 growing by 2%, 3%, and 4%



Example: Life-time income calculation

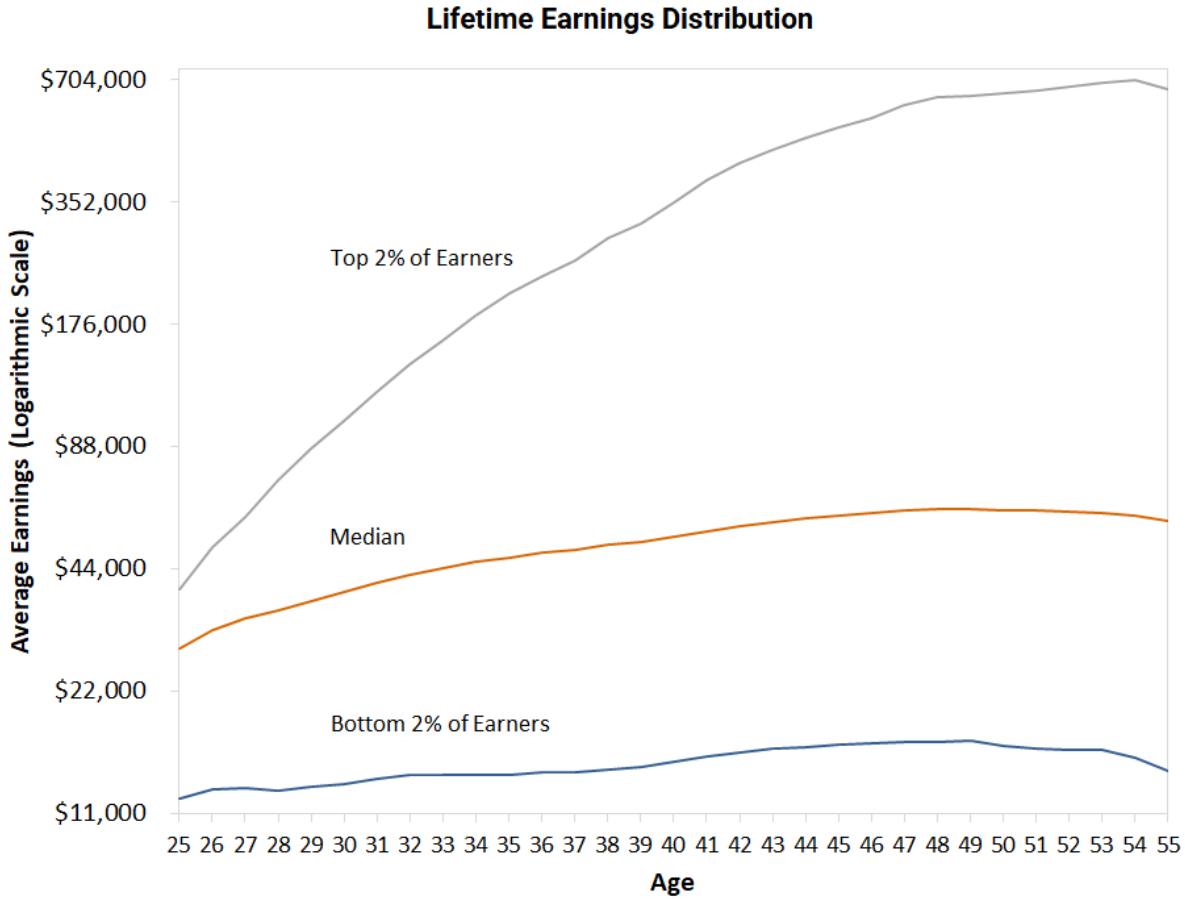
- Work life set to 18 to 65
  - **If the education intervention is for an 8-year old then the wage effect starts 10 years from now**
- Yearly income growth is half the discount rate
  - **if following the World Bank recommendation for discount rate**
- Future income flow discounted back to present value = 19.8

Present value (2026) of 3% wage growth discounted by 6%



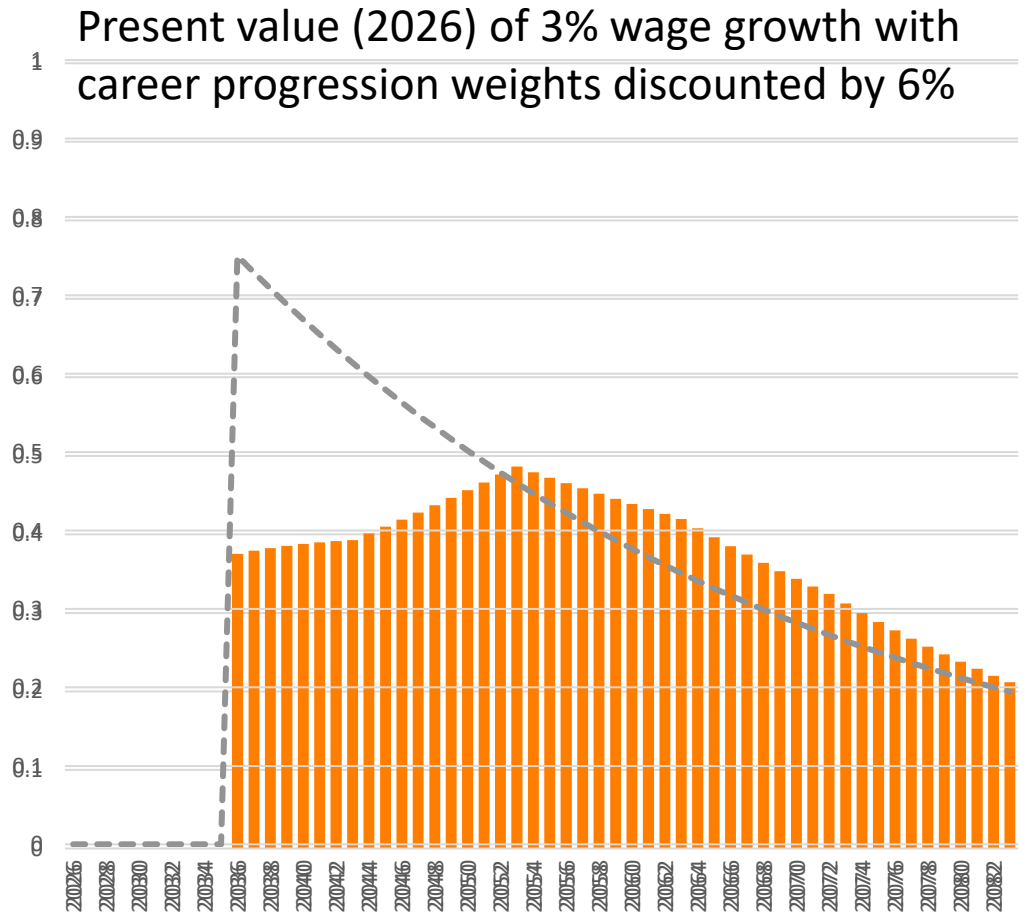
Example: What about career progression?

- Youth typically don't make the median salary from day 1
- In this US study of data from 1978 to 2013
  - **median worker earning**
  - **increases 65% from 25-35**
  - **increases 15% from 35-45**
  - **then plateaus and towards the end of career somewhat decreases**
- We add this pattern to the representative life-time earning



Example: What about career progression?

- Youth don’t make the median salary from day 1
  - **Assume 18 years-old: 50% of median, adding 2ppt per year, between 25 and 35 a 65% growth, between 35 and 45 a 15% growth, then plateau, and starting at 55 years old 1% decrease until retirement.**
  - **Average weight is 100% so total unchanged**
- Future income flow discounted back to present value is 18.1 compared with 19.8 without adjustments for career progression
  - **No big difference**



Example: Life-time income calculation

- Household surveys are a good data source for a representative or median income
- Growth rate and discount rate have significant impact
- Example:
  - **Future wage effect of TaRL with adaptive software is 5.5%**
  - **Today's median income $250 per month**
  - **Present value of learning increase 5.5% x $54,000 = $3,000**

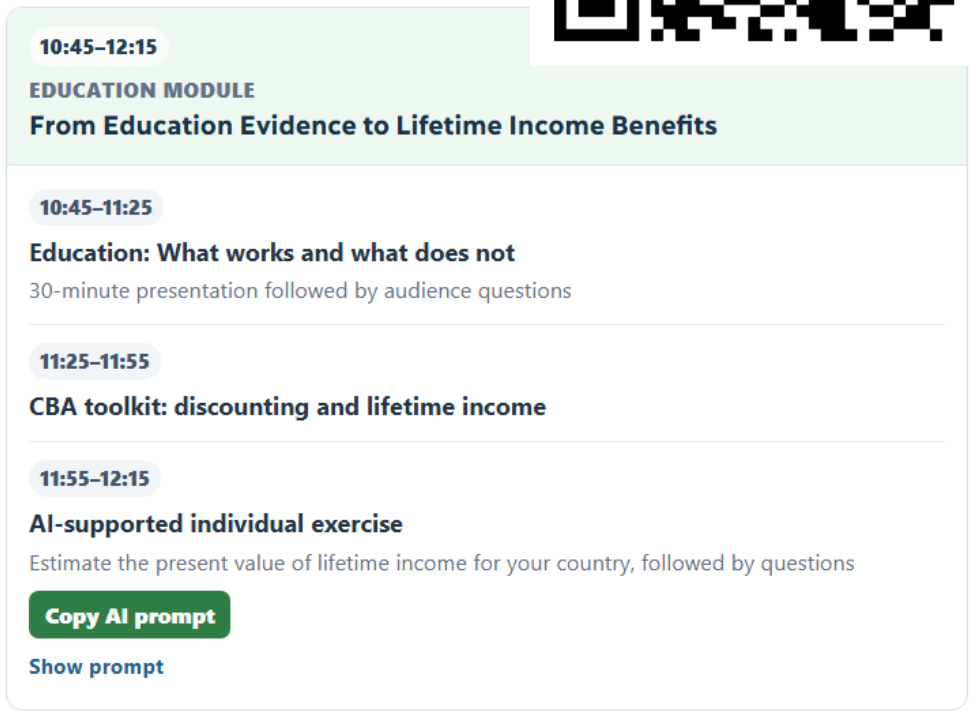
	2% growth	**3% growth**	**4% growth**
Discount rate	4%	6%	8%
Present value of life-time earning for 8-year old	24.5 x today's median income	18.1 x today's median income	13.7 x today's median income
@$100 per month today	$29,000	$22,000	$16,000
@$250 per month today	$73,000	$54,000	$41,000
@$400 per month today	$117,000	$87,000	$66,000

Estimate the present value of lifetime income for your country

AI guided exercise

Copy prompt in the conference program

- Use QR code or go to
  - **copenhagenconsensus.com/johannesburg-july-2026**
- Scroll down to EDUCATION
  - **Day 1 at 11:55**
- Click on “Copy AI prompt”
- Open your favorite AI app
- Paste the prompt



Copy prompt in the conference program

I am conducting a cost-benefit analysis and need to estimate the present value (PV) of lifetime earnings for an 8-year-old in my country.

Use a 2.5% annual real wage-growth rate and a 5% annual discount rate. Assume the working life runs from age 18 through age 65, inclusive.

Use the current median annual worker income for my country, preferably from a household survey, labor-force survey, or another credible official source. If you cannot identify my country from the conversation, ask me to specify it before calculating. If the median-income estimate is not from the current year, adjust it to today's prices using an appropriate official inflation index and show the adjustment.

Construct a realistic age-earnings profile in which earnings rise by 65% between ages 25 and 35, rise by a further 15% between ages 35 and 45, then plateau before declining somewhat toward the end of the career. Normalize the profile so that average annual earnings across the working life, before applying economy-wide wage growth, equal the median annual worker income. State the exact assumptions used for ages 18-24 and for the size and timing of the late-career decline.

Apply 2.5% annual real wage growth to future earnings and discount each year's earnings back to age 8 at 5%.

Report: (1) the estimated PV of lifetime earnings; (2) the currency and price year; (3) today's median annual worker income and its source, with a link; (4) any inflation adjustment; (5) the formulas and calculation steps, including enough year-by-year detail to audit the result; and (6) how many times the median annual worker income the PV represents. Clearly label any assumptions or data limitations.