Human Capital Development in Africa

Senior Policy Seminar XXV

Bringing Rigour and Evidence to Economic Policy Making in Africa

AFRICAN ECONOMIC RESEARCH CONSORTIUM
CONSORTIUM POUR LA RECHERCHE ÉCONOMIQUE EN AFRIQUE

Human Capital Development in Africa

AERC Senior Policy Seminar XXV

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Seminar Papers

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About African Economic Research Consortium (AERC)
African Economic Research Consortium, established in 1988, is a premier capacity building institution in the advancement of research and training to inform economic policies in sub-Saharan Africa. It is one of the most active Research and Capacity Building Institutions (RCBIs) in the world, with a focus on Africa. AERC's mission rests on two premises: First, that development is more likely to occur where there is sustained sound management of the economy. Second, that such management is more likely to happen where there is an active, well-informed cadre of locally based professional economists to conduct policy-relevant research. AERC builds that cadre through a programme that has three primary components: research, training, and policy outreach. The organization has now emerged as a premier capacity building network institution integrating high quality economic policy research, postgraduate training, and policy outreach within a vast network of researchers, universities, and policy makers across Africa and beyond. AERC has increasingly received global acclaim for its quality products and services and is ranked highly among global development think tanks.

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Abbreviations

ACET	African Center for Economic Transformation
AERC	African Economic Research Consortium
AU	African Union
BAU	Business-As-Usual
CAPEC	Cellule d'Analyse de Politique Economique du CIRES
CEEPA	Centre for Environmental Economics and Policy in Africa
CERDI	Centre d'Études et de Recherches sur le Développement International
CGE	General Equilibrium
CNRS	French National Center for Scientific Research
COVID-19	Coronavirus disease 2019
CSO	Central Statistical Office
CTF	Clean Technology Fund
DATs	Digital Agricultural Technologies
EGH	Elder of the Order of the Golden Heart
FAO	Food and Agricultural Organization
FE	Fixed effects
GDP	Gross Domestic Product
GGWI	Great Green Wall Initiative
GIC	Growth Incidence Curves
GIMPA	Ghana Institute of Management and Public Administration
GNI	Gross National Income
GTAP	Global Trade Analysis Project
H.E.	His Excellency
ICT	Information, and Communication Technology
IHS	Integrated Household Survey
ILO	International Labour Organization
ILRI	International Livestock Research Institute
IMF	International Monetary Fund
NORAD	Norwegian Agency for Development Cooperation
OLS	Ordinary Least Squares estimator
P&I	Poverty, and Inequality
RCBIs	Research and Capacity Building Institutions
SDGs	Sustainable Development Goals
SPS	Senior Policy Seminar
SREP	Scaling Up Renewable Energy Program
SSA	Sub-Saharan Africa
TFP	Total Factor Productivity
UN	United Nations
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environment Programme
UNICEF	United Nations Children's Fund
USA	United States of America
VAR	Vector autoregressive
WB	World Bank
WDI	World Development Indicators
WHO	World Health Organization
WTP	Willingness to Pay
ZEPARU	Zimbabwe Economic Policy Analysis and Research Unit

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Preface

The African Economic Research Consortium (AERC) convenes Senior policy seminars to provide high level African policy makers the opportunity to come together to dialogue on the results of research conducted by AERC and its affiliates, exchange policy experiences and interact with the researchers in an atmosphere of peers. The themes of these seminars are selected based on topicality and contemporary interest to African policy-making.

AERC Senior policy seminars are forums where policy makers and researchers engage in uninterrupted deliberations on a set of important issues considered significant to policy-making in Africa. The seminar format insulates the policy makers from pressures related to their responsibilities and thus, creates an environment for lively professional discourse on the selected issue. Aside from the specific aims of bringing researchers and policy makers together, the seminars are directly useful to AERC because they help identify research imperatives crucial to transforming Africa. They also improve prospects for policy involvement of the researchers and enhance AERC's visibility in the policy community. Consequently, serving to highlight the growing capacity in the region for policy research and, overall, provide important feedback to AERC for its research and training programs.

Exchange of country-specific experiences is particularly important in these seminars. The policy makers are normally identified for their interest in policy research issues and the level of seniority of the policy makers is generally right, leading to detailed discussions. Researchers are reasonably well balanced between Anglophone and Francophone, and attendance by Francophone policy makers is always encouraged. Policy makers report that they have found their experiences in the seminars very useful. The information exchanged helps them update their knowledge on current research and sieve out issues that are relevant to their duties. Some have even been embarrassed to find that during negotiations with international financial institutions, they have agreed to certain policies without understanding the full implications of the policy package. Seminars of this kind, while not intended or able to make the policy maker an economist, nevertheless afford the opportunity of considering the wider ramifications of their policy decisions.

AERC is hugely indebted to Hon. Eliud Owalo, Cabinet Secretary, Ministry of Information Communications & Digital Economy, Kenya, who was the Guest of Honour at the official opening of the Seminar and delivered a keynote speech. The welcoming remarks were by Prof. Théophile Azomahou, Ag. Executive Director, AERC. The conference was also graced by Hon. Prof. Njuguna Ndung'u, EGH, Cabinet Secretary, National Treasury & Economic Planning, Kenya; Hon. Bangasi J. Bakosoo, Minister for Public Service & Human Resource Development, South Sudan; Hon. Kobygda Larba Issa, Ministere de l'Economie, des Finances et du Developpement, Burkina Faso; Dr. Wilson T. Banda, Governor, Reserve Bank of Malawi; Hon. Issa-Toure Salahaddine, Speaker of the National Assembly, Togo; H. E. Dr. Kerfalla Yansane, Ambassador of Guinea to the USA & Former Minister for Mining & Geology; and H.E. Dr. Kheswar Jankee, Ambassador of Mauritius

in Russia. Other specials guests were Dr. Donald Kaberuka, former President of the African Development Bank (AfDB) and Her Royal Highness (HRH), Queen Nozizwe Mulela, Kingdom of Eswatini, among other high level policy makers including five (5) ministers, three (3) Ambassadors, a Governor of Central Bank, a Permanent Secretary, a Queen, and four (4) former ministers. This hybrid conference attracted a total of 598 participants (131 physical participants and 467 online participants) drawn from 43 countries across Africa. A total number of 1,909 registered online to participate in the event.

The conference featured four presentations by thought leaders on the theme "Human Capital Development in Africa". Human capital—the education, skills, and health of people — plays a pivotal role in the transformation of African economies. Sub-Saharan Africa scores the lowest of all the world's regions on the World Bank's Human Capital Index of about 0.40, a measurement of how well countries invest in the next generation of workers. This is despite the fact that access to sources of human capital in Africa, although still low, has increased significantly over the past two decades.

Session One was on "A Lifecyle, Economy-Wide Framework for Human Capital in Africa", presented by Prof. Lant Pritchett, Harvard University, USA. This session was chaired by Hon. Bangasi J. Bakosoo, Minister for Public Service & Human Resource Development, South Sudan. The paper was discussed by Dr. Adam Mugume, Executive Director, Bank of Uganda. Session Two was on "Human Capital Investments and Economic Growth in Africa" presented by Prof. Jere R. Behrman, Department of Economics, University of Pennsylvania, USA. This session chair was H. E. Dr. Kheswar Jankee, Ambassador, Embassy of Mauritius in Russia and the paper was discussed by Dr. Sherillyn Raga, Overseas Development Institute (ODI), UK.

The Third Session was on "Human Capital Accumulation in Africa: Drivers, Consequences, and Way forward". This session was chaired by Hon. Kobygda Larba Issa, Ministere de l'Economie, des Finances et du Developpement, Burkina Faso. The paper was presented by Prof. Germano Mwabu, Department of Economics, University of Nairobi, Kenya. The discussant for the paper was Prof. Olu Ajakaiye, African Centre for Shared Development Capacity Building, Nigeria. The fourth paper was on "Education in Africa: Career Progressions, Gaps in Learning Outcomes and Responding to the Learning Crisis". This session was chaired by Dr. Wilson T. Banda, Governor, Reserve Bank of Malawi. The paper was presented by Prof. Adrienne Lucas & Dr. Gerald Ipapa, Lerner College of Business & Economics, University of Delaware, USA. This paper was discussed by Dr. Elizabeth Nanziri, University of Stellenbosch, South Africa. The presenters produced high-quality papers, and the participants were very active, thus enabling us to produce the seminar's policy recommendations that were shared as a communiqué with other African policy makers who did not find time to take part in this important event.

We are grateful to all those who made the seminar a great success. Dr. Dianah Muchai, Manager, Research, Dr. Scholastica Odhiambo, Prof. Théophile Azomahou, Director of Training, who made valuable inputs into the preparation and implementation of the seminar. In equal measure, AERC very much appreciates the hard work of Senvy Maistry, Chief Communications Officer, Dr. Charles Owino, Publications Manager, Joel Mathia, ICT

Administrator, and Lancer Wao, Communications and Publications Assistant in organizing the event. AERC also acknowledges with gratitude Dr. Tom Kimani, Lead Manager, Training and Dr. Mark Korir, Manager Training for their role as rapporteurs, as well as Pamela Kilwake, Sheila Lyaga, Hellen Muthoni, Margaret Mwangi, Natalie Chaponda and Jackson Ng'ang'a, who assisted with logistics. To these individuals, and the many others who were involved in one way or another, AERC extends its heartfelt appreciation.

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A Lifecycle, Economy-Wide Framework for Human Capital in Africa

Lant Pritchett

Introduction

This overall work has three distinct parts and together they are a proposed structure for a forward-looking approach to researching human capital in Sub-Saharan Africa.

Two caveats. First, this is not a standard "review of the literature" that is intended to be a balanced summary of the available issues; rather is one person's assessment on: (i) what are the big, pressing, policy and practical questions; and (ii) a take on a feasible path forward in researching those questions.

Second, this three-part work is an expression of my own distinct and distinctive view on the major issues and, as such, it differs from the "mainstream" view (of both economists and educationists) about education and about economic growth. My goal is not to express a "consensus" nor that the reader simply "adopts" my view. Rather my hope is that by presenting my sharply critical and distinctive view on important issues, I encourage the reader to shape their own view, a view based on their own judgment of what is important in their own country (and regional) context and, hence, not simply adopt the existing paradigm either of economics or of education on policy as the basis for their research (which is, understandably, a powerful professional temptation)[1]. I explicitly advocate a path forward for research on human capital that shifts the existing "human capital" paradigm in three ways.

Thomas Kuhn's classic book, The Structure of Scientific Revolutions, made a sharp distinction between "normal science" as the patient fleshing out of questions raised within the dominant paradigm (e.g., Newtonian gravity or pre-quantum mechanics particle physics). Also a part of "normal science" is seeing if the paradigm can be expanded, modified, and tinkered with to accommodate observed factual anomalies and to expand the range of phenomena explained by the dominant paradigm. But in Kuhn's terms, a "paradigm shift" changes the framework and basic ideas about the underlying phenomena that shifts the ways in which the anomalies are seen and then creates a whole new set of questions for a new "normal science" to address, while hopefully "encompassing" and, hence, also being able to explain everything the previous paradigm could. Obvious examples of paradigm shifts are the shift from Newtonian gravity to Einstein's General Relativity, the shift from classical to quantum mechanics, the idea of evolution through natural selection as the explanation of variations across species, the understanding of the structure of DNA.

The overall work has three parts (and this current product contains just part I).

Part I argues that the existing paradigm in discussions of the acquisition of human capital has been focused on the drive to universal schooling and expanding access and grade attainment. This focus has been quite successful. The expansion of schooling in Sub-

1 Both caveats help explain what would be, in a paper with any pretense of being a "review" the striking degree of self-citation.

Saharan Africa (SSA) over the last decades has been impressively rapid, in percentage growth terms much faster than other regions of the world, because SSA at political independence began far behind most other regions.

However, the paradigm needs to shift as "invest in human capital", which implicitly focuses on the acquisition of valued skills, has mostly been treated as equivalent of "spend on school" and this conceptual elision has produced very mixed results on learning and the creation of cognitive skills, which were, and are, taken to be an important goal of schooling. This section, therefore, focuses on some facts about schooling and learning with an emphasis on both the question of whether: (i) "Sub-Saharan Africa" has been distinctive as a region; and (ii) the heterogeneity across SSA both in sub-regions and across countries that make generalizations about SSA problematic (if not outright unhelpful).

The conclusion is that there needs to be a shift from the crude "accumulationist" model of "invest in human capital" as exclusively: (i) more years spent in school; and (ii) more spend on school. "Invest" in human capital must mean: (i) acquisition of valued skills, capabilities, dispositions; and (ii) *effective* spending. This implies three major changes in the research paradigm: (i) stop using "year of schooling" as the major "outcome" to be pursued; (ii) stop using a naïve "education production function" to evaluate impact of inputs towards a systems approach; and (iii) as part of that, work towards a more realistic positive model of the politics of learning.

Part II proposes a *life-cycle approach* as an overall framing of the issue of human capital in Africa. In this life-cycle approach, I propose two basic periods, one the "accumulation" phase, and two the "utilization" phase. The accumulation phase divides the period of "conception/birth to adulthood" into sub-periods and transition (e.g., first 1000 days, starting school, primary to secondary) decisions that affect human capital accumulation. This raises the distinctive set of questions in each period. The second basic period is of "human capital utilization (and continued acquisition)" which is, the much longer period of human life from youth-to-adulthood to old age to ultimately, in the jargon of economists, "the inevitable Cap T." This section starts with the "school to work" transition and the very tricky and differential across individuals in the "blend" or transitional ages from say, age 15 to 25 and onward into career paths, job transitions, etc.

What is very different about these periods (and their sub-periods) is to a large extent the "policy and programmatic" tools and levers for improving outcomes and their modes of engagement and contact with the child and the relative mix of engagement in three broad classes of "institutions" (either "social", "state/government" and "economic"). In particular, I think a human capital in Africa project should acknowledge the very important role in human capital of the overall ways in which the capabilities and competencies that augment human capital are gained when young (and these are across the array of both "soft" and "hard" skills, competencies, values, dispositions, attitudes, traits) and how these individual capabilities are embedded productively (or not) in various roles as adults: parents, community leaders, citizens, workers, entrepreneurs, political leaders, thought leaders, etc. That is, "Human Capital in Africa" should include both how human

capital is formed, developed, and *created* in Africa but also how that human capital is *deployed,* further shaped, and *utilized* in Africa to allow individuals to promote their well-being, that of their families, communities, cities, regions and countries.

Part III addresses the "utilization" of human capital. Part I is primarily about the acquisition of capabilities in youth and in particular acquisition of cognitive skills in formal K-12 schooling. Part II extends that to include both before K-12 and also after. My argument is that the challenges Africa faces are at least as much in "utilization" as in the "accumulation" phase and, without improvements in the "utilization", how productively labour and human capital are deployed in the economy—further progress in accumulation might be of limited value (if not, one might fret, counter-productive).

This in turn suggests a shift in the research from the simple "accumulationist" views of human capital as represented by a simple aggregate of "factors" of "capital" and "human capital" in growth models such as the Solow/Swann model and expand research into the connections between measures and types of human capital and the deeper determinants of the evolution of economic productivity. We cannot ignore that the main reason human capital is low in Africa is because the human capital is embedded in people who work in Africa.

Part I: A Paradigm Shift from Schooling to Learning

The first part has four sub-sections. The first (I.A) outlines the conceptual distinction between "invest in human capital" and "spend on school" and why the general conflation of "spend on school" with "invest in human capital" has led to large, but limited success. The second sub-section (I.B) shows the facts about the (mixed) success in expanding schooling in SSA. The third (I.C) discusses what is known about the extent to which "schooling", measured as "time served", actually translated into "education" and the accumulation of valued skills and capacities that can legitimately be called "human capital." The fourth (I.D) discusses how this combination of facts and experiences points to the need for a new research paradigm about schools, schooling, and education/learning.

I.A: *"Invest in human capital" has been treated as "spend on school"—but it isn't*

"Invest in human capital" has been an integral part of development advice since there was such a thing as "development advice" starting in the 1950s/1960s.[2] One parsing

2 It is a complete and total myth that "early" development efforts or development economics "ignored" human capital. The recurrent claims that this or that innovation "discovered" an important role of human capital (e.g., either Becker's microeconomics or macroeconomic "endogenous growth" models) are just false. For instance, Gunnar Myrdal's classic *Asian Drama* written in the late 1950s already took it as the already settled conventional wisdom that expanding schooling was a necessary part of

"invest in human capital" is great development advice (the parsing that "invest in human capital" means "develop a high productivity labour force and a high capability citizenry). But the dominant parsing/interpretation upplants "invest" with "spend" and "in human capital" with "on schooling." "Spend on schooling" became the dominant paradigm in development, and hence in Africa, for research, policy analysis, and advocacy and recommendations.

The "spend on school" paradigm is deeply problematic in many ways and, while it was perhaps a necessary stage, no further good can come from research or policy action that adopts that paradigm. Let me count the *seven* ways that "spend on school" is a conceptual mistake and leads to practical mistakes. Some of these lead to the challenges addressed in Part I, others will be taken up in Part II and Part III.

- First, "spend on school" conflates "spend" with "investment" whereas current "spend" is "investment" if and only if it is *effective* at creating future value. "Spend on school" confuses "accounting cost", what gets allocated as expenditure to what budget head, with "economic cost", which is conceptually what is the *minimum* needed to be spent to achieve a given outcome (Pritchett and Aiyar, 2014). Budgetary spend that is ineffective as producing outcomes is not really an "investment" as it does not contribute to useful "capital" (for an analogy to physical capital, see Pritchett, 2000). As a crude, perhaps inflammatory, example, suppose one had an effective school that was producing good learning outcomes for its students and then it was decided to hire an artist to paint a mural on the front of the school and the mural cost the same as the rest of the school. This undoubtedly increases the "spend" on the school but, unless it affects student outcomes, is conceptually not an "investment" in human capital.
- Second, "spend on school" conflates "time served" with "valued capabilities created." Schooling can create valued capabilities if there are effective teaching and learning practices enacted in the school. The assumption is that schooling and learning were causally connected by a "learning profile" such that "more schooling" reliably meant "more capabilities", hence more "human capital." But, we have painfully learned what happens when you assume and we know that "schooling ain't learning" (Pritchett, 2013) and that if the learning profile for a child attending a given school is flat (or very shallow) then lots more schooling can lead to little or no additional human capital.
- Third, "spend on school" assumed that all, or nearly all, of the relevant "investment" in human capital happened in a formal institution called a school and, hence,

development. Although W. Arthur Lewis's 1955 Theory of Economic Growth is taken to have promoted rising savings and investment rates as they are key to higher sustained growth, this discussion of savings and investment comes on page 256—well after extensive discussions of how institutional change and expanded education are part of the growth process. Theodore W. Schultz's contribution on investment in human capital was published in 1961. By the time there was a "development" economics, human capital was part of it.

downplayed the household. It ignored the key role that decisions controlled by the household, especially but not exclusively in the early years, played in the creation of human capital. The creation of human capital is affected by the (often sharply constrained) choices of households that affect the biological outcomes (e.g., the effects of malnutrition on size, neurological development, motor skills), the social and emotional dispositions, and the preparedness for learning inside schools.

- Fourth, the "spend on school" paradigm often assumed (though not necessarily) that the formal institution of the school could be separated from the communities (and hence parents and student) into which the schools were placed and that "schooling" could be treated as a strictly technocratic and neutral social process. Or, even more aggressively, "school" was seen as a social transformation independent of, perhaps even dismissive of, what parents and communities wanted.
- Fifth, the "spend on school" paradigm often assume (though not necessarily) that the standard mechanisms of the "modern" state, a "civil service" organization that was top-down, hierarchical, rules and compliance oriented, was an adequate administrative structure to create an effective school system. That is, the assumption was that "spend on school" could be more or less completely conflated with "budget to a Ministry of Education" where a "Ministry of Education" followed the same "civil service" paradigm of service provision as the post office or other branches of government (Pritchett, 2014).

  In addition to all of the limitations of the "spend on school" approach in actually creating skills, competencies, capabilities that lead to improved life outcomes (in all roles of people as adults (parents, citizens, workers, community members), it also assumed away the "utilization" of skills question as a key determinant of "human capital" in two important senses.

- Sixth, "spend on school" more or less assumed away the "school to work" transition on the assumption that everything that was needed to be an effective worker was teachable in the standard "school" paradigm and, hence, "school to work" was the key transition and that (nearly) all skills needed in the workforce that were not taught in school were either general "characteristics" (and hence not teachable in school) or were "firm specific" knowledge and, hence, would be learned from employers who would have an incentive to invest in their workers.
- Seventh, the "spend on school" approach assumed that "school" and "utilization of school acquired skills" were completely separable. In fact, far and away, the most important determinant of "human capital" in a total, absolute, monetary value sense is the productivity of the place in which a person's skills are used (Rosenzweig 2010). Since "human capital" is often measured at the individual level as the expected net present value of wages/earnings/income over their lifetime, then the act of migration reveals starkly that an individual's human capital is dramatically affected by the "place premium" of the location in which the individual is working. Estimates show that low-skill migrants from African countries working in the US make many-fold higher wages than equal "intrinsic" productivity workers working in Africa (Clemens, Montenegro, Pritchett 2019).

I.B: "Spend on school" has been successful in rapidly expanding schooling in Sub-Saharan Africa

The "spend on school" variant of "invest in human capital" has been adopted and implemented around the globe. It has been successful at expanding access, enrollments, and grade attainment around the world, pretty uniformly across regions and countries, including in SSA and its geographic sub-regions.

There are several facts about this expansion of schooling that need to be emphasized as they are not widely known.

- First, using the standard database of Barro and Lee and investigating the evolution of the average years of schooling of the labour force aged population (15-64), we can see that expansion of schooling in the developing world since 1960 has been so rapid that most developing countries in 2010 have more AYS (adult years of schooling) than many European countries had in 1960, at a time at which those countries had much, much higher GDP per capita.

  Panel 1 of Figure 1 shows that Kenya in 2010 had more AYS (7.3) than either the UK or France in 1960—at a GDP per capita (GDPPC) about a fourth as high (P$2,379 versus over P$10,000 for the UK or France). Even a very low performing country in terms of AYS, Cote d'Ivoire at 3.7, was in 2010 not that far behind France in 1960 even though, again, its GDPPC was only a fourth as high.

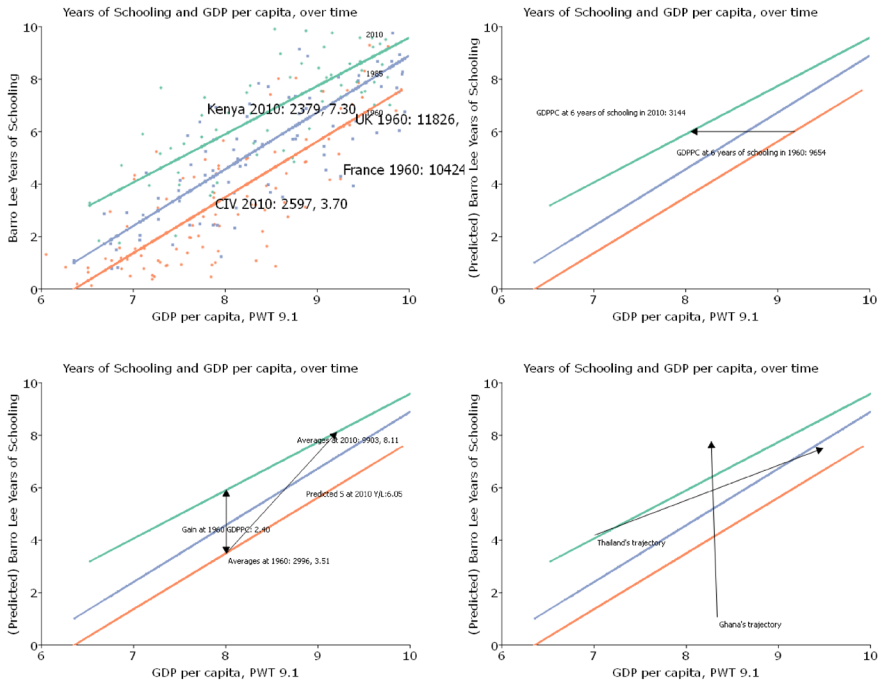
- Second, some claim that economists over-emphasized economic growth and under-emphasized the expansion of schooling. While this might be true, this is not what happened. In fact, the years of schooling increased by much more than would have been expected from economic growth alone. That is, the cross-section relationship between years of schooling and GDPPC shows the "expected" (in the strict "conditional mean" sense) growth in AYS from a given growth in GDPPC. As shown in Panel 2 (the southwest graph), growth in average developing country GDP would have produced an "expected" increase in average years of schooling from 3.51 to 6.05 (about 2.5 years) but the actual 2010 AYS was 8.11 (2.1 years higher than "expected" for the 2010 level of GDPPC). Or, put another way, a country with the same GDPPC in 2010 as in 1960 (zero per capita economic growth) has about 2.4 more years of schooling in 2010 than in 1960.

  Of course, one could reverse that relationship and say that the average GDPPC for a country with the same level of AYS has fallen. In Panel 3 of Figure 1 (northeast), it shows that the average country with 6 years of schooling in 1960 had a GDPPC of around P$10,000, whereas a country with 6 years of schooling in 2010 had a predicted GDPPC of only a third as much (P$3,144).

  However, one frames the relationship, it is just not the case that many countries expanded GDPPC but did not expand schooling, rather the opposite, many countries expand schooling quite rapidly even in the face of sluggish economic performance.

- Third, countries have had very different trajectories of accumulating schooling and increased GDPPC. Panel 4 of Figure 1 (southeast) shows the trajectory of Ghana and Thailand. Ghana had a much *larger* increase in AYS than Thailand, increasing AYS from 1.1 to 7.7 versus an increase in Thailand that started from a much higher level, from 4.2 to 7.5. Nevertheless, GDPPC in Ghana in 2010 was roughly what it was in 1960, whereas Thailand's GDPPC increased more than ten-fold between 1960 and 2010. We return to this in Part Three.

Figure 1: The evolution of GDP per capita and adult years of schooling (AYS), schooling years completed have increased by much more than 'expected' from GDPPC



Source: Author's calculations with Barro and Lee (2011) and PWT9.1

A standard part of the "Africa lagging" narrative is that successful regions, such as East Asia, "invested in human capital" (parsed as "spend on school" and "expand enrollment and grade attainment") and Africa did not. This narrative has small nuggets of truth, but these nuggets are hidden in very large piles of tailings. Figure 2 uses the standard Barro and Lee data on the average years of schooling, updated to 2015, and examines the percentage growth from 1950 to 2015 of the average years of schooling, this time focused only on those aged 25-34[3] and call this "average years of schooling of young adults" (AYS-YA).

The percentage growth in the AYS-YA of the median country in SSA is higher than for all other regions in the world. Since many SSA countries began in 1950 with very low levels of schooling, the proportional rate of growth has been phenomenal. While most advanced countries slightly more than doubled the AYS-YA, and in the East Asia and Pacific region the AYS-YA increased by 344% (from 2.2 to 9.7), in Africa the median AYS-YA increased from only 0.78 to 6.64, which is by 744%—increasing by a factor of 8.

Showing the individual standard three letter country labels with the boxplot shows two additional points. One, that the percentage growth of AYS-YA was more rapid in the 25th percentile SSA country (Uganda) than it was in the very high economic growth countries of Korea, Taiwan or Hong Kong. This was because the base in 1950 was much higher in those countries and, hence, the same absolute amount of increase was a lower percentage rate of growth. If one does the simple regression of the percentage rate of growth of AYS-YA on the initial level in 1950, there is no indication that SSA had slower percentage growth of AYS-YA than "expected" (again in the strict conditional mean sense of "expected") as the binary variable for SSA is modestly positive.

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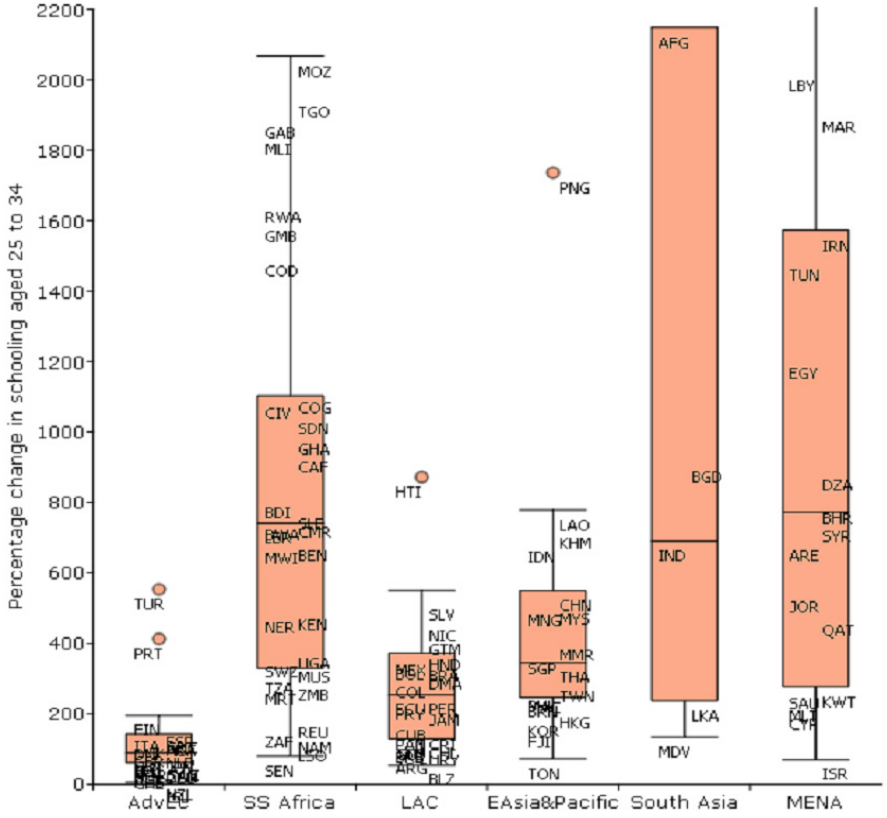
3 I use this age range as the younger group of 15-24 masks the improvement of those in the OECD as many are still in school at those ages whereas the entire population is a weighted average of older and younger populations and does not reflect the increases in grade attainment as rapidly.

Figure 2: The percentage growth in the average years of schooling of the 25–34-year-old cohort was actually faster in SSA than in nearly all other regions of the world



Source: Author's calculations with Barro-Lee data on average years of schooling of young adults (25-34). Three letter country abbreviations are the ISO codes.

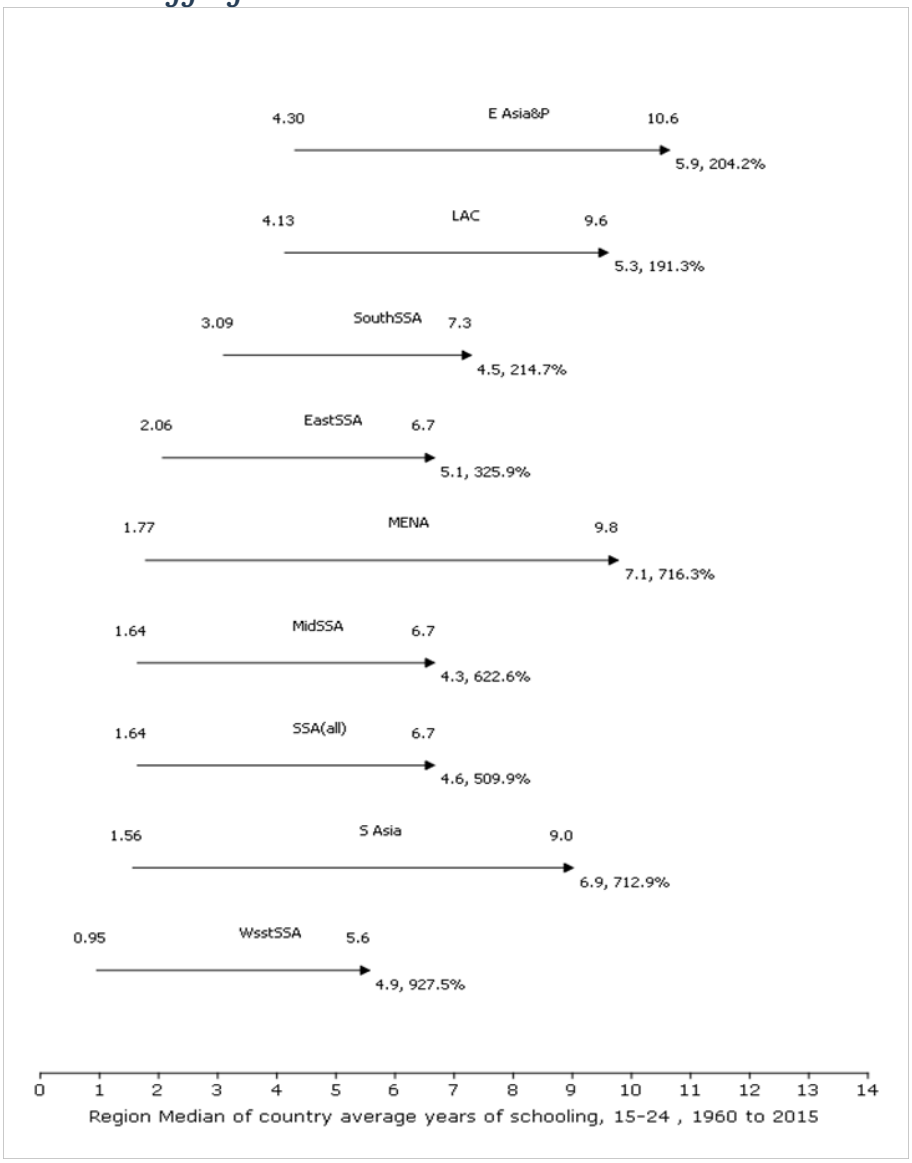
The second point is that the range of outcomes of growth in average years of schooling of the youth cohort is quite large within regions of the world, and especially within SSA. Because some countries such as Mozambique and the Democratic Republic of Congo - DRC (the ISO three letter code in the graph is COD) and Mali began from very near zero schooling their percentage rate of growth was over 1000% (levels increased by more than ten-fold) whereas countries with a higher base, such as Zambia, had a lower percentage growth. Therefore, on the face of it, it is not at all obvious there is anything distinctive about SSA as a region in the percentage growth of schooling but rather there are a number of sub-regional patterns.

Figure 3 shifts the age group to the young (AYS-Y) and changes the time period from 1960 to 2015 (as many SSA nations only gained independence in the late 1950s and early 1960s and onwards). Here, one can see there are some nuggets of truth that SSA lagged behind other regions in its expansion of schooling in absolute terms. There has been an expansion of schooling that is massive in absolute terms—the AYS-Y of the median SSA country increased by 4.6 years from 1960 to 2015, which is a 500% expansion. However, this was slower than regions that started near the same level (e.g., MENA and South Asia) and, while it was near in absolute terms to other regions (e.g. LAC and East Asia), these regions started ahead (and the youth 15-24 age range understates their gains as tertiary is expanding in those regions).

But the most important take-away of Figures 1, 2 and 3 together is that the recommendation "expand schooling" has been a constant of development advice since there was development advice, and this advice has been followed in practice. There has been an expansion of enrollment and grade progression and, hence, grade attainment in the developing world that is massive in absolute and even more impressive in percentage expansion terms. Nearly all developing countries, and most in SSA,are at a higher level of grade attainment today than was the case in the typical advanced economy in 1950 or 1960 (when their incomes were much, much, higher than in SSA today).

An implication of that fundamental take-away is that, given these massive changes in years of schooling completed of the population, any claim of the type: "Expanding schooling will improve outcome Y" should be relatively easy to document as true, or to refute. Two simple points about research is that: (a) any given research finding should also be able to embed an encompassing understanding of the relevant phenomena; and (b) in doing research, what leads to precision of the estimation of the association of X with Y is variation in X. Therefore, if someone says "Expanding basic education will reduce economic inequality", one should: (a) be able to reconcile that statement with a five-fold expansion in years of schooling and trends in economic inequality; and (b) recognize that the very large time series changes in years of schooling implies it should be possible to be quite precise about the association (and, since the change in economic inequality over the period has been small and mixed, have to be very small). Put another way, "expand schooling" is an experience that has been tried. Therefore, claims about the consequences of expanding schooling that were conjectural in the 1960s or 1970s need to be grounded in the reality that there has been massively expanded schooling and, hence, if the promised consequences have not been manifest, some re-thinking is needed before continuing with "more of the same."

Figure 3: Expansion in the average years of schooling of youth 15-24 in regions and in sub-regions of SSA shows massive expansions, with SSA lagging



Source: Author's calculations with Barro and Lee updated data

I.C: *The learning profile: Linking "spend on school" to "invest in human capital"*

A massive limitation of the "spend on school" interpretation of "invest in human capital" is that, on whatever measure of learning used, there are five key facts:

(i) there are massive variations across countries in the learning profiles,

(ii) and the typical developing (and typical African) country has a learning profile much less steep that was assumed would be the case and, hence "basic schooling" completion did not (and does not) reliably produce basic education,

(iii) these differences in learning profiles lead to massive differences in the stock of learning from a given number of years of schooling,

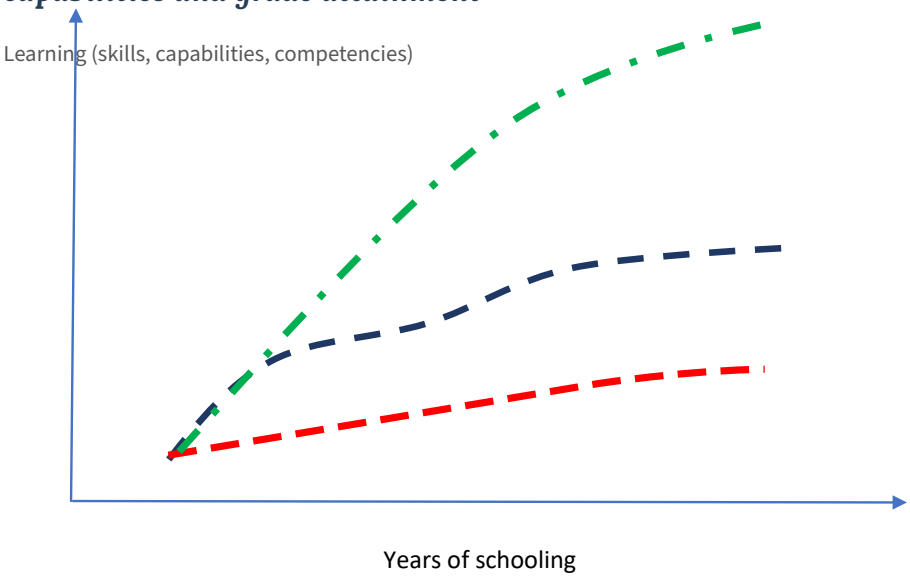
(iv) there is evidence from the descriptive learning profiles that they have gotten shallower or less steep over time, that is, there appears to be much less learned per year of primary schooling currently that 30-40 years ago, and this downward trend is substantially larger in Africa than in other regions, and

(v) The challenge of low learning is not limited to the "marginalized" or "excluded" but affects all categories and all levels of socio-economic status.

I.C.1: Learning profiles: Connecting schooling ("time served") and learning "capabilities gained"

No one ever really believed that just sitting in a school year after year or even just moving from grade to grade would magically produce all of the economic (and other social and political) benefits expected from education. The assumption that schooling would lead to improved life outcomes has always been based on beliefs/assumptions about a "learning profile." A *causal* learning profile is the connection between time spent in school and learning, where "learning" is broadly interpreted as the acquisition of skills, capabilities, competencies, attitudes, dispositions, values, etc (one can think of the causal learning profile for any given individual as the LATE - Local Average Treatment Effect) on a measure of learning outcomes from an incremental year of schooling in a specific school/classroom). Figure 4 presents three possible generic "learning profiles": high, medium, low.

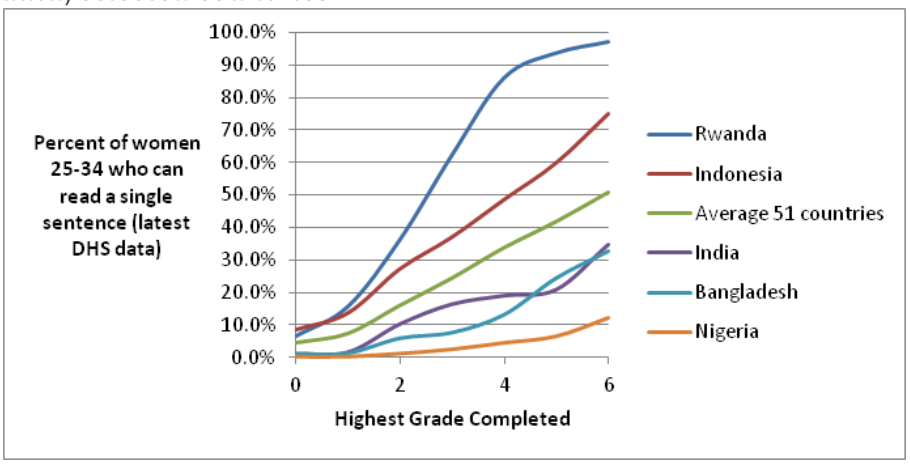
Figure 4: Three hypothetical causal learning profiles, the causal connection between the acquisition of skills, competencies, capabilities and grade attainment



I.C.2: There are massive variations in descriptive earning profiles across countries (literacy and numeracy)

The Demographic and Health Surveys (DHS) ask adult women (the primary respondent sampling frame is women aged 15-44), their highest completed year and level of schooling and then, for those women whose highest schooling is completing primary school or less, asks each woman to read a single, simple, sentence in any language of their choice (the surveyors carry cards with the sentences in the range of languages they might encounter). The DHS data allows the construction of a retrospective, descriptive learning profile (which is not a prospective causal learning profile) by plotting the connection between the fraction of women who can read and the years of schooling completed by country, as in Figure 5, which shows various countries. Figure 5 illustrates that in among the 51 DHS countries (which skew towards the very poor countries in the world), only about half of women who completed six years of schooling can read a single simple sentence in any language. Many commitments to "universal primary schooling" were premised on the notion that the learning profile was steep enough that someone who completed primary schooling was enabled and equipped with at least the rudiments of literacy (and other skills). But this is not currently true. In some countries, the rates of reading acquisition are very low. In Nigeria, for instance, only about 11% of women with grade 6 (but no higher) completed could read.

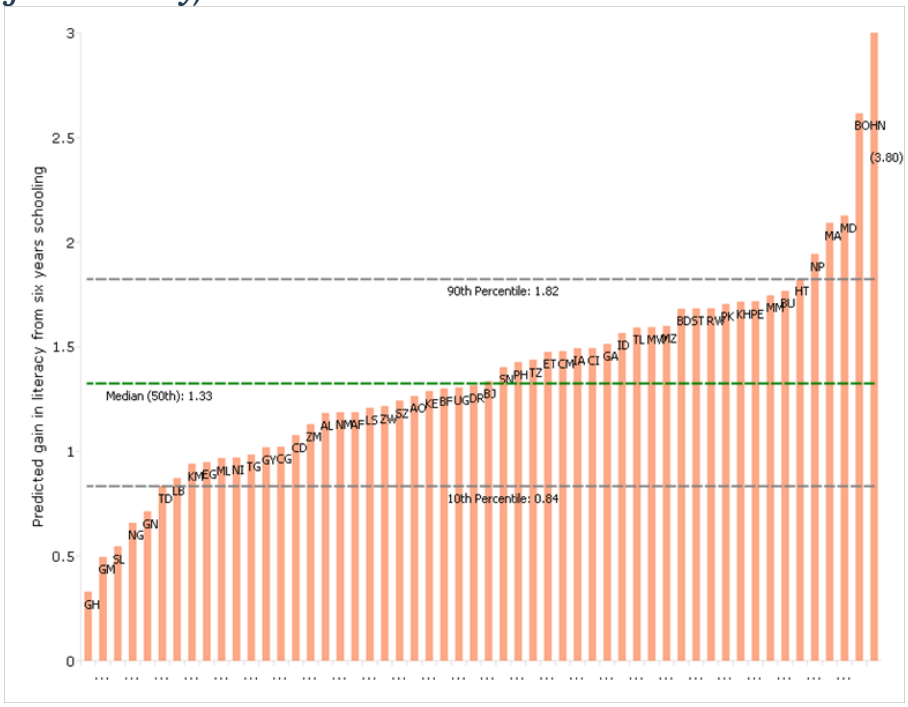
Figure 5: Learning profile of reading and years of schooling, DHS data, selected countries



Source: Adapted from Pritchett and Sandefur (2017)

Figure 6, from Pritchett and Kaffenberger (2021) shows the heterogeneity across countries from the DHS in a different way. For each country, we show the predicted effect of six years of primary schooling (versus no schooling) on the DHS literacy indicator scaled from 0 (cannot read at all), to 1 (can read some words but needs help to read the whole sentence) to 2 (can read the sentence by themselves). Therefore, if universal literacy (at the very limited definition of just being able to read a sentence) were achieved from primary school would imply a coefficient of 2. We see in Figure 6 that the gain on this two point scale of literacy ranges from very low numbers, like less than 0.5 in Ghana (GH) to about 1.7 in Rwanda (RW). Kenya (KE) is near the median of 1.33. An important point from Figures 5 and 6 is that variation across countries in the extent to which a year of schooling translates into increased likelihood of being able to read (which is the slope of the learning profile) is massive. Pretty much any learning outcome from primary school that could happen, from (near) zero impact to (near) universal ability to read, does happen in some country.

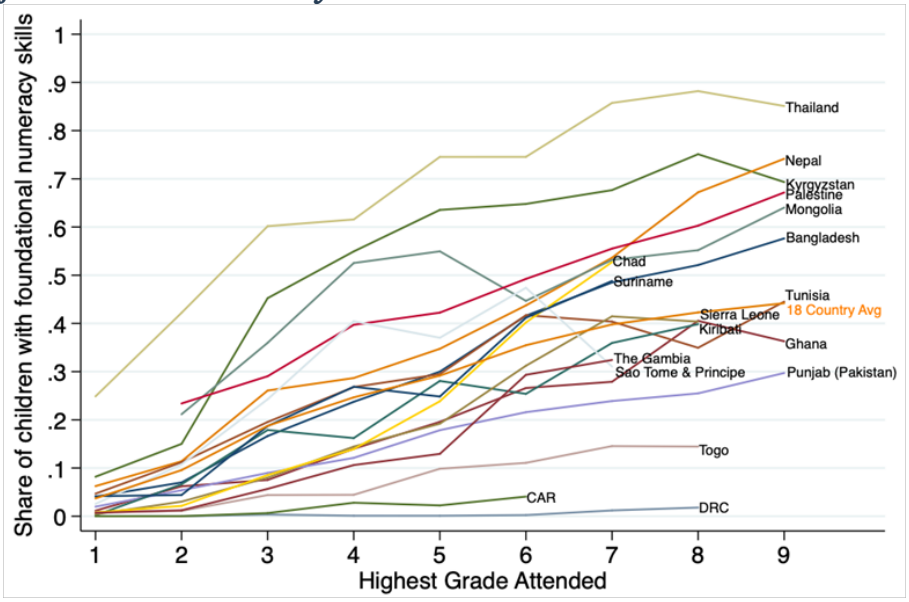
Figure 6: The predicted gain from six years of schooling on a 0 (cannot read), 1 (read with assistance), 2 (read without assistance) scale of reading a single sentence (in a language of the surveyed woman's choice) ranges across countries from very low (very unlikely a woman gains literacy) to very high (nearly every woman gains literacy)



Source: Pritchett and Kaffenberger (2021)

This massive variation across countries in learning profiles is also true of numeracy and with measurement of current differences in learning outcomes. The UNICEF MICS (Multiple Indicator Cluster Surveys) data measure the fraction of children reaching foundational numeracy by grade enrolled across a number of countries. Figure 7 shows the results for 18 countries. Again, the range is huge as 70% of students in Thailand have reached "foundational numeracy" by grade 5 but 10% or less of students have done so in Togo, Central African Republic (CAR) and DRC.

Figure 7: There are also massive differences across countries in the descriptive learning profiles of currently enrolled students for foundational numeracy



Source: Silberstein (2021) based on UNICEF MICS6 data

The massive range in descriptive data in learning gain per year of schooling does imply that "completed primary school" is not a very informative measure of "education." Therefore, one cannot measure country's commitments to, or achievements of, "education" (which implies gains in learning) from data on progress in "schooling" alone.

I.C.2: Measured stocks of learning are low in Africa

There have been two recent attempts to measure cross-nationally comparable levels of the performance on assessments of cognitive skills of enrolled students in secondary school across nearly all countries. The technical challenge is to create a "concordance" that reliably maps assessment outcomes on one instrument, such as PISA to another instrument, such as the assessments used in the African regional assessments such as SACMEC or PASSEC and to estimate learning for those countries with no assessments.[4]

4 A third effort, Patel and Sandefur (2020), uses a different method to establish the link between regional and global assessments and, rather than linking assessments via overlapping countries gave an assessment containing test items from the various assessments to a sample of students in India. This created a "Rosetta Stone" linkage directly between assessments. This limits itself only to those countries with an assessment.

The World Bank's Human Capital Index (HCI) is one such effort. Table 1 shows the "Harmonized Test Score" from the October 2018 version of the Human Capital Index. Like most comparisons of learning outcomes, it adopts a numerical "norm" (usually for the OECD countries) for the assessment of 500 (this is just a norm as the numerical level of any assessment is arbitrary). The table shows both the level and heterogeneity across SSA compared to other developing countries. On average, SSA is modestly behind other regions (a median of 373 versus 407), but there is substantial heterogeneity across SSA as the 25th percentile is 338 and 75th percentile is 397 so the within SSA 25th-75th range of 59 points is about twice as big as the average gap between SSA and other developing countries (34 points).

Table 1: The "Harmonized Test Score" from the World Bank Human Capital Index

	SSA (40 countries)	All other developing (68 countries)
Lowest	305	321
25th percentile	338	368
Median of SSA	373	407
75th percentile	397	436
Highest	473	538

Source: https://datacatalog.worldbank.org/dataset/human-capital-index

Another very recent effort at estimating learning outcomes across the world is Gust, Hanushek and Woessmann - GHW (2022), which uses a different set of methods than the World Bank HCI to combine the existing international and regional efforts of student assessment, and uses different techniques to extrapolate to countries, which lack assessments. They combine this measure of "achievement of enrolled secondary students" with estimates of enrollment rates in secondary to create an estimate of students in a cohort achieving "basic skills" using a definition of the threshold for "basic skills" that roughly corresponds to the Sustainable Development Goal - SDG 4 standard.

Table 2 in column 1 shows the fraction of enrolled *not* reaching basic skills. This varies from 22% in North America to 89% in SSA. This, combined with the fact that the net enrollment rate in secondary school is still only about 33% in SSA implies that 94% of youth in SSA are *not* reaching basic skills at around age 15.

This varies somewhat across the sub-regions of Africa as in, but not by much, as the best region is "middle" Africa (which includes oil rich Gabon) where 88.7% do not reach and the worst region is Southern where 97% do not reach. But even within these regions there are large variations, as for instance East Africa includes Kenya where 68.7% of students do not reach basic skills and Zambia where 96% of enrolled students do not reach basic skills.

Table 2: Only six per cent of youth in Sub-Saharan Africa are reaching a threshold of basic skills in maths and science

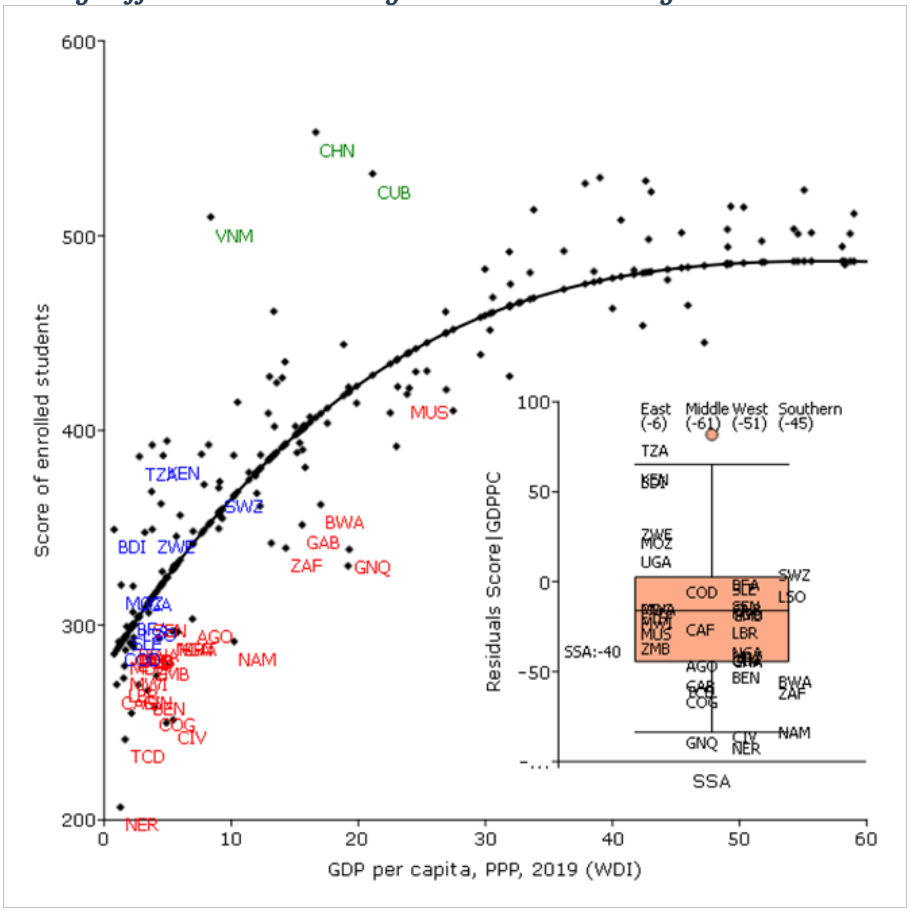
By region (and sub-regions of Africa)	Fraction of enrolled students in secondary education not reaching basic skills	Fraction of youth not enrolled in secondary education	Fraction of youth not reaching basic skills
World	0.617	0.355	0.657
Sub-Saharan Africa	0.893	0.665	0.941
East	0.878	0.630	0.925
Middle	0.830	0.650	0.887
West	0.886	0.649	0.935
Southern	0.932	0.664	0.969
South Asia	0.85	0.402	0.892
Middle East & North Africa	0.639	0.195	0.679
Latin America & Caribbean	0.612	0.21	0.652
Central Asia	0.4	0.094	0.421
East Asia & Pacific	0.252	0.219	0.291
Europe	0.259	0.102	0.284
North America	0.222	0.069	0.239

Source: Gust, Hanushek and Woessmann (2022), Table 2, sub-regions of Africa are author's calculations with data in Appendix Table A4

Since one suspects two-way causal association between learning outcomes and the level of GDP per capita (as higher learning allows higher output and higher output allows for higher learning outcomes). Figure 8 shows the association of the average score of enrolled students and 2019 level of GDP per capita (PPP adjusted). The estimates use a quadratic functional form in GDPPC, which allows flexibility for a non-linear association. The Figure shows that measured learning increases strongly with GDPPC but levels off at around P$30,000.

Figure 8 shows that most SSA countries are below even the predicted level of learning for the GDPPC. If only allows a binary variable for SSA, the estimate is -40 points (on the 500 point scale). The box and whisker plot within Figure 8 shows the distribution of the residuals from the GDPPC regression for SSA countries—how much countries are above or below the "expected" level for their income, separately by sub-region. There are a number of East African countries who are (conditional on GDPPC) high learning performers (e.g., Tanzania, Kenya, Burundi) and the estimated regional dummy for East Africa is only -6 points (and not statistically significant), suggesting East Africa's learning performance is at par with other countries of similar GDPPC.

Figure 8: Adjusted for GDP per capita, Africa still modestly under-performs on measured maths and science achievement, but with strong differences across regions and within regions



Notes. In the box and whisker diagram, the estimated dummy variables for SSA and for each region are reported in parenthesis.
Source: Author's calculations with data from Table A4 of Gust, Hanushek and Woessmann (2022)

The other sub-regions of Africa are lower than conditionally expected (between 45 and 61 points lower). Some countries with relatively high GDPPC, such as oil rich Gabon, have scores that are absolutely higher than many other SSA countries, but low for its income level. Similarly, South Africa (ZAF) has GDPPC three times higher than Kenya (P$14,269 vs P$4,641) but, perhaps not surprisingly given its history of racial discrimination and inequality, South Africa has lower learning performance, on average, than Kenya (339 vs 387).

One other noticeable feature is that highlighted in green; three countries outside of Africa that are very high for their level of income. For instance, Vietnam has estimated learning performance of over 500 although, even after two decades of rapid growth, its GDPPC in 2019 was still only P$8,381 (and started in the 1990s with a level of GDPPC similar to African countries).

I.C.3: There has been a long-term deterioration in learning outcomes at primary schooling

Nestour, Moscoviz, and Sandefur (2021) have used the fact that the DHS surveys include women of very different ages (their samples are of women 15 to 44) and that there are various waves of the DHS across the years for many countries to estimate how the likelihood a woman with five years of schooling complete can read has changed over time (the different years of DHS allow them to adjust for cohort versus generational effects as there are multiple estimates for the same cohort—e.g., the cohort of women aged 25-30 in a survey in 2000 are aged 30 to 35 in a survey in 2005 and 35-40 in 2010). This is one possible descriptive measure of "school quality" (although of course the socio-economic composition of those in school and completing exactly grade 5 has changed). Their results are shown in Figure 9.

Figure 9 shows how Africa has performed relative to non-African countries in the expansion of women's enrollments (those who complete grade 5 or higher) and on the deterioration in whether primary school produces the ability to read. To make country results comparable, even though the period spanned by the data is different across countries, we take the annual rates of change over the available period for each country and estimate what the 35 year again (the typical span) would have been at its annual rate for each country.

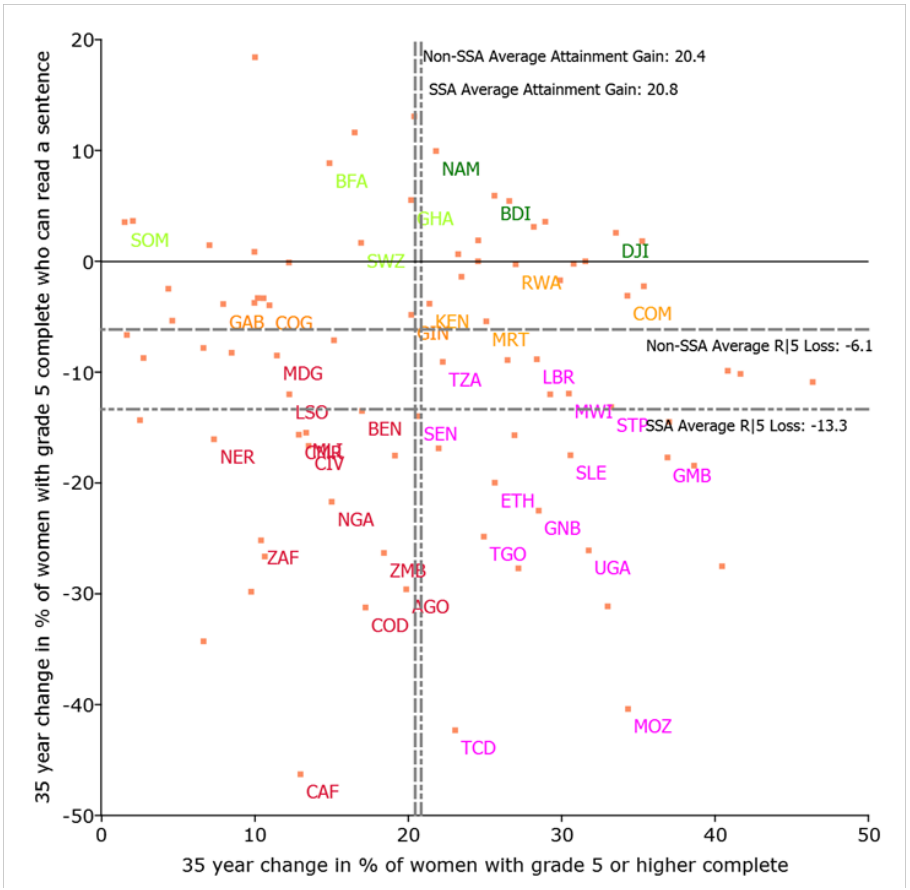
This figure shows that the average expansion in fraction of women with more than five years of schooling was very similar between the SSA and non-SSA countries, with both expanding by about 20 percentage points. As emphasized above, "spend on school" produces expansion in grade attainment.

However, the fraction of women with grade 5 (but no higher) complete who can read fell substantially on average over the (roughly) 35 years covered by this data (from women born in the 1950s/early 1960s to women born in the mid to late 1990s and, hence, attending schooling in the 2000s. Across SSA, the fraction fell by about 13 percentage points, versus only about 6 percentage points in non-SSA countries (the DHS data is focused on poor countries and, hence, not globally representative).

Figure 9 is color coded to show the large variation in outcomes across SSA. In red are those SSA countries with a larger learning loss than the non-SSA country average. In darker red in the "southwest) of the graph are those countries (e.g., Nigeria (NGA), Cote d'Ivoire (CIV), Niger (NER)) which have both less expansion in schooling and larger learning losses. In the lighter red (in the "southeast" of the graph) are countries that had larger learning losses than average in non-SSA countries, but had larger expansion than average (e.g., Uganda (UGA), Ethiopia (ETH), Mozambique (MOZ)).

There are only seven SSA countries in which this measure of learning did not fall, and only three (all small) African countries in the "northeast" with positive gains in learning more rapid than average—Namibia (NAM), Burundi (BDI), and Djibouti (DJI).

Figure 9: The likelihood that five years of schooling produced the ability to read has declined over time, and massively so in some countries



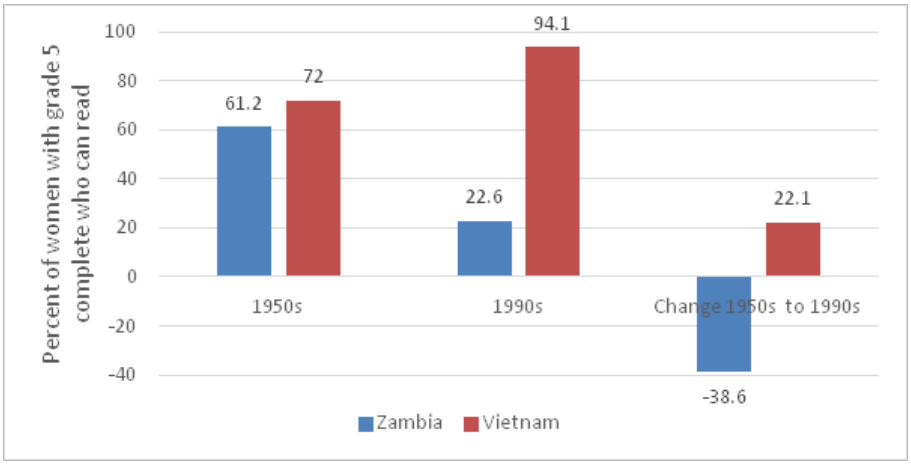
Source: Author's calculations with data from Nestour, Moscoviz, and Sandefur (2021)

A common reaction to the descriptive fact in Figure 9 that there has been a fall in reading of those who completed grade 5 is to argue that the causal explanation of this fact might not be a deterioration of learning conditions in schools but rather that the observed fall is simply due to the changing composition of who completed grade 5 as the education system expanded enrollments. That is, perhaps learning of those with grade 5 complete fell because those who achieved exactly grade 5 (or any given grade) in school from the birth cohorts in the late 1990s were very different from those women attending school in the 1950s and that student composition had a harder

time learning. While this, in principle, is a possible factor, there are two important points. One, if this "compositional" shift were a major explanation of the observed descriptive fact of learning falls, one would expect that the magnitude of expansion of attainment and the learning loss would be strongly correlated (as countries with large expansions would have large learning losses)—but this is not true. There is only a very small (and not statistically significant) association of magnitude of expansion and learning loss. The dots for country observations in Figure 9 are clearly not in a strongly downward pattern (with larger expansion countries having larger observed falls in learning). Two, SSA countries generally have more learning loss at each level of expansion—there are more countries in the "south" (large learning losses) of the "west" (low attainment gains) and more SSA countries in the "south" (large learning losses) in the "east" (large attainment gains).

This very new information on the long-term changes in an important measure of learning is very important. Prior to this study, one could have assumed that the low performance of African countries on learning was a "constant" thing and just a chronic "feature" of Africa. But, instead, we see that the current low levels of learning are, to a large extent, because of larger falls in the learning in SSA than other countries. For instance, in Figure 8 above, relating learning levels and GDPPC one can see that Zambia, at about 250, lags far behind Vietnam at about 500. But these current levels could be because Zambia has just always been behind Vietnam, but both are on the same trend line. But in this DHS data, we can see in Figure 10 that the gap in learning was much smaller in the past and has emerged because Zambia's fraction who can read at grade 5 completion has deteriorated in absolute levels over time (to only 22.6% in the most recent cohort) whereas Vietnam has improved to reach nearly universal level.

Figure 10: The gap in learning between Zambia and Vietnam was small in the 1950s and large in the 1990s because learning fell in absolute terms in Zambia and rose in Vietnam



Source: Author's calculations with data from Nestour, Moscoviz, and Sandefur (2021).

This new information about the long-term evolution in learning is also important in framing the discussion of human capital in Africa and the challenges in improving learning outcomes. The default assumption should be that "more of the same will produce more of the same" (though there are exceptions). More of the same of the "spend on school" parsing of "invest in human capital" should be expected to produce: (i) more years of schooling completed; (ii) mixed (at best) contribution of these more years of schooling to sustained episodes of rapid growth; and (iii) very different, usually low, and declining (at best stagnant) levels of learning for those enrolled.

I.C.4: The low level of learning outcomes affects the elite as well

One last fact about learning outcomes in SSA is that while there is a great deal of legitimate and important attention to expanding access and learning for "marginalized" groups, the challenges of globally low levels of learning affect the elite as well. While this point can only be illustrated with precision for the two SSA countries that participated in PISA-D, the problem is quite general. There are three important facts.

- First, we (Pritchett and Viarengo 2023) can estimate the absolute number of children in a "learning performance elite"—how many children in the cohort of those aged 15 are reaching PISA (Programme of International Student Assessment) level 4 or above. This level is achieved by about 30% of youth in the OECD, which is roughly how many advance to a four year university education in those countries and, therefore, one can think "how many children are on a path to enter a (quality) university education?" The answer is that for Zambia, the PISA-D estimates suggest there are single digits for Maths, Reading, or Science. Of the 360,000 15 year olds in a given year, one can count literally on one hand those reaching PISA level 4 or above. In Senegal, there are at most a few hundreds in any of the three domains of learning assessed.

  This seems like a vitally important issue for a country's progress that goes largely unremarked in discussions of human capital. Many African countries are relatively small and have quite low learning performance, on average, and do not in fact have notably higher inequality in learning outcomes. Countries such as Vietnam have, each year, a quarter of a million students in the global "learning performance elite" because it is a large country with high learning performance. Indonesia has, across the three learning domains, between 50,000 and 100,000 because, while it has low mediocre learning performance, it is a very large country. While it is important for an education system to produce mass access and universal basic education, education systems also play the role of producing those who go on to fill the professions: engineers, scientists, doctors, accountants, and who go on to civic and thought leadership and into political leadership. It is hard to imagine how African countries can cope with the many challenges of national development in a globalized world without a larger and more robust learning performance elite.

Table 3: The estimated "learning performance elite" is very small in two SSA countries (Zambia and Senegal)

Country	Total number of 15 year olds in country	% taking PISA	Mathematics		Reading		Science	
			% at PISA Level 4 or above (>544.7)	Estimated total 15 year olds at PISA Level 4 or above	% at PISA Level 4 or above (>552.9)	Estimated total 15 year olds at PISA Level 4 or above	% at PISA Level 4 or above (>558.7)	Estimated total 15 year olds at PISA Level 4 or above
Zambia	360,000	36.0	0.0039	5	0.0040%	5	0.0017	2
Senegal	337,636	29.0	0.351	344	0.197	193	0.015	14
Cambodia	370,856	28.1	0.103	108	0.004	4	0.000	0
Paraguay	135,869	55.6	0.048	37	1.325	1,000	0.198	150
Guatemala	387,167	47.5	0.077	141	0.695	1,276	0.096	177
Honduras	193,268	41.4	0.649	519	1.172	937	0.339	271
Ecuador	352,702	60.6	1.174	2,508	4.231	9,038	1.414	3,021
Denmark	68,174	89.0	35.0	21,249	28.4	17,255	27.2	16,492
Vietnam	1,803,552	48.5	27.5	240,605	18.5	161,466	32.1	281,245
United States	4,220,325	83.5	20.6	727,777	30.1	1,060,945	27.6	973,884
Indonesia	4,534,216	68.2	3.42	105,742	2.04	63,070	1.68	51,858

Notes: "Total number of 15 year old in country" refers to the number of individuals who are 15 years old in the country; "Percent taking PISA" refers to the coverage rate of the PISA sample with respect to the total population of 15-year-olds; "Percent at PISA Level 4 or above (>544.7)" refers to the share of students who take the PISA test and perform at a Level 4 or above of the PISA proficiency scale; "Estimated total 15 year olds at PISA Level 4 or above": absolute number of 15 year old in country who perform at a Level 4 or above of the PISA proficiency scale
The methodology to estimate the total number of 15 year olds at PISA Level 4 or above consists of the following calculation: "Total number of 15 year old in country" * "% taking PISA" * "Percent at PISA Level 4 or above". The table includes countries that participated in PISA-D and as comparators countries that participated in PISA.

Source: Table 2 of Pritchett and Viarengo (2023) using PISA-D and PISA Database; OECD (2018) PISA Results, Tables 3,9 (Reading), 30 (Mathematics), 51 (Science)

While we can estimate this precisely and comparably only for the two PISA-D countries, this point applies more generally as the combination of very low average level of learning and inequality in learning outcomes that is about the same as other countries implies the upper tail (e.g., 95th or 99th) percentile of learning outcomes is also very low - a point comparisons using the micro data that estimates the whole distribution of learning has emphasized (e.g., Crouch and Rolleston, 2017; Patel and Sandefur, 2020).

- The second important fact is that the average learning performances even of children from advantaged and socio-economically elite conditions who are enrolled in public schools have very low levels of learning. While it is the case that children from more "marginalized" conditions—rural residence, non-native speakers of the language of instruction, migrants, girls—on average have lower learning and children from lower SES (socio-economic status) households do worse, it is not the case these differences are so large that this implies the advantaged SES elite children are doing well. In Pritchett and Viarengo (2023), we estimate that the average PISA result on Maths for an advantaged (male, urban, native speaker, non-migrant) and SES elite student in Zambia is 332 and in Senegal is 311. This is on the PISA scale where reaching the SDG minimum level of learning is reaching 417. Therefore, even if all schooling and learning gaps in these two countries were completely eliminated on *all* of these five dimensions (sex, rural residence, mother language, migrant status, SES) it is still the case that less than 20% of children would reach the SDG learning goals.
- The third important fact, which is much harder to interpret, is that the gradient of learning with respect to SES is not larger in the SSA countries than even in the high performing and socially equal countries such as Denmark and Finland. That is, of children enrolled at age 15 and participate in the PISA assessment, there are SES gaps for all countries and these gaps between "rich" and "poor" children are, in the two SSA countries absolutely smaller, even relatively smaller, in Zambia than in the developed countries. The reason this is hard to interpret is that in the OECD countries, enrollment is nearly universal and there is no "selection" on SES in being enrolled at age 15 whereas there is in the SSA countries. Therefore, part of the reason for the small SES gaps in learning of the enrolled is the differential enrollment, so that only relatively well performing children from low SES HHs in SSA stay in school until age 15.

But, overall, it is just not factually correct to characterise the low levels of learning performance of those enrolled in SSA as the result of a lack of inclusion, or marginalisation, or inequality. There is a very small global learning performance elite and even the advantaged SES "elite" in public schools are receiving an education well below the global minimum levels of the SDGs.

I.D: Elements of a "invest in human capital" versus "spend on school" research agenda

Sections I.A, I.B, and I.C show that SSA, by and large, has had massive expansions in access, enrollment, and grade attainment since independence, and that whether SSA was "fast" or "slow" in expanding schooling depends on whether one takes absolute gains or percentage gains (or, as we explore in Part Three, some other measure of "schooling capital") but that "SSA lagged in expanding schooling" is a very robustly true statement. We do show that, across countries, and even adjusting for level of income, the measured level of cognitive skills acquired from schooling in Africa is low and, moreover, there is evidence that in many countries, on some measures of learning, it has been getting worse, for a long time.

The obvious, but to my mind, not yet fully acknowledged, implication is that if most SSA countries continue with their same conceptual, policy, and practical approaches, the mostly likely expectation is that grade attainment levels will continue to rise and learning levels will continue to fall (or at best stagnate). That is, from "business as usual" one should expect "more of the same" and it is hard to see how anyone would expect that the same institutions, laws, policies, programmes that have produced the outcomes we now observe would somehow begin to produce very different results from minor, project tweaks. As Albert Einstein is reputed to have said, "Problems are not solved at the same level of thinking that created the problem."

I suggest three very different approaches to research that, as they are different, at least might produce the kinds of findings and recommendations that could make a difference in accelerating progress in creating learning from schooling.

I.D.1: Integrate learning outcomes directly into measures of expanded education

The first and obvious (and already partially adopted at the global cutting edge) is to stop using a "year of schooling" as the unique summary statistic of policy or programmatic actions. That is, some studies (explicitly or implicitly) take as their goal the estimation of a LATE (local average treatment effect) where the "effect" of the treatment is measured in "additional years of schooling. But one acknowledges that the gain from learning from a year of schooling (of any type of learning, whether cognitive or non-cognitive) differs massively across countries, across schools, across individuals, across grades (and across grades by individual); that is, that the slope of the causal learning profile (incremental gain from a year of schooling) is wildly different, then it no longer makes any sense to judge a policy or programme or project solely by whether it produced an additional year of school.

This is important because additional schooling is typically justified instrumentally on the grounds that it increases the well-being of the individual who receives more schooling. But there is zero reason to believe that the gain to well-being from a year of schooling is invariant with respect to what happens during that year of schooling.

For example, suppose one believed that women's education was important in expanding women's well-being because it led to greater women's empowerment and that claim was backed up by evidence of a relationship, perhaps even a credibly established causal relationship from some country or context, between years of schooling completed and empowerment. But suppose that in country Y, where the LATE of schooling on empowerment was established with evidence, the learning profile was steep and in country X, where one is contemplating a programme to extend women's schooling the learning profile is flat. Then there is zero reason to believe the impact of a "year of schooling" in country X is going to produce the same impact on female empowerment as it did in country Y as the LATE alone does not reveal the intermediating causal mechanisms, one of which could be, and plausibly is, the amount learned from the year of schooling.

This concern that the LATE of additional schooling and the LATE of additional learning are not the same is far from hypothetical. For instance, a recent study evaluated the impact of two different modes of targeting girls for scholarships. One targeted girls who were from poor households, a different program design targeting girls who were high academic performers. A short-term evaluation showed both increased enrollment. However, a long term follow up of the girls who had received assistance found that the "poverty" targeted scholarship increased schooling but not no detectable effect on cumulative learning—and no detectable effect on any measured life outcome for the targeted children. But the "achievement" targeted recipients had more schooling and had more learning and had, on some measures, better life outcomes (Felipe Barrera-Osorio et al., 2018, Barrera-Osario, de Barros, and Filmer, 2018).

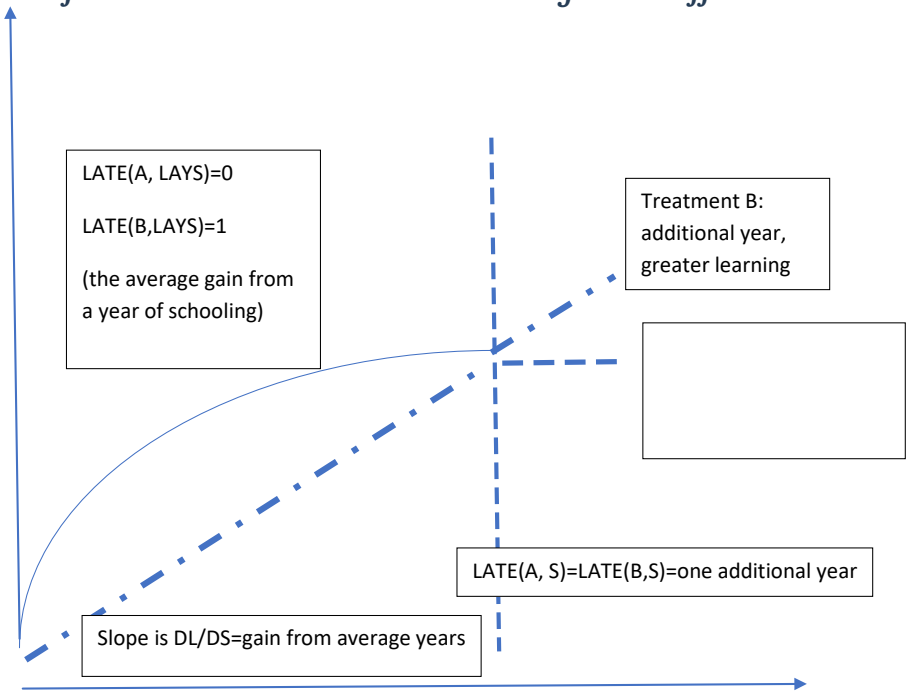
The very famous conditional cash transfer programme in Mexico with the RCT impact evaluation that showed the conditional cash transfer (CCT) expanded grade attainment also showed that the additional grade attainment did not lead to significantly greater learning. In a study of different modalities of giving scholarships, an RCT had two different treatment arms, one of which targeted children based on their poverty status and one of which targeted children based on their academic performance. Just to be clear that this criticism has "edge", we would argue it implies that nearly all of the research on "conditional cash transfers" has, from a point of view of "human capital" been largely a waste as researchers devoted the latest RCT techniques to examining the LATE on enrollment/grade attainment without any real attention to whether this increased "human capital" versus just "time served" in school. One can make the argument that this was even worse as it shifted attention from where it should have been—"are schools effective at creating useful learning?"—to act as if parent and student decisions were the main problem, thus shifting accountability from where it should have been.

Moreover, if dropout or schooling transition decisions are endogenous to academic performance and to anticipated learning (and optimally they should be, and there is strong empirical evidence in some circumstances they are) then the children induced to stay in school by programmes that reduce costs of schooling are those who are the least likely to learn. In contrast, programmes that induce additional enrollment by raising anticipated learning induce the incremental enrollers on the basis of increased learning benefit. There is no plausible economic theory that suggests that those two acquired "years of schooling" should have equal impact on well-being outcomes.

A simulation model that allows for concave learning profiles (learning declines by year) and endogenous dropout shows that programmes that expand enrollment without changing the learning profile could have massive impacts on years of schooling and next to zero impact on learning (Kaffenberger and Pritchett, 2021).

At the aggregate level, a recent paper from Indonesia has shown that it is possible to have very large expansions in schooling attainment and yet, if the learning profile (i) shifts inwards and (ii) is flat in the later years, one can have no change at all in the cognitive skills of a cohort. Beatty et al (2021) show that between 2000 and 2014, the fraction of the cohort of youth 18-24 completing senior high school (grade 12) increased by about 20 percentage points and yet the measured mastery of simple primary school arithmetic of the cohort actually fell. One reason was that the learning profile shifted inwards (less learning per year), such that the average seventh grader in 2014 only had the same competence in arithmetic that fourth grade had in 2000.

Figure 11: The LATE of enrollment alone and the LATE of "learning adjusted years of schooling" can be very different for different programmes (or different treatment arms within programmes) and future research needs to acknowledge that difference



Source: Author, as described in text

Figure 11 explicates the point that the LATE on schooling of two programmes could be exactly the same, but if the learning profile of one treatment, say, "A" were flat and the learning profile of another intervention, which raised the learning profile for the student was "B", then the LATE measured exclusively on S would risk getting policy questions completely wrong. Suppose that all of the benefits from an additional year of S were from the learning acquired (on a very broad measure of learning), then one could find that the "cost-effectiveness" of A in expanding schooling was high but the "value effectiveness" was zero. And supposing that intervention B, which improved learning, was (much) more costly than a treatment that just kept kids in school, then it would appear on a comparison of just LATE(S) that A was more "cost-effective" (same gain in S for less cost) but the "value effectiveness" or "human capital creation" effectiveness would be much higher for B than for A.

This pervades the analytics of alternative interventions as if we think that a child stays enrolled for an additional year if the marginal benefit is greater than the marginal cost (MB>MC), then one can either reduce costs or increase benefits. Benefits that lower marginal cost (e.g., reduction of distance, reduced tuitions, free schooling, or conditioning cash transfers) can induce children to remain in school even if marginal benefitis low (or, in the case of CCTs, zero or even negative). Interventions that induce additional years by raising benefits are less likely to simply push children out a flat (or nearly flat) learning profile, but measuring programme impact in research only by measuring its gain in years cannot reliably be used to differentiate the true cost-benefit of alternative interventions.

The latest summary of evidence on education from the Global Education Evidence Advisory Panel uses a "year of learning equivalent" measure to compare different "interventions", as some may increase years of schooling and some may increase learning per year of schooling. In adjudicating "cost effectiveness", one needs a common unit. This exact measure is almost certainly flawed in various ways (as it implicitly assumes all of the benefits of school come through standard measures of learning) but is a large step in the right direction. The World Bank's Human Capital Index at the country level also adjusts the "human capital" for not just years of schooling but also for the learning per year, again, a step in the right direction in the aggregate "macro" measurement of human capital.

I.D.2: A system approach to school

A central question for research motivated by the facts above, is: "why in some countries are learning profiles steep (and rising?) and, hence, children acquire skills at an acceptable pace and, hence, nearly all children emerge from basic schooling prepared for their adult roles while in other countries there are shallow learning profiles (and falling?) and even completing basic schooling does not produce the needed foundational skills?"

The key difference between a "spend on school" and "invest in human capital" approach to school is that in the "spend on school" approach, the performances of schools seen as organization level issues that can be handled as (more or less purely) technocratic and management issues. That is, there is the (largely incorrect) view efficacy of the schooling system at achieving a, b and c of every child attending school: (a) with effective teaching

and learning practices; (b) which are inclusive; and (c) is primarily (exclusively?) about the operation of a Ministry of Education and the policies it adopts and the implementation of those policies.

Moreover, it is nearly always assumed that organizational success in creating effective education can be reduced to a "logistical" task based on "thin input" and "process compliance", of the type a typical Weberian bureaucracy is capable of producing. In this view, success at education can be achieved by more effective organizations more or less autonomously by achieving higher levels of the "proximate determinants", which are "thin inputs" of learning.

In complete and sharp contrast, the system view sees the outcomes of a country's schooling as the result of the endogenous operation of a system, within which a Ministry of Education (and/or private schools) are embedded as one element. In a system view, the "proximate determinants" of effective learning in schools and classrooms are the endogenous result of how the entire system operates, not a "choice" of an organization (and much less the choice of a single "leader" such as a Minster of Education).

The need for a system approach to research on improving learning is three-fold:

- First, the "proximate determinants" approach, especially that based on the standard measures of "thin inputs" such as class size, input availability, infrastructure quality, and formal qualifications of teachers, cannot really explain the observed differences. For instance, we saw above that the performance of Vietnamese students was roughly 200 points higher than for similarly situated students in Senegal, Zambia (or Cambodia or Guatemala). Efforts at "decomposing" this Vietnamese success into the standard "proximate determinants" largely fails. Dang, Glewwe, Lee, and Vu (2020) use PISA data and find that the available student (and household - HH) and school characteristics explain very little of Vietnam's superior performance. Even more strikingly, using panel data from the Young Lives survey that followed children in four locations (Ethiopia, Peru, Andhra Pradesh in India, and Vietnam) from very young ages through their schooling lives, Glewwe, James, Lee, Rolleston, and Vu (2021) find that the very large difference in learning between Vietnam and India cannot be explained at all with standard student and school/teacher "thin inputs", as only 1-2% of the gap can be accounted for. Only when they introduce an endogenous and sophisticated measure of "maths teacher pedagogical skills" (not teacher formal qualifications but in practice assessed) do they even explain 10-12% of the difference in outcomes. It is a common finding that the huge dispersion in learning outcomes as seen in Figure 8, with gaps of 100 points of more between countries at similar levels of GDPPC, are only weakly accounted for by observed inputs.
- Second, individual "interventions" aimed at improving learning outcomes show very different outcomes, and the most plausible explanation of why there are often very low (zero) impacts even of seemingly attractive and "common sense" interventions is that features of the system lead to little or no impact.

We provide three quick examples, followed by a more extended example of how impact, even of the same "intervention" varies widely across systems. One, it is often thought that low education quality is the result of low teacher pay, but an impact evaluation of a programme in Indonesia that roughly doubled teacher pay found zero impact on teacher performance or student learning (de Ree, Muralidharan, Pradhan, and Rogers, 2017), which the authors conjecture was because nothing about the system generated any connection between pay and performance. Two, an impact evaluation of a scaled "school improvement plan" in Madhya Pradesh India found that although the schools actually did do a diagnostic and did prepare a school-specific improvement plan, nothing else happened, as neither the school nor the education support bureaucracy appeared to actually act on the plan and hence, not surprisingly, there was zero impact on learning outcomes (Muralidharan and Singh, 2020). The authors point out that the education system was actually geared around "process compliance" and was not actually conducive to programmes/interventions aimed at improving actual learning outcomes. Three, in a paper based on a very early impact evaluation carried out in the 1990s (although the paper came out much later) Glewwe, Kremer and Moulin, 2009) provided textbooks to children in Busia, Kenya, fully expecting that providing additional textbooks so that each child had their own book would increase learning, but they found zero average impact on learning, which they eventually discovered was because the textbooks were too hard for the actual learning level of the students and, hence, only the most advanced students benefitted from the increased "inputs."

A more detailed example is a recent paper (Angrist and Maeger, 2022) that reviews the rigorous estimates of the LATE of doing TaRL (teaching at the right level). They find that while all of the estimates find positive impacts, the range of those impacts is enormous, from 0.07 to 0.78 effect sizes. This implies the "rigorous" evidence supports that TaRL "works" (has positive impact) but the range of outcomes is a factor of 10, which would imply the practical importance and cost effectiveness differ widely and, with a range this wide, knowing the "average" impact is only of modest value. They investigate the source of this wide variation across studies and discover that nearly all of the variation is due to differences in implementation. In technical terms, studies usually measure only the programme impact (LATE) as the "intention to treat", which is the relevant impact measure if future implementation is going to be of the same fidelity (and uptake) as in the evaluated programme. They find that the "treatment on the treated" estimates are remarkably similar across countries. They also find that the mode of implementation (with regular teachers or with volunteers) plays a large difference in the resulting estimated impact. They also undertake a new experiment aimed not at changing the intervention itself but rather solely at increasing the fidelity of implementation. They find that this "meta" intervention raises the impact (LATE as 'intention to treat') by 0.22 effect size gain from the "same" intervention (in a literature where a 0.10 effect size is considered a "large" impact). This study reveals that the usual published literature about interventions only contains a small part of the relevant information needed to be known in attempting to adopt or adapt an intervention. Knowing that somewhere, someone found an effect size of 0.78 does not imply the best prediction of doing the "same" programme will be similar to that unless one can

recreate in the context fidelity of implementation and that, in turn, depends on the education system.

- The third reason a system is needed is that, even if one understands the proximate determinants, if the existing proximate determinants of learning are endogenous chosen by existing actors in the system, then there may be little or no scope for changing outcomes without changing the system level proximate determinants. The strength of economics and economists it not at being better informed about technical relationships in the production function than others (e.g., there is a huge difference between agronomists and agricultural economists), but rather about understanding how a decentralized system produces, endogenously, emergent properties and outcome through the choices made by actors.

There are a number of ways to model an education system, but one of them, which is the World Development Report 2004 approach, extended to education (Pritchett, 2015), is to model the schooling system as the operation of set of accountability relationships between actors, including citizens in general (and associations of citizens), politicians, the organisations of the State, the organisational providers of schooling (including a Ministry as provider), and parents, students and communities. Actors in this systems approach are engaged in accountability relationships that can be strong or weak at achieving outcomes depending on the design elements. In this view, schooling systems that achieve high performance in learning outcomes are those with overall systems that are coherent for learning, both across and within the four key accountability relationships (politics, compact, management, and voice and choice).

A system approach brings new concepts, such as "coherence", that are not obvious at the unit/organisational level or from an "input by input" proximate determinants approach. One can use the concept of "coherence" within an accountability relationship. Let me give three examples of the concept of coherence.

- One, in a well-structured relationship between employer and employee (say) the elements of the relationship (delegation, finance, support, information and motivation) align, are coherent, so that the agent acts in the interests of the principal. But in dysfunctional bureaucracies (both private and public), there can be disconnects at each state: delegation can be unclear (or overambitious) and not related to available finance/resources. Support (training) can be given that is not useful to achieving the purposes or goals of the organisation. The information collected about performance can be merely procedural and unconnected to actual outputs or outcomes. Therefore, there can be a lack of coherence within an accountability relationship.
- Two, there can be incoherence between the curriculum (what is formally stated as the learning objectives), the actual classroom capability and practices of the teachers, and what the high stakes examinations assess. For instance, in a "survey of the enacted curriculum" in Uganda and Tanzania, Atuhurra and Kaffenberger (2020) show a massive disconnect between the topic coverage and depth of understanding in each topic in the curriculum, which expected deep understanding of advanced topics) and the teaching, which mainly focused on rote learning/memorisation of very few basic topics.

- Three, as an education system is part of an overall political and social system, there can be a lack of alignment or coherence between the various "principals." For instance, at the "front-line" level, classroom teachers and school head teachers and principals in public schools are typically civil service employees of a large bureaucracy and, hence, accountable in that relationship but are also intended (at least rhetorically) to be accountable to the students, and the parents of the students, and communities in which they teach. But the two "principals", the Ministry of Education and the students/ parents/ communities/ local governments often had quite different views on what is important about education and what teachers should be doing. Qualitative work in Africa, Malawi (Watkins and Ashforth, 2019) and Nigeria (Bano, 2022), and also Pakistan (Siddiqi, 2022) and Indonesia (Bano and Dyonisius 2022) reveal that the lack of coherence of the goals of the various actors in education leads to tensions and often leave local actors alienated and frustrated with the local public schools. This lack of coherence implies that "bottom up" efforts at "community based management" as a means of improving schools often fails.

The main point is that the research agenda of showing "what can, in principle, work?" with specific, limited scale, often NGO or researcher implemented, interventions is played out and has reached the limits of its general usefulness. For instance, Kerwin and Thornton (2021) demonstrate the extreme sensitivity to RCT findings about programme effectiveness as one version of a mother-tongue reading programme in Northern Uganda produced very large positive gains in literacy, but that version was very expensive and hence a reduced cost version was developed, trying as best as possible to keep the principles and design of the programme. But the reduced cost version had zero or even negative effects. Therefore, the first RCT finding about "what works" was of only academic interest as its cost made scaling infeasible and even what the designers thought was the "same" but reduced cost version did not work to improve literacy/reading.

A second example is from Busia region of Kenya where an RCT impact evaluation implemented by an NGO of reducing class size by either hiring an additional teacher in civil servant status or on a renewable contract found that there were reliable learning gains only when the additional teacher hired was hired on contract basis (Duflo, Dupas and Kremer 2015). Because reducing class size in early grades is a pressing issue for the Kenyan government, they decided to take this rigorous evidence on board and scale up this "intervention" of hiring teachers on contract. Given the lack of capability to implement this nation-wide, it was decided to engage an non-governmental organization (NGO) to implement in some regions and have the government implement in other regions. This allowed the possibility of RCT impact evaluation of the impact on learning of the "contract teacher" intervention when scaled, and when scaled by NGO vs government. The results were both entirely predictable and striking. When the programme was implemented by an NGO, it had roughly the same impact as in the original study but when it was implemented by the government it had zero impact on learning (Bold et al., 2018).

This result was predictable as the politics and reality of government implementation of a "contract teacher" scheme are radically different from when an "intervention" of this type is done by an NGO. The politics are radically different because government implementation of a scheme of "contract teachers" is (rightly?) perceived by existing

teachers and teachers unions as a threat to the civil service modality of government employment, and of the wage (Barton, Bold, and Sandefur, 2017) and tenure security that come with that, and hence government adoption and implementation, predictably, created massive political push-back. The result was also predictable as the hypothesized mechanism of action whereby the contract teacher path led to more learning because teachers perceived that if they did not perform well their contract would not be renewed. This hinges on the credibility of the lack of renewal both among the community/school and of the hired teachers. There were good reasons to believe that the government, whatever it said *ex ante*, would not (and in some sense deeply count not) actually fail to renew contracts and, hence, the mechanism of action was credible when done by NGOs but not credible when done by governments.

More generally, the public administration scholar Mark Moore (Moore, 2019) argues that the idea that one can "innovate" in the NGO sector and then "scale" this innovations by transplanting them into government (or even government-financed) programmes is fundamentally flawed. This approach to innovation assumes away the hard part. The answer to the question: "can we, freed of the inevitable (and in many ways legitimate) constraints of implementation of doing things in the government, do something more effective than what the government is doing?" is "of course you can." The reason that answer is obvious is that it is built into the question, almost by definition if you are "freed of constraints" in a constrained optimization problem you will be able to achieve better results unless the constraint was not binding (technically this is built into the Kuhn-Tucker conditions of optimization in that the only way relaxing a constraint does not lead to better results is that if it was a "slack "constraint whose Lagrange multiplier was zero). The hard question is: "What can be done by the government, with either the constraints it now faces or with politically and administratively feasible modifications to those constraints, that will make things better?" For this latter question, RCT impact evaluations of boutique, NGO (or researcher) implemented "interventions" may teach us little or nothing (Vivalt, 2020).

The path forward needs to move towards "how works?" or "what will work to raise learning outcomes that is possible to be implemented in this particular context/system?" or, alternatively, "How can a system changes in coherence of accountability (in delegation, finance, support, information, and in motivation) make possible/induce organic innovations that raise learning to endogenously emerge and endogenously scale?"

This kind of research will have to take the contextual embedding of implementation in existing organisations that themselves are embedded in existing systems (with their associated "institutional" features) as a key feature of the research itself. This could involve impact evaluations, perhaps with RCTs, "at scale" (Muralidharan and Neihaus, 2017) but these are a rare form of existing RCT research because they are so much harder to arrange, fund, and implement than "field experiments" or impact evaluations of small-scale NGO-implemented interventions. A promising line of research are studies that are themselves embedded into the implementation process. Aiyar et al (2023), for instance, studied the implementation of a "teaching at the right level" reform programme in Delhi India using multiple methods, including having a research in selected schools every day for extended periods to get the "feel" of the pressures

school leaders and administrators were under and how they, and teachers, responded on a day to day basis to the new demands of this pedagogical reform. Levy et al (2018) produced a fascinating study of the challenges of producing quality education in South Africa, comparing the political and bureaucratic conditions between the Eastern Cape and Western Cape provinces.

Another kind of research is doing case studies of "success cases" that trace not just "what" was done but "how" this was accomplished. This can take a variety of forms. It can come from memoirs of those involved, such as Jaime Saavedra's (2023) recent memoir of his time as Minister of Education in Peru, or cross-national case studies of success cases, often of places that implemented similar reforms, such as Crouch's (2020) study of the implementation of core instructional support in three country/regional contexts, or Stern,Dubeck, Piper and Jukes (2022) study conditions for successful implementation of instructional support for reading.

I.D.3: A realistic politics of learning: End of the naïve confusion that "Education production function" estimates lead directly to "policy" recommendations

A considerable amount of research by economists in education has been taken up with the estimates of what is called the "education production function" (EPF), which is intended to provide guidance into the causal connections between "input" and "outputs" of the process of education. The underlying idea is that these estimates of the education production function provide useful inputs to "policy makers" or the "managers" of schools (or organisational collections of schools).

However, this underlying research agenda is deeply conceptually confused about what is a "normative" model and what is a "positive" model of the behaviour of an education "producer", and this confusion is sufficiently pervasive that this research may, in the end, be not just useless, but worse than useless (Pritchett, 2009). That is, one can estimate an education production under the presumption the producers are, as a positive descriptive model, following the normative prescriptions for maximization. Either they are not or they are.

If the hypothesis that "normative is positive" is rejected, systematically so, then this line of research rejects the notion that producers are efficient at maximizing the measured outputs. This is what nearly all empirical studies do, implicitly rejecting the conditions of maximization, often by orders of magnitude (Filmer and Pritchett, 1999). In this case, this line of research leads to the question, "if producers are not maximizing the measured outputs/outcomes then what is it they are doing?" and also the question: "if producers are not maximizing the measured outputs under the existing system (where the structure of the system is the proximate determinant of the proximate determinants ("inputs") measured in EPF estimates) then why not, and what would be the changes in the system that would lead producers to make other choices?"

If the hypothesis that "normative is positive" is accepted, that is, that producers are producing efficiently then there is no "guidance" to be given to the producers (as they are already doing the best they can with what they have).

What is not logically coherent, but is nevertheless very common, is to reject that producers are maximizing (routinely, and by large amounts) and then use those same estimates to give "advice" as to how to maximize something the relevant decision-makers are demonstrably not maximizing (Pritchett, 2009). This is like saying "Here is what a person should do if they were trying to lose weight." Then I observe that people's consumption choices are wildly at odds with what they would be doing if they were trying to lose weight. The obvious conclusion is that they are not, in fact, trying to lose weight. If so, then telling them: "if you ate less of X you would lose weight" is not, in any sense, "advice" to people who are not trying to lose weight.

We stress this because it is a clear example of the difference between a methodological innovation within an existing paradigm versus a paradigm shift. That is, the onset of the fad of using randomized control trial (RCT) techniques in development is a (kind of) methodological innovation. One idea would be to use RCTs to recover estimates of the causal impact of specific inputs in a quasi-EPF way. This is obviously just a better method for the same paradigm (normal science). But if the underlying paradigm of giving advice from EPF estimates under the presumption that "normative is positive" is wrong, then the RCT estimates of EPF, even if they do identify a causal impact better than estimates using observational data, are no more useful for policy and practice than non-RCT EPF estimates.

One needs better guidance about system features and design RCT experiments to help understand the operation of the system. But here the paradigm shift comes first, then the method: method does not lead. More bluntly put, the "innovation" of RCTs has set the economics of education back by 20 years. Instead of realizing that the economics of education needed a radically better overall framing (that was embedded in a system approach), people just used the new tools for old paradigm questions, thus putting off the reckoning that the old paradigm of EPF where "normative as positive" was itself conceptually flawed. The many new "systematic reviews" of the literature that supposedly provide guidance for "evidence based" choices in education policy are only marginally better than the old reviews of the empirical literature from nearly 40 years ago (e.g., Hanushek 1986; 1995) as, without being embedded in a coherent theory that allows for contextual differences in the estimated LATE of various inputs that encompasses the observed variation and lack of external validity (and some progress is being made on this front, e.g., Glewwe and Muralidharan, 2016) and without an understanding of the serious issues with "construct validity" of estimates of LATE from specific interventions (Kerwin and Thornton, 2021; Pritchett, 2017) more RCT estimates are, in and of themselves, of little value.

While I don't want to get too distracted by questions of RCTs per se, it is important in formulating a new, forwarding looking, research agenda in asking what the "value added" to the existing stock of knowledge would be from any given use of resources devoted to education. Whereas, say, 25 years ago, when there were very few RCTs in development and very few RCTs in education in development, one might have been able to make the case that an incremental new RCT would be of high value; this is no longer the case, for two reasons.

- First, just declining marginal product. The first RCT in a domain or about some topic might be useful but, as with nearly everything, the marginal product is declining and the nth is of much less worth.
- Second, and more importantly, as there have been more and more RCTs, it has become clear that the problem of "external validity" is just overwhelming empirically as the variability across RCT estimates is so large as to make any given RCT of limited value (Vivalt, 2020). Moreover, the proponents of RCTs have never been able to give even a minimally logically coherent account of how the evidence from RCTs was to be used to update beliefs (in any sense, not just an "optimal" or Bayesian mode) (Pritchett and Sandefur, 2014; Pritchett and Sandefur, 2015). My recent paper (Pritchett, 2023) shows that the suggested approach of doing 'systematic reviews' of 'rigorous estimates' of LATE does *worse* (and potentially much worse) at predicting programme impact (in the standard lowering the RMSE (Root Mean Square Error) across a variety of contexts than the simplest possible "old school" approach of just using Ordinary Least Square - OLS context by context (Pritchett, 2023).

On a more constructive note, this implies that tackling the question of the politics of learning is a promising domain for new research. Mostly, economists and educationists have ignored the politics of learning and adopted a "spend on school" approach where it was imagined that the key problem was that politicians were not expanding access to education fast enough because they were insufficiently "committed" to education, or alternatively, because they were insufficiently committed to the expansion of education to "marginalized" groups. But the facts in Section IA, IB, and IC suggest that is an egregiously inadequate characterization of the nature of the question to be asked and answered.

The really puzzling question is not: "why do some countries expand schooling and others not?" or "why do some countries do 'free' schooling and others not?" or even "why do some countries spend higher fractions of government revenue on schooling than others?" These are not particularly interesting questions because the extent and pace of expansion in schooling has been so large and so uniform.

The puzzling question is: "Why do some governments spend so much to expand schooling and then get such modest learning outcomes from that schooling (relative to other countries)?" And, even more pointedly: "What is the nature of the politics such that some governments have expanded both schooling and learning very rapidly (e.g., Vietnam) whereas other governments have expanded schooling with stagnant learning outcomes, and others have expanded schooling while learning within schools was deteriorating consistently over decades?" And the simplistic answer that just extends the "spend on school" paradigm to claim that expansions cut "resources per pupil" and hence "lack of commitment to spend" is still the answer is not even first order plausible. Many governments, as in Indonesia and India, have actually increased real spending per pupil by a factor of 2 or 3 over recent decades and still suffered sustained deterioration in measured learning per year of schooling.

I believe there are two key elements to constructing a realistic politics of learning:

- First, models of why governments control the means of production of learning need to incorporate that governments, pretty much everywhere and always, whether democracies or not, seek to control the socialization process in schools. The political scientist Agustina Paglayan (2021; 2022) has shown generally historical myth that governments expanded public schooling as a response to public pressure due to expanding democracy is that, a myth. She shows that governments expanded schooling as a mechanism to deflect and defray opposition to State control by expanding their control of socialization. This implies that what those in the "political settlement" that controls the State think is the objective of education will have a large role in shaping the true objectives around which the education system is coherent. Opalo (2023) traces how debates within the ruling party in Tanzania have shaped how the purpose of expansion of access to schooling was framed and reframed over time as power shifted. In particular, the combination of a commitment to rapid expansion of primary education but very sharp limitations in expansion of secondary schooling emerged from Nyerere's view to education in producing Tanzania citizens with basic skills, but the attempt to avoid an "over-educated" population.
- Second, the commitment of governments to universally high levels of learning in basic education will depend on a strong commitment of the elites who constitute the "political settlement" that their vision of the future actually depends on an educated population. While this is a common rhetorical commitment, many political settlements that depend on the control and redistribution of a narrow pool of economic rents (e.g., point source minerals or resources) have elites which do not see a realistic link between a highly educated (as opposed to just schooled) population and their vision of the national future (and their role in that future). A set of case studies of the politics of learning in twelve (12) developing countries illustrate the diverse ways in which "learning" has to compete with other political priorities and the reasons why it has been easy to construct a "high access/low learning" equilibrium. In contrast, the political case study of high performing Vietnam (London and Duong, 2023) reveals that the strong and deep political and social commitment to learning managed to produce impressively high levels of learning, not through a well-implemented top-down plan, but rather through what might be called "pressured chaos."

I.D.4: Two topics: technology and private sector

In discussions of this paper generally, and in particular in its presentation to generalist policy audiences (e.g., non-education specialists), two themes consistently emerge which I have not yet addressed: the role of technology and the role of the private sector. I have a similar view with respect to both, which is that if and when these are integrated into an overall systematic approach, they have the potential to be "enabling" factors that can contribute but that, in and of themselves, if pursued as general or major "solutions" or contributions to the learning crisis they will fail.

I.D.4.i: "Technology" and education

There are two major ways in which "technology" is seen as crucial to the future of education. One is that the application of technology will help solve the learning crisis and improve teaching and learning practices. The other is that the education that children receive should focus more on teaching them how to use technology, for instance that the education should enable children with skills in using computing and media to be more productive.

The latter concern is easy to address with a simple answer: yes and no, no, no. Yes, children being educated in 2023 and in the future should have higher levels of adeptness with, and skills in, the use of modern computing and information technology. But, no, this is not the key problem for most SSA schooling systems. That is, the learning crisis implies that most children do not acquire foundational literacy, numeracy, scientific, and critical thinking skills early in their schooling experience and, hence, arrive at very late levels of schooling with very low stocks of needed cognitive skills. Simply adding curricular objectives at the late stages of schooling (e.g., junior and senior secondary) about computing and information technology and their uses cannot be effective as the students lack the foundation that is needed for those to be effective.

The first question of whether "technology" is, or can be, a major contributor to solving the learning crisis comes up against the brutal facts laid out above, contrasted with the facts about progress in computing. That is, we have seen that: (a) learning per year of schooling appears to be on either a stagnant or declining path in most developing countries; (b) the levels of learning are very much lower in some countries whereas some developing countries have managed consistently very high levels of measured learning (e.g., Vietnam); and (c) (though this is less documented here) the Organization for Economic Co-operation and Development - OECD countries achieved their current levels of PISA-like assessed learning at least by the early 1970s and have made near zero progress since.

These facts line up very awkwardly with the fact that Moore's law describes the rapid progress in computing power, which cumulatively has led to a 10 to the 10^{th} power increase in computing power. This means that, if by "technology" one means information and communication technology and the capability to process, store and communicate bits and bytes, this has increased a near trillion-fold over the last 60 years.

These combined facts imply at least four things. One, "technology" was not a necessary condition for achieving very high levels of cognitive skills in the now developed countries, which are very high compared to those in SSA today. Two, "technology" was not a necessary condition for the currently high performing countries to achieve their high levels of performance today (or of those that achieved high levels in the past at low incomes, such as Japan and Korea). Three, the trillion-fold improvement in computing power has not been a sufficient condition to improve learning outcomes in the OECD. Four, the trillion-fold improvement in computing power has, as yet, been consistent with secular decline in learning in the developing world.

Therefore, to my mind, the view that somehow technology is going to play a large role in solving the learning crisis seems a bit like the old saying about second marriages being the triumph of hope over experience. There is a constant hope that "technology" can lead to "leapfrog" approaches that accelerate learning, but there is as yet no evidence that this has been true in any of the cases of sustained success, and a long string of well-evaluated failures for "computers in classrooms" to make a positive difference.

That said, if governments do the other needful things to make their education system coherent around learning, then there is no reason why technology cannot be a modest enabling factor in helping that overall system reform.

I.D.4.ii: *Private schools*

There is a tendency to see rapid expansion in private sector schooling as a promising feature and that this indicates possibilities of "public private partnership." I believe there is a powerful "liberty" case for allowing people the freedom to start and run private schools (with modest regulation) and a "liberty" case for allowing people the freedom to choose the school their child will attend. Therefore, there is a strong case for allowing private schools to operate. I also believe that no country has produced a high quality system of basic education without high quality publicly produced schooling. Therefore, there is a strong case for producing high quality education in the public sector. Where I am dubious is whether there is much scope for the third "p" in public-private-partnership. There are two types of envisioned PPP. One is that "money follow the student" to either public or privately-owned-and-operated schools. The second is that the public sector should "contract in" management of schools from private sector operators.

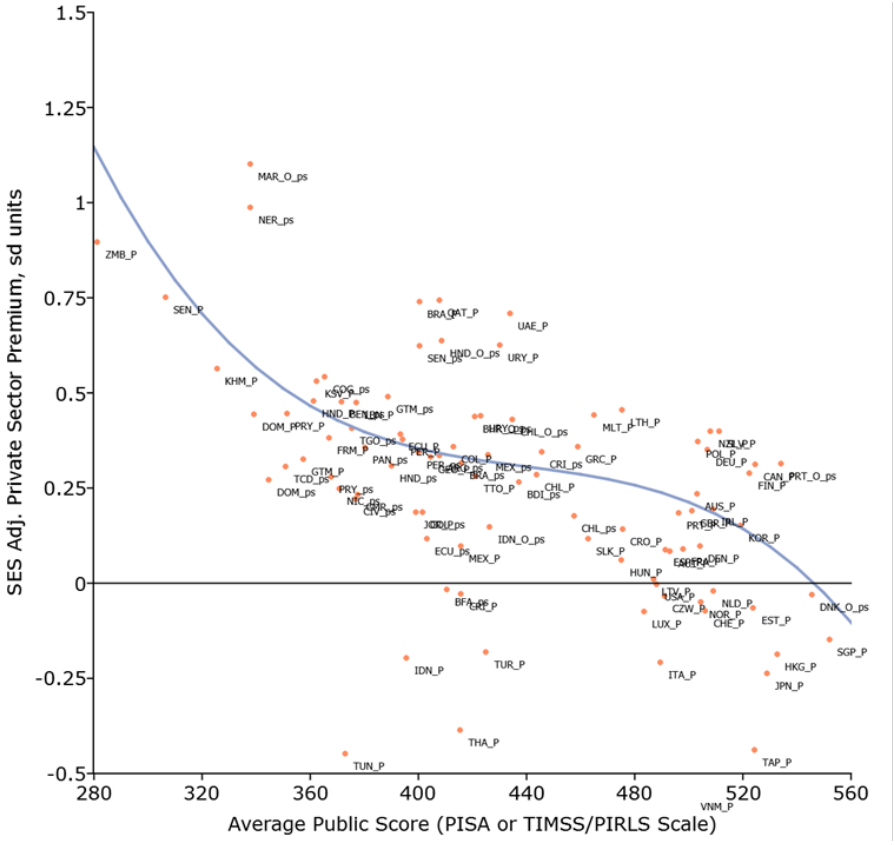
There is a historical case of "money follows the student" leading to high quality education systems, which is that the "low countries" such as Belgium and the Netherlands resolved their social and political conflicts between secular, Protestant, and Catholic systems by creating a three-pillar approach where all three pillars were publicly funded on an equal basis, subject to some regulation of content and socialization. These countries have maintained these systems and, hence, have the highest levels of "private" enrollment at basic levels in the world. But this "private" is tightly regulated and seen as an integral part of an overall system.

There are four quite powerful arguments against seeing "money follows the student" in and of itself as key to building a successful education system.

- First, it is not at all clear that a rapid expansion of enrollment in the private sector is because the private sector has some sector-specific "secret sauce" or whether there are significant issues with the public sector. My reading of the cross-national evidence is that reasonably well-functioning public sector education systems are able to produce learning as cost-effectively as private schools. Much of the apparent superiority of private sector schooling in learning outcomes is due to powerful "selection effects" in which students who would have otherwise had high learning attend private schools (e.g., high SES students) and not that private schools have higher value added in learning than public schools in well-functioning systems.

- Figure 12 shows the estimates of selection corrected estimate of the private sector learning premium adjusted to student SES using both standard PISA data and the Patel and Sandefur (2020) data. This data shows both the level and variance of the private sector premium for countries with different levels of learning performance in the public sector, with three obvious points. One, when the public sector is very low, the premium tends to be very high. Two, when the performance is moderate (say in the range of 360 to 480) one sees that, on average, the PSLP is very high—but, at the same time, there are a significant number of countries for which the SES adjusted premium is low, or even negative (private schools have lower learning value added by these SES-adjusted estimates). Third, when public sector performance is high there is still large variance and some countries with high estimated PSLP but, on average it is low and, for a significant fraction of the countries there is no SES-adjusted positive learning premium at all.

Figure 12: Average public scores and private premium adjusted for observed SES



- Second, recent research on the underlying demand for quality adjusted schooling implies that schooling quality is quite price inelastic. This implies that while a "voucher" like system would shift some students from lower to higher value added schools, the fraction shifted would be relatively modest compared to current enrollments, and hence a main feature of a voucher system would be "infra-marginal" as it would just compensate parents who would have had children enrolled in private schools in any case. This means from a public finance view that, even if a voucher were to increase scores, it might be a very cost-ineffective way of doing so as the learning gains to the movers come at the expense of large transfers to the non-movers (Das, 2023) .
- Third, it is not at all obvious that for private schools the cost of "partnership" with the public sector to receive public monies would not dilute precisely the features that allowed whatever higher performance in "cost effectiveness" they had. For instance, in South Asia, a huge cost advantage of the private sector is that they pay teachers much lower wages - only a fifth to a tenth as high as the public sector wage, as the public sector wage has a huge element of 'rent' (Pritchett and Aiyar, 2014) on India. Therefore, if receiving public sector finances came at the condition of paying equal wages, it is not clear this would be attractive for the private sector. Or, there are other regulations in the operation of the school that may reduce its flexibility or modes of instruction that eliminate its attractiveness. In a number of countries which "nationalized" significant groups of private schools by leaving them private but subsidizing them on a per student basis, the "private with public money" schools are the least cost-effective. In Chile's "voucher" system nearly all of the traditionally "elite" private schools opted out of receiving the public sector voucher as the conditions for receiving the voucher were unattractive.
- Fourth, if the overall education system does not have reliable data on learning performance and cannot manage the system to improve, it is not obvious that the conditions for "money follows the student" are present for the public sector to make this put positive pressure on the private schools. If, on the other hand, the public sector is learning-oriented and dynamic, and performance pressured, it is not clear "money follows the student" is needed.

Conclusion to Part I

This is an exciting time for research into human capital in Africa. The reigning paradigm for the last 50 years or so in global education has been to conflate "invest in human capital" with "spend on school." This has brought about the paradox of the combination of very rapid expansion in the access, enrollment, and grade attainment and, hence, much more schooling, but with generally low (and, on new evidence, secularly falling) levels of learning.

The paradigm has shifted so that it is increasingly recognized that the future of "invest in human capital" has to focus on the creation of valued skills (and these skills are of personal, community, social and economic value). This is not reducing learning to only what is valued instrumentally in a market while in school. This shift in the

overall paradigm requires shifts in the priorities for research about basic schooling and education and I have outlined three: (i) a shift to the use of "output" and "outcome" measures that are not just "time served" but "human capital gained"; (ii) away from an attention on proximate determinants, particularly "thin inputs" to the system level, to put attention on the "why" and "how" and the realities of implementation, how the proximate determinants of the proximate determinants structure endogenous choices and outcomes; and (iii) to an explicit consideration of the politics of learning and an explicit rejection of the naïve use of "normative as positive" as a basis for "policy recommendations" and the formation of better models of why governments do what they do in the domain of basic education.

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2

Human Capital Investments and Economic Growth in Sub-Saharan Africa: Fertility, Early Life Human Capital and Schooling Investments

Jere R. Behrman

Introduction

Sub-Saharan Africa (SSA) is exceptional among the major world regions with regard to its experiences on human capital and human fertility, which has important implications for economic growth. Schooling is the form of human capital on which the empirical literature has focused most. Schooling progress in SSA has lagged behind other world regions, and SSA now comes in last place in average schooling attainment (Barro and Lee, 2013). SSA also lags in terms of most other human-capital indicators, as described in Section 2 below. SSA is the only major region with a total fertility rate (TFR) in excess of four children per woman, the result of later and slower fertility decline (UNDESA, 2019). Largely due to this high fertility, the UN projects that it will become the world's most populous region by the end of the century. Within the standard *quantity-quality* fertility model (summarized in Section 1.3 below), SSA's exceptionalism in terms of human capital investments and in terms of human fertility are not independent, but likely to be interconnected.

A major contribution of the African Economic Research Consortium (AERC) - Bill and Melinda Gates Foundation (BMGF) collabourative research project on human capital and growth in Africa is to adopt a much broader view than many previous studies on what constitutes human capital and what are the channels through which human capital might work. This paper summarizes two of the project's papers that adopt aspects of this broader perspective and the implications for policies with respect to some important components of how human capital might affect economic growth in SSA: "Fertility Change and Human Capital Growth in Africa" by Tom Vogl (2021) and "Early Life Human Capital Investments in SSA" by Jere R. Behrman and Claudia Vazquez (Behrman and Vazquez, 2021).

Vogl's paper seeks to document recent fertility and human capital, in particular schooling trends in SSA, shed light on their interlinkages, and identify key questions for their future trajectories, starting with the framework of the quality-quantity fertility model elabourated on in Section 1.3. Within an aggregated production function (see Section 1.2), increased human capital for women may impact output growth by reducing the number of labourers in the children's generation and increasing their human capital with multiple impacts on growth.

Behrman and Vazquez (2021) focus on early life human capital investments in the pre-school lifecycle stage, which are particularly important because of the rapid physical and neurological developments that occur in this lifecycle stage that lay the foundation for and often have critical dynamic complementarities with subsequent human capital investments in the school ages and beyond (Black et al., 2021; Ritcher et al., 2019; Black et al., 2017; Engle et al., 2011; Cunha et al., 2010 and Heckman, 2006). Support for early life human capital development needs to be multidimensional, as recognized explicitly in the WHO/UNICEF (Black et al., 2021; and WHO/UNICEF, 2018). Nurturing Care Framework, with its five (5) components pertaining to: learning, health, nutrition, responsive interactions, and safety and security. This support in early life typically comes primarily from families, but increasingly with children's ages in interaction with

broader environments, institutions and policies (Black et al., 2021). Currently, however, ~250 million children under five (5) years of age in Low-and-Middle Income Countries (LMICs), including over 116 million in SSA, are estimated to be at risk of not developing their potential because of inadequate support for their development (Black et al., 2017; Ritcher et al., 2017; Lu et al., 2016). The Behrman and Vazquez (2021) article focuses on three general dimensions of support for human capital development of SSA children in this critical pre-school lifecycle stage: nurturing care through age five, nutrition through age five but particularly before age two, and pre-primary programmes generally for ages three to five. These are not the only dimensions of support for children in this lifecycle stage, but they encompass three important dimensions of such support for which a fair amount of evidence exists in LMICs generally, and for which more research is needed for SSA. Early life human capital, such as nutritional and cognitive and socio-emotional development in the first years of life, has been increasingly emphasized as critical for human capital development, with impacts on economic growth when the children become adults through the multiple channels in the aggregate production function discussed in Section 1.2.

The present paper builds extensively on these two papers by Vogl (2021), and Behrman and Vazquez (2021). The present paper first presents definitions and some simple frameworks for thinking about human capital, fertility and growth in the SSA context (Section 1). Section 2 documents some dimensions of SSA exceptionalism in terms of human capital and fertility and early life human capital investments. Section 3 summarises analyses of fertility-schooling interactions in SSA and Section 4 summarizes estimates of the *costs-of-inaction* in terms of lost future income of not investing sufficiently in early life human capital in SSA and the losses in terms of the present discounted value of future income due to COVID-19 pre-school shutdowns in SSA. Section 5 concludes with discussion of economic rationale for policies, policy implications and research needs.

1. Definitions and Frameworks for Analysis

Human Capital Defined

Human capital includes the stock of capabilities accumulated from earlier investments that are embodied in humans and that increase their productivity in labour markets, home production and other activities. Such investments include those in nutrition, health, education, training and experience (e.g., learning on the job). These investments include education, but are not limited to education. Investments other than education have high long-run returns in low- and middle-income context (e.g., nutrition (Hoddinot etal., 2013a; Hoddinot etal., 2013b; Behrman etal., 2009; Maluccio etal., 2009 and Hoddinot et al., 2008) and responsive parenting (Gertler etal., 2014; Walker et al., 2021 and Walker etal., 2011). Also, if education means learning and acquiring knowledge, then education is produced by schooling attainment but also by a number of other important factors, including family and community environments, pre-school experiences, pre-school and school qualities, genetic endowments, etc. Therefore, it is a simplification requiring strong assumptions to equate schooling attainment with education (e.g., that other inputs into education are not relevant, despite empirical evidence to the contrary, or that other inputs are perfectly correlated with schooling attainment, again

contrary to empirical evidence). Nevertheless, schooling attainment is often equated with education in the empirical literature, which probably causes misunderstanding of the role of other educational inputs and of schooling attainment (since empirically schooling attainment in part represents other correlated educational inputs that are not included in most studies, e.g., school quality (Behrman and Birdsall, 1983), pre-school and post-school experiences (Behrman et al., 2014), and family background and genetic endowments (Behrman et al., 1980; Behrman and Rosenzweig, 2002; Behrman and Rosenzweig, 1999). Equating schooling attainment with human capital requires even stronger (usually implicit) assumptions about the irrelevance of non-schooling investments in human capital despite substantial empirical evidence to the contrary (some of which is cited above) or that all forms of human capital are perfectly correlated with schooling attainment, again contrary to empirical evidence. Yet, in part because of the relative availability of data on schooling attainment in comparison with other inputs into and components of human capital, schooling attainment in the empirical literature is often equated with human capital, which again may lead to a misunderstanding of the impact of schooling attainment (e.g., by attributing to schooling attainment the effects of other correlated but uncontrolled inputs into human capital) and under-estimating the importance of the non-schooling attainment inputs into human capital. In the summary of Vogl's work in this paper, therefore, and to void confusion "schooling attainment" (the empirical representation that he uses) is used instead of the possibly much broader term "human capital." For Berman and Vazquez (2021) study, their terminology is used in this paper since they refer explicitly to various forms of early life investments, not to schooling or education as a portmanteau for human capital.

1.2 Aggregate Production Functions

Aggregate growth models have long been used to characterize the determinants of growth (Barro, 2001; 1999). Typically, such models posit aggregate production functions in which output (*Y*) depends on the state of technology (*T*), the quantity of physical capital (*K*), natural resources (*N*), and the quantity (*L*) and quality (*H*) of human resources:

$$Y = Y(T, K, N, L, H) \tag{1}$$

This implies that change in output due to a change in human capital (*H*) is a weighted average of the changes in each of the right-side terms in relation 1) in response to a change in human capital (*H*):

$$\frac{dY}{dH} = \frac{\partial Y}{\partial T}\frac{\partial T}{\partial H} + \frac{\partial Y}{\partial K}\frac{\partial K}{\partial H} + \frac{\partial Y}{\partial N}\frac{\partial N}{\partial H} + \frac{\partial Y}{\partial L}\frac{\partial L}{\partial H} + \frac{\partial Y}{\partial H} \tag{2}$$

Thus, in general, a change in human capital may affect output through a multiplicity of indirect channels, including changing technology, physical capital, natural resources and the quantity of labour, in addition to any direct changes in output due to changes in human capital (the last term in relation 2). Human capital, moreover, is a multi-dimensional construct, including the effects of investments in education, health and nutrition, training and experience. Much of the literature focuses on one input into

education, schooling attainment, but education in the sense of learning is determined by a number of factors beyond schooling attainment, including for example, early life care, health and nutrition, pre-school programmes, the quality of schools, and stimulation and support in home and community environments. Therefore, it may be important in considering the relation between human capital and growth to consider a much broader perspective than just schooling attainment.

1.3 Quantity-Quality Fertility and Human Capital Investment Model

Economic demographers would argue that one cannot think about one of the forms of SSA exceptionalism regarding human capital and fertility noted in the introduction without also thinking about the other. The family is a major locus for human capital investments and fertility-related decisions. As Becker (1991) posited, parents make joint decisions about how many children to have and how much to invest in each child's human capital, and these decisions are in turn shaped by parental human capital. This view suggests that SSA's "unique" fertility transition (Bongaarts, 2017) shapes its human capital trajectories, and vice versa.

Vogl (2021) presents a theoretical framework in the spirit of family economics, capturing key linkages among parental human capital, fertility, and child human capital. In his framework, parents, perhaps with bargaining, maximize their utilities that depend, *inter alia*, on the quantity and quality of children subject to human capital production functions and budgetary constraints. The demand for children is increasing in income, but decreasing in price, which critically incorporates the opportunity cost of women's time, which increases with more schooling. The framework highlights economists' key contribution to the theory of fertility: the insight that having more children raises the cost of investing in them, or equivalently that investing in one's children raises the cost of having more of them (Becker et al., 1973; Willis, 1973). This so-called *quality-quantity tradeoff* yields a number of predictions that are useful for interpreting SSA's record and predicting its demographic and human capital future. A key insight is that drivers of fertility decline tend to encourage investment in children. The theoretical framework also embeds several ways that schooling attainment among adults, particularly women, may influence fertility by raising human capital preferences for either parent directly or via social norms, raising the bargaining power of women if women have higher preferences for children's human capital and lower preferences for number of children given the burden of child bearing and raising children, and raising the opportunity costs of time that shifts consumption from large numbers of children. Vogl (2021) says that his framework has three broad takeaways. First, women's human capital may reduce fertility by raising the opportunity cost of time, shifting bargaining power in the household, or re- shaping individual preferences. Second, forces that encourage lower fertility also tend to encourage more investment in children's human capital. Third, changes in the distribution of fertility across more and less educated parents reshapes the prevalence of childhood disadvantage in the next generation, with implications for the distribution of human capital in the next generation.

2. Sub-Saharan Africa Exceptionalism in Dimensions of Human Capital and Fertility

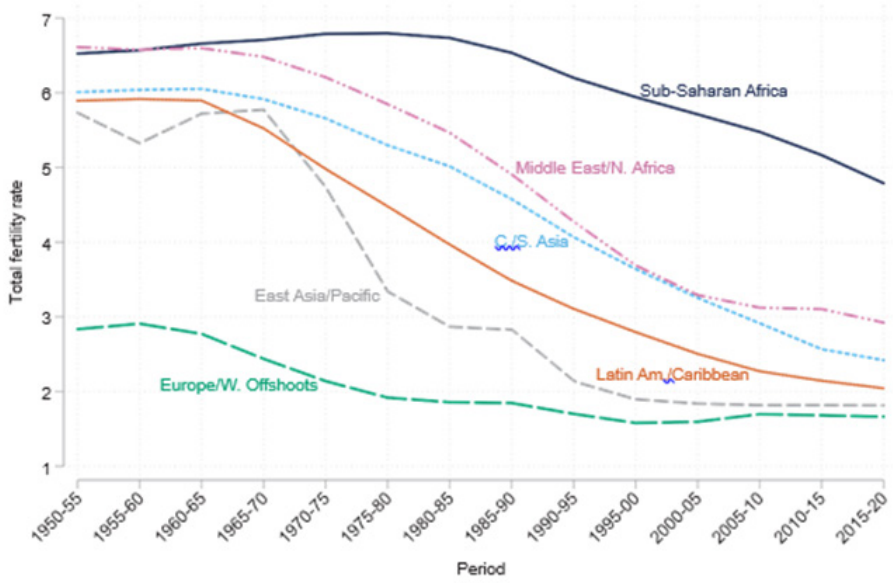
2.1 Schooling and Fertility

Guided by the quantity-quality framework in Section 1.3, Vogl (2021) documents a series of facts about fertility and human capital in SSA relative to the rest of the world using standard cross-country datasets (Barro, 2013; United Nations Department of Economic and Social Affairs – UNDESA, 2019; World Bank, 2020) for: 1) time series of fertility and adult schooling across world regions; and 2) cross-sectional and panel analyses of country-level data.

2.1.1 Regional time series analysis

SSA's fertility exceptionalism is clear in Figure 1, which plots regional trends in the total fertility rate (TFR) from 1950 to 2020. The TFR has fallen since 1950 in all world regions, but the timing of onset and pace of decline vary. Compared with other high-initial-fertility regions, the SSA TFR started declining later and then declined at a slower rate. The Middle Eastern and North African region, which had the world's highest TFR in 1950, reached SSA's current TFR three decades ago. SSA's TFR is now more than 50% higher than the next-highest region, which weighs heavily in projections of the regional distribution of the world's population.

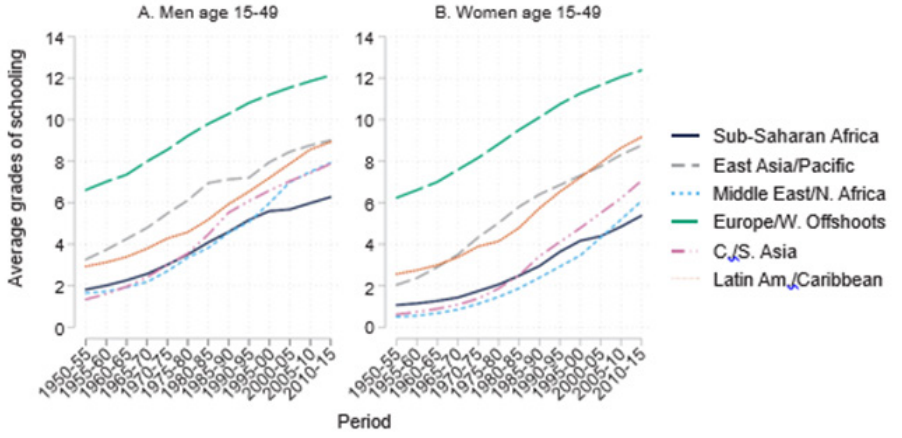
Figure 1: Total fertility rates over time, by world region



Notes: Population-weighted average total fertility rates across 235 countries
Source: UN (2019), From Vogl (2021) Figure 1

The quality-quantity framework (Section 1.3) suggests that SSA's demographic exceptionalism is likely to be intertwined with human capital exceptionalism, and indeed it appears to be for schooling attainment. Figure 2 reports regional trends in average schooling attainment among men and women aged 15-49 for 1950-2015. Schooling attainment steadily increased since 1950 in all world regions, but more slowly in SSA than elsewhere. For both men and women, the region started fourth among the six regions; currently, it is last. According to the quantity-quality frameworks, slow schooling progress among adults tends to impede fertility declines, and higher fertility tends to accompany lower investment in children.

Figure 2: School attainment over time, by world region

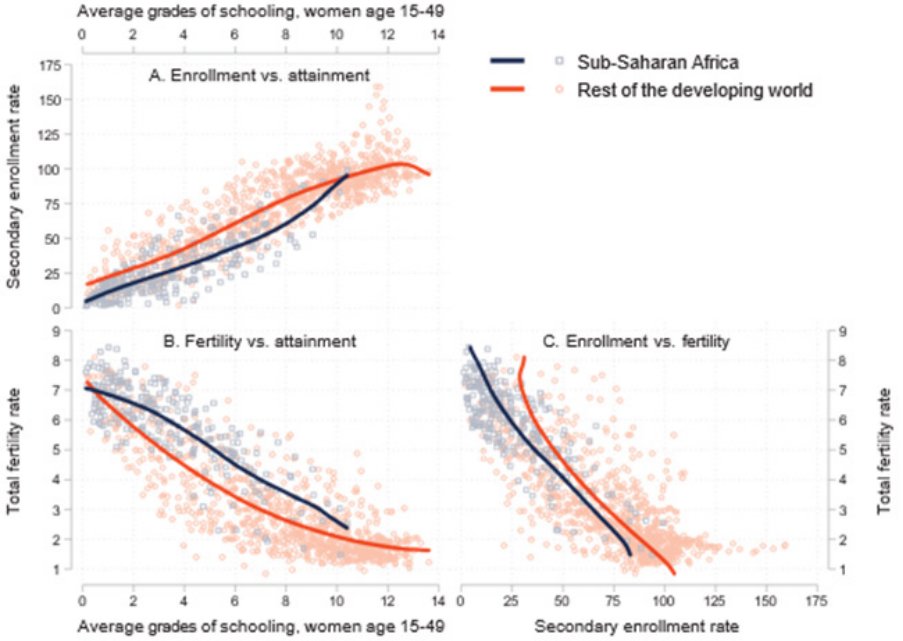


Notes: Population weighted average years of schooling across 146 countries from Barro and Lee (2013)
Source: Slightly modified from Vogl (2021), Figure 2

2.1.2 Country panel analysis

Figure 3 plots bivariate associations (scatterplots and local linear regressions) among adult schooling attainment, fertility, and child schooling enrollment for a panel of 142 countries for 1970-2015, a period that includes years before and after the onset of fertility decline in SSA, which Figure 1 places in the early 1980s. Each panel draws separate plots for SSA and the rest of the developing world. Panel B plots TFR against average schooling of women of childbearing age. SSA and the rest of the world have similar negative slopes, with each additional schooling grade associated with a reduction of almost half a child per woman. The SSA scatterplot is denser at lower levels of schooling, such that women's schooling is associated with some part of SSA's higher fertility. But at most schooling levels, SSA countries average higher TFR than non-SSA countries; thus, women's schooling does not fully explain the fertility gap.

Figure 3: Fertility and education in a country-period panel



Notes: Curves are local linear regressions with bandwidths of 1. In Panel C, the secondary enrollment rate (on the horizontal axis) is treated as the dependent variable. Sample includes 1,115 observations, reflecting 142 countries in five-year periods between 1970-75 and 2010-15. Source: Total fertility rates are from UN (2019), educational attainment is from Barro and Lee (2013), and school enrollment is from World Bank (2020). Figure slightly modified from Vogl (2021), Figure 3

The quality-quantity framework suggests that SSA's greater investment in child quantity at a given schooling level should be mirrored by lesser investment in child quantity. Panel A of Figure 2 reveals that the levels gap between SSA and the rest of the developing world is indeed reversed in a graph of secondary enrollment against women's attainment. Again, the slopes are reasonably similar, with each additional grade of women's attainment predicting more than 7 percentage points increase in child enrollment. The slope may reflect reverse causality and may in part be mechanical, since the age ranges for attainment and enrollment overlap, but the levels gap is not an artifact. At a given level of women's schooling, SSA countries have more children and less schooling.

If women's schooling is negatively related to the TFR, but positively related to their children's secondary enrollment rate, then the TFR will be negatively related to the secondary enrollment rate, a prediction confirmed in Panel C of Figure 3. In this case, the levels gap between the estimated regression functions is not particularly meaningful. Instead, the main takeaway is that, in this pooled panel of countries, higher school enrollment goes together with lower fertility.

While instructive, many of the patterns in Figure 3 have awkward interpretations because they represent lifecycle outcomes and inter-generational relationships using period data. Children of secondary-school age in a given year are not likely to be representative of the offspring of 15-49 year-old women in the same year. The TFR summarizes age-specific fertility rates in a given year, rather than cumulative fertility over the lifecycle for any particular group of women. Panels A and C are useful descriptions of cross-country variation, but they lack a direct interpretation in terms of the joint fertility and child investment choices of any actual women or couples.

The relationship between women's schooling attainment and TFR in Panel B affords a somewhat easier interpretation because both axes summarize outcomes for women aged 15-49. Vogl (2021) Table 1 Panel A (not included in this paper) quantifies and probes this relationship in a series of Ordinary Least Square (OLS) regressions that: (a) distinguish between female and male schooling; and (b) control for secular trends affecting all countries and fixed heterogeneity across countries by including period and country-fixed effects. The estimates of TFR on an indicator for SSA indicate that the TFR of the average SSA country exceeded that of the average non-SSA country by 2.3 children per woman, or 63%. Roughly, two-thirds of this gap is associated with regional differences in women's schooling attainment. The association between women's schooling and fertility does not reflect men's schooling, correlated secular trends, or persistent country-level heterogeneity. Allowing the slopes of the schooling-fertility relationships to differ by region does not reveal significant differences between SSA and the rest of the developing world. Notably, however, the sum of the coefficients on men's attainment and its SSA interaction imply a marginally significant positive slope within SSA, such that a one-grade increase in men's attainment is associated with 0.22 more children per woman (p = 0.07). This positive slope is consistent with discussion in Section 1.3 that male schooling attainment may raise the demand for children.

Vogl (2021) converts the age-specific quantities in the UN fertility and Barro-Lee schooling data sets into cohort quantities, summarizing outcomes for women born in the same country and five-year period. The cohort data support the same conclusions as the period data. In summary, cross-country data sets confirm that African countries average upwards of two more children per woman than the rest of the world. Differences in women's schooling are consistent with two-thirds of this gap, suggesting the primacy of female schooling. Across countries, within countries over time, and within countries across successive cohorts, increases in women's (but not men's) schooling predict declines in fertility.

2.2 Early Childhood Human Capital in SSA

This section first describes the current situation of pre-school SSA children and the coverage of early life human capital investments. When data permit, comparisons are made across global regions, SSA sub-regions and SSA countries (though most of the SSA country estimates are with reference to appendices in Behrman and Vazquez (2021) and not presented in this paper, showing trends and changes over time, and disaggregating the indicators by relevant individual and household characteristics to enrich the description.

2.2.1 Child health and nutrition

Infant mortality is a clear indicator of children's well-being, health and nutrition. Global progress in reducing child mortality has been significant (Table 1): the under-five mortality rate (U5MR) has declined by almost 60% since 1990, from 93 to 38 deaths per 1000 live births in 2019 (UN IGME, 2020). SSA has the highest U5MR in the world with 76 per 1000 live births (twice that of the world and more than 14 times that of Northern America and Europe), and has more than half of all the children under five who died (growing from 30% in 1990 to 53% in 2019). Within SSA, West and Central Africa has the lowest survival probability: 1 in 10 children died in 2019 before turning five. Behrman and Vazquez (2021) Appendix Table A.1 presents country-specific U5MR for 1990-2019, illustrating the heterogeneity in the pace with which the SSA countries reduced their U5MR in the 30-year period. Figure 4 illustrates these trends for the seven project-focus countries. Ethiopia and Uganda had the fastest reductions (75% end-to-end compared to 63% for low-income countries) while Nigeria only reduced U5MR by 44% and was still over 100 deaths per 1000 live births in 2019, more than 30 years behind the world average, which achieved 93 in 1990.

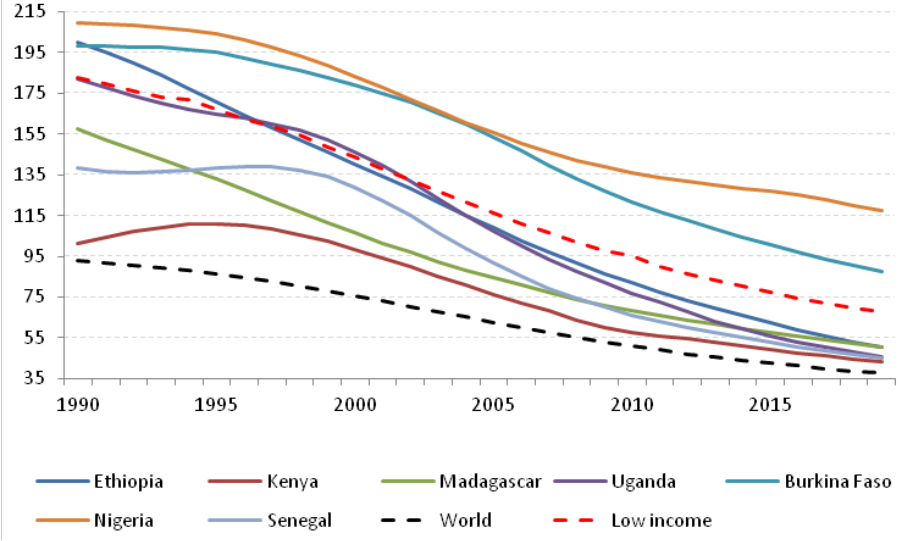
Table 1: Under-five mortality rate and number of deaths of children under five, by SDG region, 1990, 2000, 2010, 2019

	Under-five mortality rate				Number of deaths (thousands)			
	1990	2000	2010	2019	1990	2000	2010	2019
World	93.0	75.8	51.2	37.7	12,494	9,749	6,950	5,189
Sub-Saharan Africa (SSA)	180.3	152.4	102.2	76.4	3,720	3,878	3,212	2,766
West and Central Africa	196.2	168.0	120.6	94.7	2,020	2,190	1,989	1,836
Eastern and Southern Africa	161.9	133.4	81.2	55.4	1,806	1,796	1,314	1,009

Source: United Nations Inter-Agency Group for Child Mortality Estimation (UN IGME) 2020. Excerpted from Behrman and Vazquez (2021), Table 1

Infectious diseases, including pneumonia, diarrhea and malaria, together with preterm birth and intrapartum-related complications, are the leading causes of U5MR. These illnesses that affect children in poor settings are highly prevalent in SSA. Malnourished children are at a higher risk of suffering and dying from these common childhood illnesses (Pelletier et al., 1995; Caulfield et al., 2004; Black et al., 2008), which are in turn important determinants of malnutrition (Checkley et al., 2008) in a synergism of adverse nutrition status and susceptibility to infections.

Figure 4: Country-specific under-five mortality rates (deaths per 1,000 live births), both sexes, 1990-2019



Source: United Nations Inter-Agency Group for Child Mortality Estimation (UN IGME) 2020, from Behrman and Vazquez (2021), Figure 1

Malnutrition can be reflected in different indicators. *Stunting*, when a child's height-for-age, is more than two standard deviations below the median for well-nourished international reference populations of the corresponding sex and age defined by the World Health Organization (WHO) growth standards, reflects chronic malnutrition in early childhood. *Wasting* refers to low weight-for-height and is an indicator of shorter-term undernutrition: children are considered wasted when their weights-for-heights are more than two standard deviations below the medians for the reference populations. Sub-optimal growth, reflected in stunting and wasting, was found to have the highest proportion of attributed child deaths (Black et al., 2008) and has been associated with worse outcomes over the life cycle, including child developmental and educational outcomes (Walker et al., 2011; Grantham-McGregor et al., 2007), shorter adult height, less schooling and less income (Adair et al., 2013; Victora et al., 2008; Hoddinott et al., 2013). Overweight is defined here (other definitions are sometimes used) as when children's weights-for-heights are more than two standard deviations above the medians for the international reference populations of the corresponding sex and age, and it results in short- and long-term risks to health (Koplan et al., 2005; Lloyd et al., 2012).

Table 2 presents the percentages and number of children stunted, wasted and overweight under five in 2019. 37% of all stunted children under five in the world lived in SSA, particularly in Eastern and Western Africa (23.1 and 17.8 million, respectively). Also, SSA, together with Southern and South-Eastern Asia, were among the regions with the highest prevalence of wasting in the world: 23% of all wasted children (10.6 of the 47 million children worldwide), particularly in Western and Eastern Africa (4.8 and 3.6 million, respectively). The number of children overweight, in contrast, was not concentrated in SSA, which accounted for only 16% of all overweight children in 2019. The sub-region with most overweight prevalence within SSA was Southern Africa, with 12.7% of children under five (0.9 million).

Table 2: Percentage of stunted, wasted and overweight and million children under 5 affected, 2019

	Prevalence (%)			Children (million)		
	Stunted	Wasted	Over-weight	Stunted	Wasted	Over-weight
World	21.3	6.9	5.6	140.0	47.0	38.3
Africa	32.5	6.4	3.1	57.5	12.7	9.4
North Africa	17.6	7.2	11.3	5.1	2.1	3.3
Sub-Saharan Africa	33.0	6.8	3.0	52.4	10.6	6.1
Eastern Africa	34.5	5.3	3.7	23.1	3.6	2.5
Western Africa	27.7	7.5	1.9	17.8	4.8	1.2
Middle Africa	31.5	6.7	5.1	9.5	2.0	1.5
Southern Africa	29.0	3.3	12.7	2.0	0.2	0.9

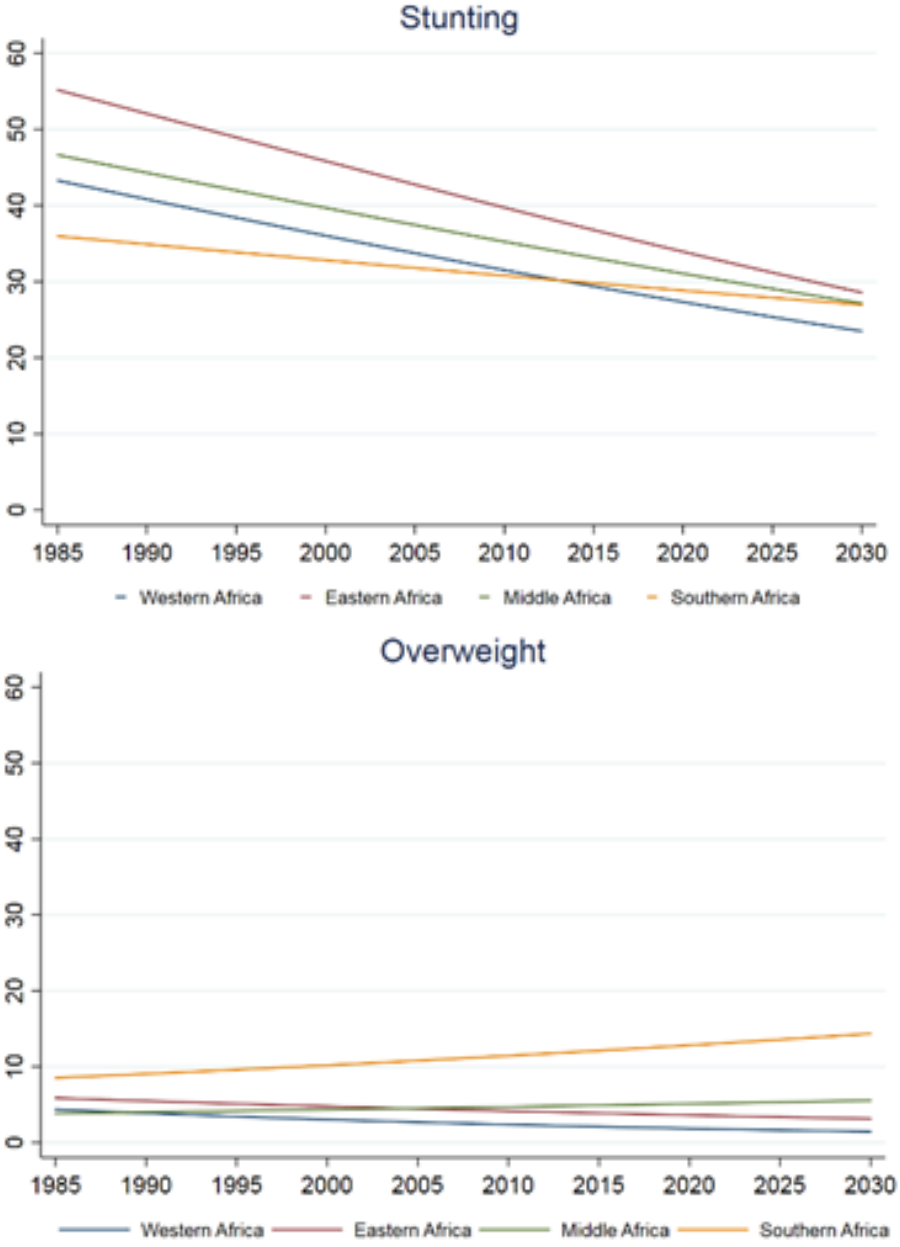
Source: UNICEF, WHO, World Bank: Joint child malnutrition estimates. Excerpted from Behrman and Vazquez (2021, Table 2

Figure 5 shows the estimates and projections for the percentages of stunted and overweight children under five for 1985-2030 by SSA sub-regions. Although the trends in stunting prevalence show a continuous decline over the past three decades, the levels are still high and due to fast population growth, the number of stunted children in the region increased in the past two decades. Stunting prevalence has declined more rapidly in Eastern Africa, the sub-region most affected by stunting. The prevalence in this sub-region went from 55.2% in 1985 to 34.5% in 2019, and it is projected to reach 28.6% by 2030. Similar gains were observed in Western and Middle Africa, where stunting declined from 43.3% and 46.6% in 1985 to 27.7% and 31.5% in 2019, respectively, and is projected to be 23.5% and 27.2% in 2030. The reduction in Southern Africa was at a slower pace, going from 36% in 1985 to 29% in 2019 and projected to be 27% in 2030.

The prevalence of overweight in Southern Africa has grown from 8.5% in 1985 to 12.7% in 2019 and is projected to reach 14.3% in 2030. The percentage of children overweight also increased in Middle Africa, although to a lesser extent (from 3.8% in 1985 to 5% in 2019 and 5.5% in 2030). Eastern and Western Africa show declines in overweight prevalence during the period.

Table 3 gives the trends in percentages of children under five stunted, wasted and overweight for the seven project-focus countries in the last two decades (Behrman and Vazquez, 2021). Appendix Tables A.2, A.4 and A.6 cover all SSA countries. At the country level, there have been steady reductions in the prevalence of stunting in the last 20 years, although at different rates, with very few exceptions. Also, a general downward trend is observed in the prevalence of wasting, although less pronounced.

Figure 5: Prevalence of stunting and overweight in SSA sub-regions, 1985-2030



Source: UNICEF, WHO, World Bank: Joint child malnutrition estimates. From Behrman and Vazquez (2021), Figure 2

Table 3: Prevalence of stunting, wasting and overweight. % of children under five

Five-year average. Project-focus countries												
Country	Stunting				Wasting				Overweight			
	2000-2004	2005-2009	2010-2014	2015-2019	2000-2004	2005-2009	2010-2014	2015-2019	2000-2004	2005-2009	2010-2014	2015-2019
Burkina Faso	43.1	37.6	32.5	24.3	21.2	17.9	10.6	8.2	5.4	7.0	1.2	1.3
Ethiopia	57.6	50.4	42.4	37.6	12.4	12.4	9.3	8.6	5.5	-	7.7	-
Kenya	38.3	37.9	26.2	-	6.8	6.9	4.2	-	4.6	4.2	3.0	2.7
Madagascar	52.7	49.4	48.9	41.6	15.1	-	7.5	6.4	3.1	4.6	1.0	2.0
Nigeria	42.5	39.9	35.3	37.8	11.2	14.0	12.1	8.3	7.1	6.7	6.5	-
Senegal	26.0	19.9	20.0	18.3	10.0	8.7	8.4	8.0	4.8	8.0	9.2	4.5
Uganda	44.9	38.3	33.7	28.9	5.0	5.3	4.2	3.5	4.9	4.1	4.4	3.7

Source: UNICEF, WHO, World Bank: Joint child malnutrition estimates. From Behrman and Vazquez (2021) (2021), Table 3

Table 4 disaggregates the prevalence of stunting, wasting and overweight in children less than five years old by household wealth, urbanization, age, and sex in the seven project-focus countries for the last year with available data (Behrman and Vazquez, 2021)

Appendix Tables A.3, A.5 and A.7 present the results for all SSA countries and Figure A.1 plots the distributions of these indicators conditional on household and individual characteristics. Undernutrition is highly correlated with the socio-economic status of households. The prevalence of stunting in the first wealth quintile is, on average, for the seven countries, 2.4 times the level for the fifth quintile. The gaps are particularly large in Senegal (4.2) and Nigeria (3.3) and less pronounced in Madagascar (1.1) and Ethiopia (1.7). Wasting is also negatively correlated with wealth; on average, the prevalence in the first quintile is 2.3 times that in the fifth quintile. Urban areas tend to be less affected than rural areas by both stunting and wasting. Stunting prevalence is, on average for the seven focus-countries, 60% higher in rural settings, while wasting is 30% more prevalent in rural areas (Nigeria and Senegal are also the countries with the widest gaps). Regarding individual characteristics, older children (24 to 59 months old) suffer from stunting more frequently than children younger than 24 or 12 months, as has been found previously on average for all LMICs in Demographic Health Surveys (Victora et al., 2010), while a different pattern is observed regarding the association with wasting, with younger children being more affected. Boys tend to be more affected than girls by both stunting and wasting, which is consistent with the higher U5MR for boys than for girls. On average, wasting (stunting) prevalence is 36% (21%) higher for boys than for girls.

Overweight prevalence shows a positive association with wealth and with urbanization. No clear pattern emerges for overweight by sex, but a significant negative correlation is observed with age, with children younger than 12 months having higher prevalence of overweight (almost five times higher than children aged 24 to 59 months).

Micronutrient deficiencies: Children who are deficient in micronutrients can suffer long-lasting consequences. For example, vitamin A deficiency causes blindness and is associated with an increased risk of mortality from measles and diarrhea in children. The estimated prevalence of vitamin A deficiency in children aged six to 59 months in 138 LIMICs was 29% in 2013, with the highest rate in SSA (48%). Moreover, SSA and South Asia were the only regions where Vitamin A deficiency did not decrease since 1991 (Stevens et al., 2015). Vitamin A supplementation (VAS) coverage, measured as the percentage of children aged 6-59 months that received two high doses of VAS, was 61% in 2018 in the 64 deemed priority countries for national-scale VAS where UNICEF tracks progress. The sub-region of Eastern and Southern Africa achieved the lowest at 57%. However, sub-regional averages mask wide variations. Table 5 presents VAS coverage in 2000-2018 for the seven project-focus countries (see Behrman and Vazquez, 2021 Appendix Table A.8 for all SSA countries). VAS coverage was heterogeneous, from almost universal in 2018 in Tanzania (99%), Burkina Faso (99%) and Madagascar (96%), to less than half in Ethiopia (48%) and Uganda (33%) in 2018.

Table 4: Prevalence of stunting, wasting and overweight. % of children under five, by main characteristics. Project-focus countries, 2014-2019

Country	Sex		Area		Wealth quintile					Age in months		
	Girls	Boys	Urban	Rural	1	2	3	4	5	<12	12 to 23	24 to 59
A. Stunting												
Burkina Faso	22.0	27.7	21.4	37.4	41.6	37.2	37.8	33.4	18.6	11.9	28.1	28.1
Ethiopia	33.4	40.2	25.6	40.6	41.9	41.9	39.7	34.9	24.1	16.8	40.2	45.3
Kenya	22.4	29.9	20.0	29.2	36.0	30.4	25.5	20.8	14.1	13.5	31.4	28.6
Madagascar	38.5	44.6	37.7	42.6	40.8	44.7	45.2	39.9	35.5	25.6	46.0	46.0
Nigeria	34.1	39.4	26.8	44.8	55.4	49.4	37.8	26.9	16.8	21.0	38.6	41.5
Senegal	16.9	20.7	10.2	20.2	27.5	18.9	14.5	9.4	6.5	17.6	19.4	19.0
Uganda	26.9	30.9	23.5	30.2	32.3	33.2	33.0	27.4	16.7	14.1	35.9	31.4
B. Wasting												
Burkina Faso	7.3	9.4	14.7	15.7	17.4	16.3	15.2	15.5	12.1	10.9	12.8	6.0
Ethiopia	5.5	8.8	5.7	7.7	11.7	7.7	4.8	6.2	4.0	14.3	12.9	7.5
Kenya	3.9	4.5	3.5	4.5	7.6	3.2	3.8	2.8	2.6	5.6	5.2	3.4
Madagascar	5.3	7.5	5.9	6.6	8.2	6.8	5.4	6.5	4.1	7.2	8.2	5.5
Nigeria	5.5	8.0	5.3	7.9	10.5	7.6	6.7	5.3	4.2	10.3	11.2	4.1
Senegal	7.3	8.9	7.3	10.0	11.0	10.5	9.3	6.4	6.2	8.2	7.1	8.5
Uganda	2.9	4.1	2.9	3.6	5.4	4.1	2.9	2.3	2.3	8.2	4.0	1.8

continued next page

Table 4 Continued

Country	Sex		Area		Wealth quintile					Age in months		
	Girls	Boys	Urban	Rural	1	2	3	4	5	<12	12 to 23	24 to 59
C. Overweight												
Burkina Faso	1.0	1.0	3.7	2.6	2.5	2.8	2.3	2.8	3.8	2.4	0.4	0.8
Ethiopia	2.2	2.0	1.7	2.2	2.5	2.3	1.8	2.4	1.3	6.7	2.9	1.6
Kenya	3.5	4.7	5.5	3.5	2.2	3.6	4.0	5.6	6.3	9.5	4.0	2.5
Madagascar	1.2	1.6	1.6	1.4	0.7	1.4	1.6	0.9	3.1	5.0	0.6	0.4
Nigeria	1.8	2.3	2.0	2.1	1.9	2.4	1.7	2.2	2.1	3.9	1.6	1.6
Senegal	2.5	2.7	1.1	0.8	1.2	0.6	0.5	1.0	1.5	6.9	2.2	1.3
Uganda	2.6	4.9	2.8	4.0	2.8	4.0	4.6	3.9	3.4	7.4	4.6	2.4

Source: UNICEF, WHO, World Bank: Joint child malnutrition estimates. The prevalence of stunting, wasting and overweight are for a year in the indicated range, which differs across countries. From Behrman and Vazquez (2021), Table 4

Table 5: VAS coverage and % of households consuming salt with any iodine (>0 ppm)

Seven project-focus countries						
Country	VAS			% consuming salt with iodine		
	2000	2010	2018	1999-2003	2008-2011	2015-2017
Ethiopia	0	84	48	28	15	86
Kenya	41	62	59	96	95	95
Madagascar	38	95	96	77	68	-
Tanzania	11	99	99	67	78	81
Uganda	0	46	33	89	91	91
Burkina Faso	10	99	99	80	92	-
Nigeria	0	91	80	94	93	-
Senegal	93	-	57	29	43	62

Source: UNICEF global databases, 2020. The percentages for salt with iodine are for a year in the indicated range, which differs across countries. From Behrman and Vazquez (2021), Table 5

Iodine deficiency can also lead to a variety of health and developmental consequences, and is especially damaging in early childhood. In their most severe form, iodine deficiency disorders (IDD) include cretinism, stillbirth and miscarriage, and increase infant mortality. Observational studies have shown that even mild deficiency is associated with a significant loss of learning ability, as it was concluded from a meta-analysis of 18 studies that IQ scores averaged about 13.5 points lower in children and adolescents with iodine deficiencies (Bleichrodt et al., 1996). Universal salt iodization has been the most widely used strategy to improve iodine intake in the population. After a dramatic and continuous growth since the early 1990s, the latest estimates indicate that 88% of the population in developing countries used salt with some iodine in 2018. East Asia and the Pacific and South Asia had the highest coverage with iodized salt at 92% and 89%, respectively. The lowest iodized salt coverage was in SSA: 76% in Western and Central Africa and 82% in Eastern and Southern Africa. Table 5 presents the shares of households consuming salt with any iodine for the seven project-focus countries (see Behrman and Vazquez, 2021, Table A.9 in the appendix for all SSA countries).

2.2.2 Child development and education

Childhood development: Table 6 presents the UNICEF Early Childhood Development Index (ECDI) for the 26 SSA countries with data. The ECDI, used as a proxy for the share of children who are developmentally on track, is based on 10 questions covering four domains: physical, social-emotional, learning and literacy-numeracy. The average percentage of three- and four-year-olds on track in SSA is 60%, which is far below the median for high-income (85%) and middle-income (81%) countries. The shares on track are higher for girls in all countries, although the gender differences may not be statistically significant in all cases. The scores in the ECDI literacy-numeracy domain are particularly low in SSA countries. For such skills to develop, two factors are key, in addition to good health and nutrition: stimulating home environments and access to early childhood care and education.

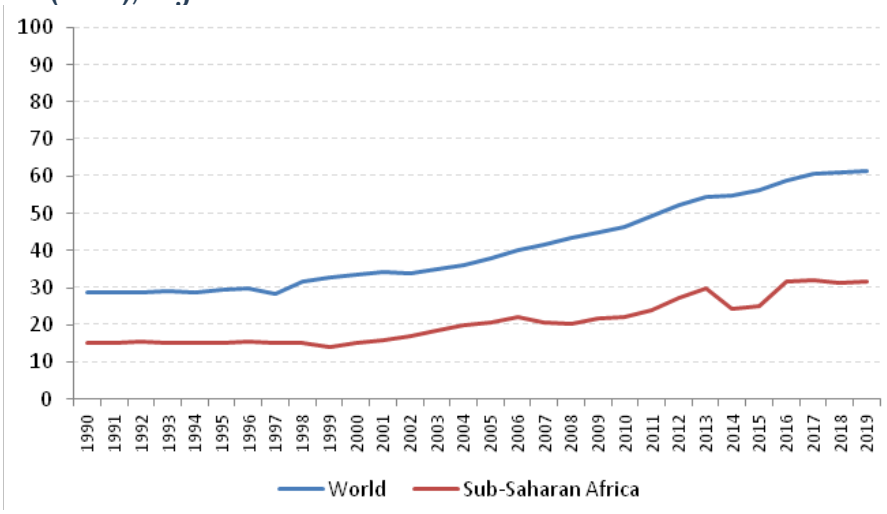
Table 6: Percentage of children aged 36-99 months, "on track"

	Total	Girls	Boys
Eastern Africa			
Burundi	39.6	45.5	33.6
Madagascar	67	68	65
Malawi	59.8	64	55.7
Rwanda	70.9	73.1	68.7
Uganda	65	65.9	64.1
Zimbabwe	70.8	73.5	68.1
Middle East			
Central African Republic	47.2	50.2	43.9
Cameroon	61.2	63.3	59.1
Dem. Rep. of the Congo	65.5	68.3	62.6
Congo	60.8	65.1	56.8
Sao Tome and Principe	54.5	55.4	53.7
Chad	32.5	34.9	30.2
Southern Africa			
Lesotho	73.1	77.7	68.1
Eswatini	64.9	66.4	63.5
Western Africa			
Benin	53.6	55.9	51.5
Côte d'Ivoire	62.8	64.8.61	
Ghana	73.7	77.6	69.9
Guinea	48.9	50.4	47.5
Gambia	67	69	65.2
Guinea-Bissau	61	65.9	55.9
Mali	61.6	63.4	59.8
Mauritania	60	61.8	58.2
Nigeria	61.2	62.2	60.2
Senegal	66.6	69.2	64.2
Sierra Leone	51.4	55	47.7
Togo	52.4	55.4	49.7

Source: UNESCO Institute for Statistics (UIS). Excerpted from Behrman and Vazquez (2021), Table 6

Early childhood education: The pre-primary gross enrollment ratio (GER), defined as the total enrolment in pre-primary education regardless of age expressed as a percentage of the population of the official age for this level of education, has increased in SSA from 15% in 2000 to 31.5% in 2019 (UNESCO Institute for Statistics - UIS, 2019), but it is still only about half the world average (see Figure 6). Behrman and Vazquez (2021) Appendix Figure A.2 country-level pre-primary GER and later school enrollment rates show a positive association between those variables. Table 7 shows the regions and income groups aggregates of the GER and the adjusted net attendance rate one year before primary school entry ages, defined as the percentage of children aged one year before the official primary school entry age that participates in one or more organized learning programmes, including programmes that offer combinations of education and care. SSA is the region with the lowest attendance rate, with only 43% of children in 2018 participating in learning programmes that help prepare them for primary school and support other domains of child well-being. In addition to the lower participation and enrollment rates, some indicators also suggest challenges regarding the quality of programmes. For example, the proportion of teachers with the minimum required qualifications in pre-primary education in SSA was 50.8% compared to 76% in Latin America and the Caribbean and 84.8% globally.

Figure 6: Gross enrolment ratio, pre-primary, both sexes (%) from BV (2021), Figure 3



Source: From Behrman and Vazquez (2021), Figure 2

Table 7: Gross enrolment ratio in pre-primary education (GER) and adjusted net attendance rate, one year before primary entry age (ANAR), by region and sex, 2018

	GER		ANAR	
	Boys	Girls	Boys	Girls
World	61.4	61.0	73.0	72.8
Sub-Saharan Africa	31.8	31.6	42.5	43.1

Source: UNESCO Institute for Statistics (UIS) Global Database, 2019 and UNICEF Global Database, 2019. Excerpted from Behrman and Vazquez (2021), Table 7

Table 8 presents the adjusted net attendance rate one year before the official primary entry age by sex, urbanization, and household wealth level for the seven project-focus countries. Behrman and Vazquez, (2021), Appendix Table A.11 shows the information for the 40 SSA countries with available data. Attendance is significantly higher in urban settings and increases markedly with the socio-economic level of the household. Location and wealth are related to the biggest gaps at the global level, but these gaps are especially apparent in SSA.

Table 8: Adjusted net attendance rate, one year before the official primary entry age by sex, area, and wealth quintile in seven project-focus countries

Country	Sex		Area		Wealth quintile					
	Girls	Boys	Urban	Rural	1	2	3	4	5	Year
Ethiopia	50.6	52.4	82.8	48.3	40.0	45.2	44.2	58.9	81.4	2016
Kenya	90.6	90.0	95.3	88.5	72.7	95.8	94.8	97.6	98.6	2014
Madagascar	60.4	58.3	75.9	55.6	40.2	50.2	60.7	78.2	91.3	2018
Uganda	73.5	71.2	86.3	69.0	46.5	65.4	76.2	86.6	94.4	2016
Burkina Faso	50.0	53.7	82.7	45.3	30.8	42.1	50.5	60.4	85.2	2010
Nigeria	61.2	59.8	78.6	48.3	24.4	46.1	67.3	83.1	92.6	2018
Senegal	29.9	26.7	43.6	18.4	18.5	21.2	28.2	32.4	48.7	2019

Source: UNICEF. From Behrman and Vazquez (2021), Table 8

2.2.3 Home environments

Diet: The WHO recommends exclusive breastfeeding during the first six months of life. An infant 0 to 6 months that is not exclusively breastfed could be at a substantially greater risk of death from diarrhea or pneumonia. Moreover, breastfeeding supports infants' immune systems and may protect them later in life from chronic conditions. After that period, infants' nutrient demands start to exceed what breastmilk alone can provide and WHO recommends that infants begin eating solid, semi-solid or soft foods. In 2019, only 44% of infants 0-5 months old were exclusively breastfed globally and 71% of infants 6-8 months old were

fed solid, semi-solid or soft foods (Table 9). Behrman and Vazquez (2021) Appendix Table A.10 presents the country trends in exclusive breastfeeding in SSA). Table 10 disaggregates the percentages of infants 0-5 months exclusively breastfed by urbanization, age, wealth, and maternal education for the seven project-focus countries. Breastfeeding decreases with infants' ages, and tends to increase with household wealth as shown in Figure 7.

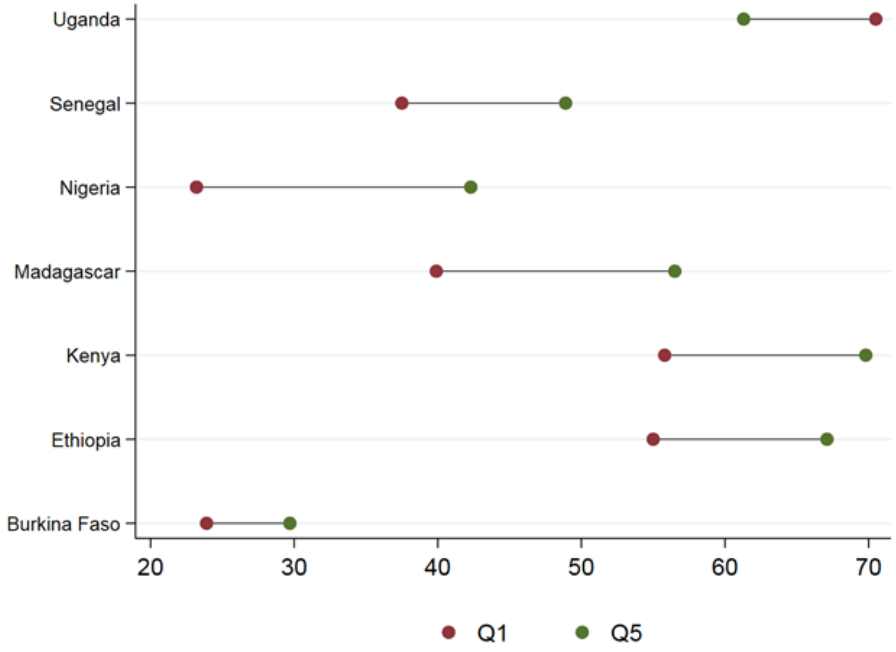
Table 9: % of infants: (i) 0–5 months old exclusively breastfed and (ii) 6–8 months old fed solid, semi-solid or soft foods, by UNICEF region, 2019

	(i)	(ii)
South Asia	57	57
East and Southern Africa	56	76
Eastern Europe and Central Asia	42	75
Latin America and the Caribbean	38	86
Middle East and North Africa	34	n/a
West and Central Africa	31	67
East Asia and the Pacific	30	83
World	44	71

Source: UNICEF global databases. From Behrman and Vazquez (2021), Table 9

Nurturing and stimulation: There is evidence of a correlation between warm and nurturing home environments and children's cognitive and socio-emotional development (Hamadani et al., 2010). Early stimulation and responsive care are associated with academic success (Engle et al., 2007). Also, home-visiting programmes aiming to improve different dimensions of home environments have shown short-term impacts on health outcomes (Olds et al., 2007) and cognitive development (Grantham-McGregor et al., 1991). Table 11 presents four indicators of home environments for the 29 SSA countries with available data: percentages of children under age five: (i) who have three or more children books; (ii) who play with two or more types of playthings; (iii) who were left alone or under the supervision of another child under 10 years old for more than one hour the last week; and (iv) the percentages of children aged 36-59 months with whom any adult household member has engaged in four or more activities to provide early stimulation and responsive care in the last three days. On average, only 2.1% have three or more children's books, 45.2% play with two or more types of playthings, 41.6% were left alone or under the supervision of another child under 10 for more than one hour the last week, and 31.7% of children aged 36-59 months had engagement with any adult household member in four or more activities to provide early stimulation and responsive care in the last three days.

Figure 7: Percentages of infants 0-5 months of age who are fed exclusively with breast milk in the fifth and first wealth quintiles from BV (2021), Figure 4



Source: From Behrman and Vazquez (2021), Figure 2

The data presented in this section suggest that, despite recent progress, the situation of preschool-age children in SSA in terms of nutritional status and access to early education and stimulation, and the wealth and urbanization gaps, implies that more investment in effective interventions to support development of pre-school-age children is needed to assure that individual and collective development potentials are not lost.

Table 10: Percentages of infants 0–5 months of age who are fed exclusively with breast milk in seven project-focus countries

Country	Year	Area		Age in months			Wealth Quintile					Maternal Education			
		Urban	Rural	0 to 1	2 to 3	4 to 5	1	2	3	4	5	No Education	Primary	Secondary	Higher
Ethiopia	2016	57.8	56.4	73.0	62.9	35.5	55.0	62.6	53.0	45.2	67.1	55.7	58.6	56.3	48.6
Kenya	2014	70.9	57.0	84.1	63.0	42.0	55.8	57.9	53.6	74.8	69.8	54.8	59.8	70.5	57.4
Madagascar	2018	51.8	50.3	73.9	54.2	23.6	39.9	49.3	51.6	59.8	56.5	42.4	52.9	n/a	n/a
Uganda	2016	65.4	65.5	82.4	68.8	42.6	70.5	69.3	66.9	57.0	61.3	67.6	66.4	63.6	59.8
Burkina Faso	2010	24.1	24.9	41.1	25.3	12.5	23.9	21.4	22.9	28.1	29.7	23.3	29.6	37.7	n/a
Nigeria	2018	35.8	24.3	38.9	29.1	17.9	23.2	20.6	27.7	34.5	42.3	20.6	24.3	38.7	43.3
Senegal	2017	45.2	40.5	63.7	37.2	24.0	37.5	42.1	41.7	43.8	48.9	37.4	53.0	45.9	n/a

Source: United Nations Children's Fund, Division of Data, Analysis, Planning and Monitoring (2020). From BV (2021), Table 10.

Table 11: Home environment

Subregion	county	% under age five		% 36-59 months		Year
		(i)	(ii)	(iii)	(iv)	
Eastern Africa	Burundi	0.1	34.9	58.2	41.9	2017
	Madagascar	2	52	25	34	2018
	Mozambique	2.8	n/a	46.6	32.5	2008
	Malawi	1.2	45.2	29.3	37.1	2014
	Rwanda	0.9	29.6	44	34.6	2015
	Somalia	n/a	n/a	79.1	n/a	2016
	Uganda	2.2	50.2	52.8	36.9	2016
	Zimbabwe	3.2	68.7	37.4	20.4	2019
Middle Africa	Central African Republic	0.7	48.5	73.7	60.7	2010
	Cameroon	4	52.5	44.3	34.4	2014
	Dem. Rep of the Congo	0.6	27.2	51.5	49.1	2014
	Congo	3.1	51.2	58.7	41.6	2015
	Sao Tome and Pricipe	5.8	64.7	62.7	15.5	2014
	Chad	0.8	40.8	46.5	47.4	2015
Southern Africa	Lesotho	2.9	57	27.6	17	2018
	Eswatini	5.9	67	38.6	16.5	2014
Western Africa	Benin	1.5	54.7	38.9	28.9	2018
	Burkina Faso	n/a	n/a	14.1	n/a	2006
	Cote d'Ivoire	1.3	45	28.7	19.9	2016
	Ghana	6.2	41.1	39.8	20.7	2011
	Guinea	0.4	32	31.4	34.2	2016
	Gambia	1.1	49.3	16.3	16.4	2018
	Guinea-Bissau	0.5	31.2	34.2	30.6	2014
	Mali	0.3	51.7	54.6	32.2	2015
	Mauritania	1.1	32.6	43.9	34.4	2015
	Nigeria	5.6	45.7	62.8	31.7	2016
	Senegal	1	23.7	29.2	27.7	2017
	Sierra Leone	2	41.1	18.9	29.9	2017
	Togo	0.5	38.1	18.5	28.7	2017

Source: UNICEF. From Behrman and Vazquez (2021), Table 11

3. Analyses of Fertility-Schooling Interactions in Sub-Saharan Africa

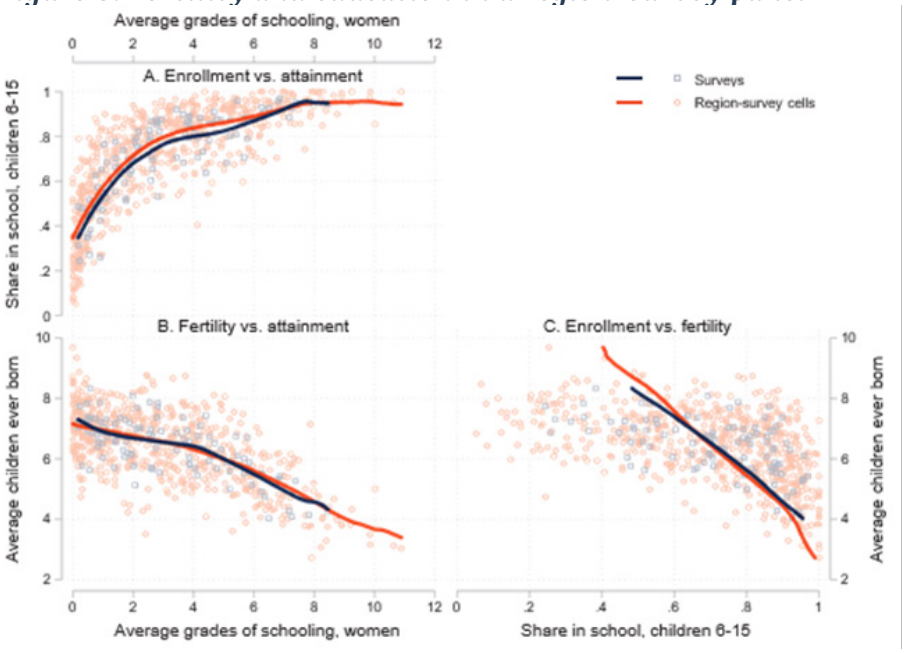
Although the analysis summarized in Section 2.1 is suggestive, it leaves several loose ends. First, cohort analogues of Figure 3, Panels A and C that consider how children's school enrollment relates to the schooling and fertility of their parents are not possible in these cross-country datasets. At any given moment, the school age range includes children with parents from many different birth cohorts. Therefore, one cannot study a parental cohort's fertility choices with their child investment choices. Second, these aggregate datasets preclude investigation into the geography of fertility and human capital change within countries, and their joint distribution within sub-national geographic units. Third, the quantity-quality framework is best interpreted as a model of the demand for surviving children, rather than children ever born, but cohort data on child survival is not readily available in aggregate datasets. Vogl's analysis now summarized addresses all three of these shortcomings.

For the analysis of cohorts, sub-national patterns, and surviving fertility, Vogl (2021) assembles a microdataset based on 103 Demographic and Health Surveys (ICF 1986-2017) in 36 SSA countries. To maintain focus on (near) complete reproductive histories, he studies the oldest respondents, ages 45-49, resulting in a sample of 83,026 women. He also analyzes school enrollment among their 112,589 children from ages 6 to 15. His analysis seeks to disentangle: (i) panel variation in country-cohort averages; (ii) panel variation in region-cohort averages within countries; and (iii) cross-sectional variation in individual outcomes within a cohort and region. Section 3.1 presents graphical evidence on the geography of fertility and schooling, and their rates of change. Section 3.2 then presents regression estimates that separate the three sources of variation. The samples reveal high levels of fertility and child mortality, and low levels of schooling. Women average 3 grades of schooling and have given birth to 6 children, of whom 1 in 5 died before the survey. Husbands average 4 grades of schooling. 7 in 10 children are enrolled in school. If parents are weighted by the number of children, mean family size is higher and mean parental schooling somewhat lower. The reduction in mean parental schooling demonstrates how differential fertility changes the distribution of childhood circumstances.

3.1 Graphical Analysis

For an initial representation of the survey data, Figure 8 describes the joint distribution of adult schooling attainment, fertility, and child schooling across surveys and survey-region cells in an analogue to Figure 3. Figure 8 plots three scatterplots with associated local linear regressions: of children's enrollment on women's schooling (Panel A), of women's fertility on women's schooling (Panel B), and of children's enrollment on women's fertility (Panel C). Unlike Figure 3, however, the enrollment rates correspond to the children of the same cohort of women whose fertility and schooling are represented in the graph. In this way, Figure 8 coherently accounts for the joint determination of child quality and quantity. Again, as noted in Section 1.3, the variables are jointly determined.

Figure 8: Fertility and education in a region-survey panel



Notes: Curves are local linear regressions with bandwidths of 1. In Panel C, share in school (on the horizontal axis) is treated as the dependent variable. Local linear regressions are weighted by the number of individual observations used to compute the dependent variable.
Source: From Vogl (2021), Figure 6

Despite its more precise intergenerational linkage than Figure 3, Figure 8 comes to largely the same conclusion. Countries and regions with more-schooled women have lower average fertility and higher school enrollment rates, and consequently, average fertility and school enrollment are negatively correlated. The local linear regressions indicate that when women from a country or sub-national region have no schooling, they tend to have seven children, of whom only one-third are enrolled in school during ages 6-15. In contrast, when women from a country or region have 8 grades of schooling on average, they tend to have four children, of whom more than 90% are enrolled. At the lowest levels of average fertility, child school enrollment approaches 100%; at the highest fertility levels, enrollments are below 50%.

The patterns in Figure 8 mix variation across space and over time between surveys. One can think of the latter source as cohort variation, since each survey captures outcomes for the cohort of women born 45-49 years before. Regression analyses model this cohort variation more explicitly with fixed effects for the year of the respondent's birth. As a first step towards describing rates of change in fertility and schooling outcomes, Figure 9 plots cohort effects from regressions of each outcome on 5-year cohort indicators and country indicators in the individual-level data. The figure aggregates respondents' years of birth into 5-year birth cohort bins to reduce clutter.

Figure 9: Cohort effects on fertility and education

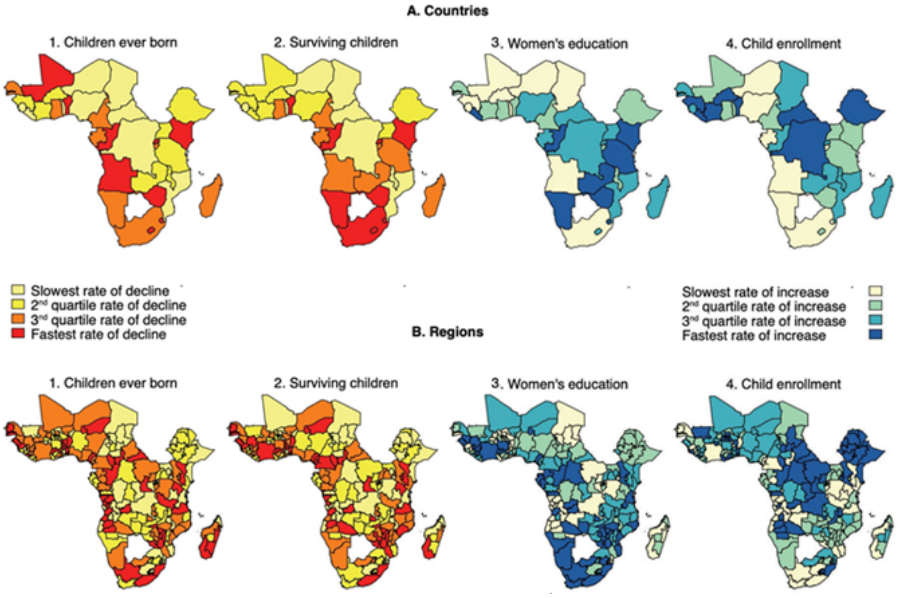
Notes: Coefficients and 95% confidence intervals on birth cohort indicators. All regressions include country-fixed effects; the school enrollment regression also includes indicators for child sex and age. Standard errors are clustered by primary sampling unit. Cohorts t={1945,1950,1955, 1960} include birth years from t to t+4. The "<1945" cohort includes birth years 1936-1944, while the "1965+" cohort includes birth years 1965-1972. All results are based on the full sample of women or children, except for husband's education, which is based on the sub-sample with data on husbands. See Vogl (2021), Table 2 for sample sizes.
Source: From Vogl (2021), Figure 7

Figure 9 shows that compared with their compatriots born in the 1940s, women born in the 1960s have fewer children and more-schooled families. In Panel A, women in the post-1965 cohort have 1.2 fewer children ever-born than women in the pre-1945 cohort, but just 0.4 fewer surviving children, a consequence of simultaneous mortality decline. Panel B evidences rapid cross-cohort growth in schooling for both women and their husbands, with the last cohort gaining more than 2.5 grades on the first. Finally, Panel C shows that children with mothers from later cohorts are more likely to go to school. This child-level model also includes indicators for the child's sex and single year of age. On average, children of the post-1965 cohort are 21 percentage points more likely to be enrolled than children of the pre-1945 cohort.

Which parts of SSA have experienced more fertility decline and have more schooling growth? Figure 10 provides preliminary evidence on this question by mapping rates of change in children ever born, surviving children, women's schooling, and children's enrollment across countries (Panel A) and regions (Panel B). The rates of change are computed with country- or region-specific regressions of the outcome on the respondent's year of birth.

The national and regional maps for fertility and women's schooling present a fairly coherent account, but the maps for child enrollment stand out. Coastal Africa has seen greater inter-cohort declines in ever-born and surviving fertility, and greater inter-cohort increases in women's schooling. Meanwhile, enrollment gains have concentrated in the interior, particularly the Democratic Republic of Congo and Ethiopia. The maps present a first indication that the drivers of enrollment gains may be different from the drivers of fertility decline. However, the rates of change in Figures 10 use different sets of birth cohorts for each country. The regressions in Section 3.2 deal with the unbalanced panel more flexibly.

Figure 10: Rates of change in fertility and human capital, Sub-Saharan Africa



Notes: Rates of change computed in country- or region-specific, individual level regressions of the outcome on the respondent's year of birth.
Source: From Vogl (2021), Figure 9

3.2 Regression Analysis

Tables 12-14 probe the patterns of Section 3.1 in a series of OLS regressions. The data set has three relevant cross-sectional units—countries, regions, and individuals—and cohort dimension. Vogl (2021) estimates a series of models with three different units of observation: survey-cohort cells, region-survey-cohort cells, and individuals. Each level of observation has benefits and drawbacks for interpretation. Therefore, using three separate models clarifies the appropriate conclusions. The cell-level analyses focus on cohort panel variation, which purges the estimates of bias from time-invariant confounders. Analysis of survey-cohort cells—effectively country-level aggregates—also minimizes risk of bias from migration, since external migration is rarer than internal. At the same time, it raises risk of bias from confounding national trends and policies. In contrast, analysis of region-survey-cohort cells within countries raises risk of bias from migration, since the DHS collects detailed information only on the respondent's *current* place of residence, but eliminates risk of bias from nationwide confounders. Meanwhile, analyses of individuals within region-survey-cohort cells raise concerns about individual-level confounders but are useful for understanding the differential fertility and its consequences.

Table 12: Adult education and fertility in Africa

	Cells						Individuals	
	Survey/cohort				Region/Survey cohort		Ever-married women	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Children ever born								
Women's education	-0.282**	-0.458**	-0.262**	-0.298**	-0.223**	-0.197**	-0.162**	-0.130**
	(0.038)	(0.066)	(0.046)	0.054)	(0.029)	(0.035)	(0.004)	(0.004)
Husband's education		0.176**		0.051		-0.041*		-0.047^^
		(0.064)		(0.035)		(0.019)		(0.004)
B. Surviving children								
Women's education	-0.113**	-0.249**	-0.229**	-0.274	-0.157**	-0.143**	-0.095**	-0.086**
	(0.030)	(0.052)	(0.052	(0.057)	(0.024)	(0.027)	(0.003)	(0.004)
Husband's education		0.137**		0.062		-0.020		-0.014**
		(0.049)		(0.034)		(0.017)		(0.003)
N	645	645	645	645	3733	3733	74,485	74,485
Country FE			X	X				
Cohort FE			X	X				
Region FE					X	X		
Survey x cohort FE					X	X		
Region x survey x cohort FE							X	X

Notes: Brackets contain standard errors clustered by country (country-survey-cohort analysis), region (region-survey-cohort analysis), or primary sampling unit (married woman analysis). Cell analyses are weighted by the number of observations in the cell.

Source: Vogl (2021), Table 3

The outcomes and covariates vary by table. Table 12 is a companion to Figure 8, Panel B, with fertility as the outcome and women's and their husbands' schooling as covariates. Table 13 complements these results by investigating desired and unwanted fertility. Table 14 is a companion to Panel A, with the same covariates but children's school enrollment as the outcome. Finally, Table 15 pairs with Panel C, with enrollment as the outcome and fertility as the covariate (Hoddinott, 2013b).

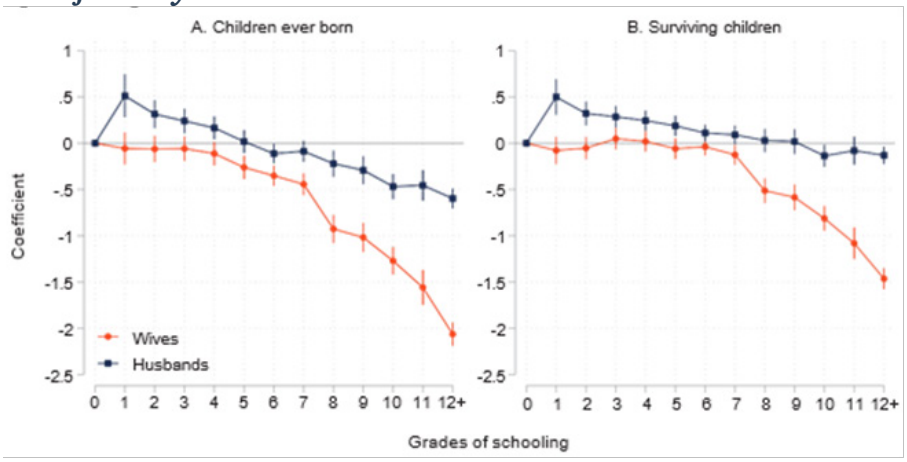
In Table 12, women's schooling has a consistently negative association with both gross and net fertility, while men's schooling shows more varied results. Columns 1-4 use survey-cohort cells. For comparison with the pooled scatterplots and local linear regressions in Figure 8, columns 1 and 2 omit all fixed effects. Across survey-cohort cells with no fixed effects or covariates, an extra grade of women's schooling is associated with 0.29 fewer children ever-born per woman and 0.11 fewer surviving children per woman (column 1). Controlling for husbands' schooling strengthens the co-efficient on women's schooling because husbands' schooling is positively associated with both gross and net fertility (column 2). With the addition of country and cohort fixed effects (columns 3-4), the co-efficients on husbands' schooling weaken and become statistically insignificant, while the co-efficients on women's schooling stabilize at 0.2-0.3 fewer children for each grade of schooling. These results are consistent with the cohort estimates in the cross-country analysis (Vogel, 2021, Table 1, Panel B, column 6).

Looking at regional cohorts within countries, columns 5-6 find somewhat smaller associations but still a robustly negative co-efficient for women's schooling. Here, a one-grade increase in women's average schooling predicts a 0.20-0.22 reduction in children ever-born and a 0.14-0.16 reduction in surviving children. The co-efficient for men's schooling is now negative but statistically significant only for gross fertility. Overall, columns 3-6 suggest that rising women's schooling reduces fertility, while rising men's schooling has weaker effects of ambiguous sign. Whether the cross-country or within-country estimates are preferred depends on the magnitude of bias stemming from time-varying country-level confounders (favouring within-country estimates) and internal migration (favouring cross-country estimates).

For comparison with the between-cell results, columns 7-8 analyze individual couples (married women and their husbands) within cells, finding negative associations between schooling and fertility, even for husbands (Behrman et al., 2009). Within a region-survey-cohort cell, a woman with one more grade of schooling than her peer tends to have 0.16 fewer children ever-born and 0.10 fewer surviving children. Husbands' schooling has a weaker association with fertility, -0.05 for children ever-born and -0.01 for surviving children; therefore, the co-efficient on women's schooling falls only 9-20% after adjusting for husbands' schooling.

These linear estimates mask some non-linearities, which Figure 11 demonstrates by replacing grades of schooling attainment with a vector of attainment indicators. The reference category is zero grades of schooling, each subsequent point estimate and 95% confidence interval corresponds to the difference in expected fertility between that reference category and the specified alternative. For women, both ever-born and surviving fertility are non-decreasing in schooling, although the relationships are mostly flat through primary school and steepen only after six grades of schooling. For husbands, the relationship is hump-shaped, consistent with Vogl (2016), who argues that income effects dominate at low levels of human capital. Because more and less educated adults differ in myriad ways, these patterns do not describe causal effects of schooling but instead its joint distribution with fertility in the cross section.

Figure 11: Non-linear within cell relationship of parental schooling with fertility



Notes: Point estimates and 95% confidence intervals based on standard errors clustered by primary sampling unit. Sample includes 74,485 ever-married women. Each panel contains results from a separate regression; both regressions include survey-by-cohort-by-region fixed effects. Cell analyses are weighted by the number on observations in the cell.
Source: From Vogl (2021), Figure 10

Irrespective of underlying causal mechanisms, this joint distribution matters because it influences the composition of the next generation. Vogl (2016) details how, in the not-too-distant past, more-schooled parents had more children, mechanically raising the share of the next generation with more-schooled parents. In more recent data, the opposite pattern holds, consistent with the results here. Thus, as the fertility transition proceeds, the average child becomes relatively more disadvantaged in terms of mothers' schooling.

The theoretical framework summarized in Section 1.3 construes these patterns as reflecting the demand for children. But they may alternatively reflect other proximate determinants of fertility that are negatively correlated with schooling, such as access to or knowledge of contraception and other family planning services. For example, more-schooled women are less likely to become pregnant while using contraception (Bongaarts, 2010). At the country level, measures of desired fertility are highly correlated with the actual total fertility rate, in both levels and changes, although slightly less in SSA than other LMIC regions) (Lam, 2011; Gunther et al., 2016; Pritchett, 1994). The relationship between desired and realized fertility suggests a role for demand-side factors.

Vogl (2021) examines this issue using DHS data on women's reported ideal fertility. He finds that increases in women's schooling are associated with declines in desired fertility and excess fertility, although the results are somewhat weaker for excess fertility. In the survey-cohort panel, net of country and cohort fixed effects, a single grade increase in women's average schooling predicts a reduction of 0.16 in the average ideal number of children and of 0.10

in the average number of unwanted children, although the latter result is only marginally significant. In contrast, increases in average husbands' schooling are associated with lower desired fertility (by women) and higher excess fertility. The opposite-signed dependence of excess fertility on the schooling of women and their husbands suggested that intra-household bargaining may be important. That more-schooled couples have lower desired fertility and lower unwanted fertility mirrors classic work by Bongaarts (2003). In the absence of ex-post rationalization, these gradients imply that more-schooled families have lower fertility targets and are more effective at meeting those targets. An alternative interpretation is that more-schooled women are more likely to rationalize their fertility outcomes ex post.

The conceptual framework summarized in Section 1.3 suggests that investments in children are key to understanding the above fertility patterns. In this vein, Table 13 includes the same regression models as Table 12, but with children's school enrollment as the outcome. The literature on inter-generational schooling mobility suggests that parents' schooling is likely to be positively associated with children's schooling in the cross section (Alesina, 2021). Reviewing a wide range of evidence from industrialized countries, Holmlund et al. (2011) conclude that a causal effect of parents' schooling on children's schooling accounts for a small but non-negligible part of this association. Studies that examine relations between the schooling of adult twins and their children, which control for all the common family background and genetic factors shared by the twins, tend to find effects of fathers' but not mothers' schooling (similar effects are found for China (Hu , 2020), while cohort panel studies (for example examining compulsory schooling reforms) tend to find effects of mothers' but not fathers' schooling, at least in initially disadvantaged families. The cell-level analysis here exploits cohort panel variation in a sample of disadvantaged families, suggesting that growth in women's (but perhaps not men's) attainment may predict growth in children's enrollment.

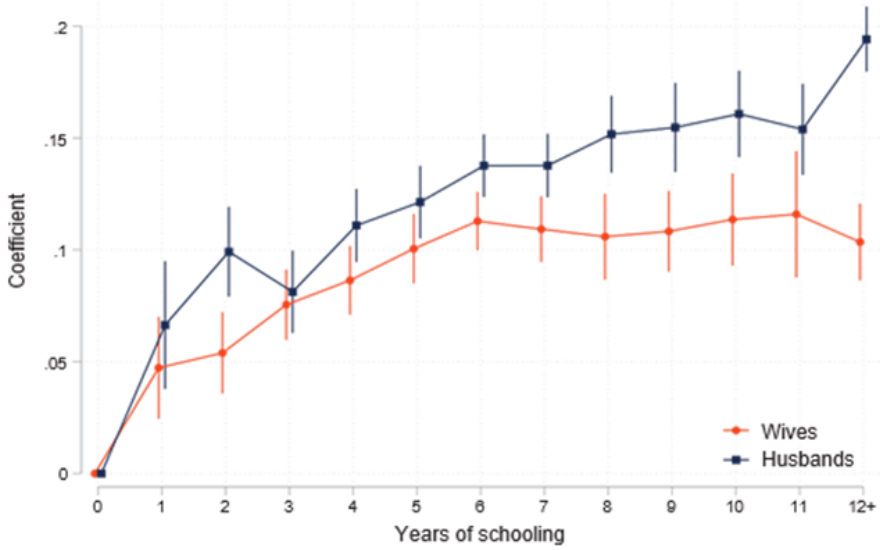
The cell-level estimates are not consistent with this hypothesis. Although the pooled survey-cohort estimates indicate a positive association of women's average schooling with children's enrollment rates (column 1), the inclusion of country- and cohort-fixed effects eliminates the association (column 3). At the country level, cross-cohort gains in women's schooling are not associated with cross-cohort gains in children's school enrollment. The within-country analysis of regional cohorts resurrects an apparent effect of women's schooling (column 5), but that effect becomes weaker and insignificant upon the inclusion of husbands' schooling (column 6). In fact, across all regression specifications that include it, husbands' schooling is consistently positively related to child enrollment. Overall, columns (3)-(6) offer limited evidence that mothers' schooling boosts children's schooling; if such an effect exists, it appears to reflect largely the benefits of having a more-schooled spouse. At the same time, the data display a robust cross-sectional association of parental schooling with child schooling, evident for both mothers and fathers. Within cells, a one-grade increase in parental schooling is associated with a 1-2 percentage point increase in child enrollment, depending on the specification and the sex of the parent (columns 5-6). Figure 12 plots year-by-year co-efficients and finds that the relationship flattens considerably above 6 years of schooling for mothers and to some extent for their husbands (Gertler, 2014). This pattern contrasts with Figure 11, which found that the within-cell relationship for fertility is relatively flat below 6 years of schooling and steep thereafter.

Table 13: Adult schooling and child (6-15) enrollment in Sub-Saharan Africa

	Cells						Individuals	
	Survey/cohort				Region/Survey cohort		Children	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Women's schooling	0.066**	0.027**	0.004	-0.019	0.013**	0.007	0.019**	0.010**
	(0.007)	(0.013)	(0.007)	(0.011)	(0.004)	(0.004)	(0.001)	(0.001)
Husband's schooling		0.037*		0.032**		0.009**		0.014**
		(0.014)		(0.009)		(0.004)		(0.001)
N	638	638	638	638	3620	3620	102,732	102,732
Country FE			X	X				
Cohort FE			X	X				
Region FE					X	X		
Survey x cohort FE					X	X		
Region x survey x cohort FE							X	X
Child covariates							X	X

Notes: Outcome is school enrollment in the current or most recent academic year. Each coefficient is from a separate regression. Brackets contain standard errors clustered by country (country-survey-cohort analysis), region (region-survey-cohort analysis), or primary sampling unit (child analysis). Cell analyses are weighted by the number of observations in the cell, Child covariates include age and sex indicators. *p<0.05; **p<0.01
Source: Vogl (2021), Table 5

Figure 12: Non-linear within-cell association of parental education with child enrollment



Notes: Point estimates and 95% confidence intervals based on standard errors clustered by primary sampling unit. Cell analyses are weighted by the number of observations in the cell. Sample includes 102,732 children aged 6-15 from the Demographic and Health Surveys. Model includes survey-by-cohort-by region fixed effects, and indicators for child age and sex.
Source: From Vogl (2021), Figure 12

This panel null results for enrollment raise questions about whether the negative association between women's fertility and children's enrollment, observed in Figure 8 Panel C, survives the inclusion of location-fixed effects. Table 14 finds that it does not. Net of location and cohort-fixed effects, gross fertility is unrelated to enrollment (Panel A, columns 3 and 5), while net fertility is positively related to enrollment (Panel B, columns 3 and 5). Stated differently, investments in children do not accompany fertility decline. Conditioning on average women's and men's schooling attainment only serves to strengthen this conclusion (columns 4 and 6). Within-cell estimates also point to no clear relationship between sibship size and enrollment (columns 7-8), consistent with earlier estimates for SSA (Vogl, 2016).

Table 14: Fertility and child (6-15) enrollment in Africa

	Cells						Individuals	
	Survey/cohort				Region/Survey cohort		Children	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Children ever born								
Number of children	-0.105**	-0.037*	0.007	0.008	0.005	0.010**	-0.007**	-0.0007
	(0.020)	(0.017)	(0.012)	(0.012)	(0.003)	(0.003)	(0.001)	(0.0008)
B. Surviving children								
Number of children	-0.087*	-0.018	0.029*	0.034*	0.008*	0.012*	-0.0009	0.0032**
	(0.034)	(0.024)	(0.012)	(0.014)	(0.004)	(0.004)	(0.0009)	(0.0009)
N	638	638	638	638	3620	3620	102,732	102,732
Country FE			X	X				
Cohort FE			X	X				
Region FE					X	X		
Survey x cohort FE					X	X		
Region x survey x cohort FE							X	X
Child covariates							X	X
Women's/husbands' schooling				X		X		X

Notes: Outcome is school enrollment in the current or most recent academic year. Each co-efficient is from a separate regression. Brackets contain standard errors clustered by country (country-survey-cohort analysis), region (region-survey-cohort analysis), or primary sampling unit (married woman analysis). Cell analyses are weighted by the number of observations in the cell, Child covariates include age and sex indicators. *p<0.05; **p<0.01
Source: Vogl (2021), Table 6

3.3 Interpreting the Estimates with the Help of Previous Research

Analyses of levels and changes in adult schooling attainment, fertility, and child school enrollments across and within countries yield several insights into SSA's demographic and schooling exceptionalism. Across countries, shortfalls in women's schooling are consistent with two-thirds of SSA's 2.3-child fertility gap relative to the rest of the world. Countries with more-schooled women exhibit lower fertility, and fertility falls over time as older, less-schooled women are replaced by younger, more-schooled women. The primacy of female schooling in explaining SSA's demographic exceptionalism is consistent with earlier claims that stalled progress in female schooling accounts for stalled fertility decline in many African countries (Kebede et al., 2019). Within Africa, a look across space seems to suggest that the continent's fertility and human capital patterns fit Section 1.3's quality-quantity framework well, but panel analyses dispel this impression. Cross-cohort gains in women's schooling, though associated with fertility decline, do not robustly predict increases in children's school enrollment. Partly as a result, countries and sub-national regions with greater declines in fertility do not exhibit greater increases in school enrollments. These results seem difficult to square with Section 1.3's conceptual framework, as most drivers of fertility decline in that model also increase investments in children.

From an empirical perspective, results from twin births make the de-coupling of schooling gains from fertility decline less surprising. Twin births increase family size but are unrelated to children's schooling in SSA (Alidou, 2019). Since twinning is plausibly outside the scope of parental decision making, these findings seem to refute a negative causal effect of child quantity on child quantity, and perhaps the quality-quantity trade-off altogether. Vogl (2021) claims that two issues complicate this interpretation, however. First, mothers of twins tend to have different socio-economic status and different health than mothers of singletons, violating the exogeneity assumption necessary for a causal interpretation (Bhalotra and Damian, 2019). Second, the logic of the quality-quantity trade-off in Section 1.3 is that both variables are endogenous. It is meant to predict cross-price effects, not the causal effect of exogenously manipulating an endogenous variable. How parents plan their fertility and child investment, given prevailing prices and opportunities, may differ from how they react to a surprise child after making those plans.

From a theoretical perspective, one way out of the quandary is to attribute fertility decline to changes in couples' preferences. In one version of this mechanism, the drivers of fertility decline (e.g., women's schooling, family planning programmes) increase the weight women and men place on their own consumption relative to the combined quality and quantity of their children. In another version, these same drivers increase female bargaining power. If women have higher preferences for own consumption than men, then the shift in bargaining power effectively raises the weight couples place on their own consumption. Such a difference in preferences may reflect the myriad ways that women face greater burdens of childbearing and parenthood, including their own health. Either explanation would on its own lead to simultaneous decreases in fertility and investment in children. However, if they act in tandem with other mechanisms in the conceptual framework, these preference or power-based mechanisms can effectively decouple fertility and child investment.

Rising women's schooling is clearly linked with declining fertility, and the link may be mediated by ideational change or shifts in bargaining power. Microeconomic studies in Africa, relying on a range of study designs, find that this link at least partly reflects an effect running from schooling to fertility. Difference-in-differences analyses in Nigeria and Uganda rely on programmes promoting primary schooling. In Nigeria, a universal primary schooling programme raised schooling attainment and reduced childbearing through age 25 among exposed girls (Osili, 2008). In Uganda, the elimination of primary school fees raised attainment and reduced teenage fertility among exposed girls, without clear evidence of catchup in early adulthood (Keats, 2018). Experimental evidence from Kenya corroborates these results, with a primary school subsidy reducing both dropout and teenage fertility (Duflo et al., 2015). Regression discontinuity evidence from Kenya and experimental evidence from Ghana extend these results to the secondary level. In Kenya, girls just above a test score cut-off for secondary school admission obtained more schooling and experienced fewer teenage births than those just below (Ozier, 2018). In Ghana, assignment to a secondary school scholarship raised schooling attainment and reduced pregnancies through age 28 (Duflo et al., 2021).

Although none of these studies can follow women to the end of the reproductive period, the persistence of fertility effects through the mid-20s in some studies suggests that the interventions are doing more than mechanically reducing risk of pregnancy by keeping them in school. The elimination of primary school fees in Uganda raised contraceptive use, implying deliberate actions that prevent pregnancy (Keats, 2018). More contraceptive use may reflect decreased demand for children or increased contraceptive knowledge. In Sierra Leone, however, an expansion in primary school access raised contraceptive use and reduced ideal family size among exposed women (Mocan and Cannonier, 2012). Cohort declines in ideal family size in Malawi, Uganda, and Ethiopia also coincided with the onset of universal primary schooling (Behrman, 2015). However, the random assignment of secondary school scholarships in Ghana did not significantly affect desired fertility (Duflo, 2021). Correlational evidence reinforces an interpretation that goes beyond keeping girls in school. Fertility is more negatively associated with measures of women's schooling that incorporate both years of schooling and literacy than it does with schooling alone (Kaffenberger, 2021).

Whether these changes in desired fertility reflect changes in couples' preferences or changes in optimal fertility under fixed preferences is not clear. But preference- or bargaining-based explanations are plausible. The Sierra Leone study also finds reductions in domestic violence (Mocan and Cannonier, 2012). A randomized controlled trial of a secondary school scholarship programme in Kenya finds that the programme increased young women's secondary enrollment and decreased their stated acceptance of domestic violence and political authority (Friedman, 2016).[73] Both sets of findings are consistent with schooling raising women's autonomy.

Evidence indicates that the resolution of spousal differences in desired fertility, for example through bargaining, matters for fertility in SSA. SSA men tend to report higher desired fertility than SSA women (Bankole and Audam, 2011; Doepke and Tertilt, 2018). Two randomized controlled trials in Zambia demonstrate how these disagreements shape family planning behaviour and reproductive outcomes. One randomized whether women were

given access to contraception alone or with their husbands (Ashraf et al., 2013). Women with sole access, free of spousal interference, were more likely to take up contraception. Another randomized the provision of information on maternal mortality risk to wives and husbands (Ashraf et al., 2020). The intervention reduced realized and planned fertility regardless of which member of the couple received the information. However, the gender of the recipient affected beliefs and inter-spousal transfers. When husbands received the information, both members of the couples reported higher perceived risks, and inter-spousal gifting did not change. When wives received the information, husbands did not update their risk beliefs, and gifts from the wife to the husband increased. The spousal asymmetries in both studies suggest a role for bargaining.

These Zambian programmes raise a broader point about the role of family planning programmes in fertility decline. Economists and demographers long disagreed about the effectiveness of family planning programmes that increase access to contraceptives without changing the demand for children (Pritchett, 1994). In practice, however, many family planning programmes combine provision of contraceptives with persuasion about the purported benefits of smaller families (Bongaarts, 2020), and a large body of empirical work—including a controlled experiment in Ghana (Debpuur et al., 2002)— suggests that such programmes do reduce fertility, for better or worse (Miller et al., 2016). Few studies of family planning programmes examine the quality-quantity linkages discussed in Section 1.3. Outside of Africa, in the widely cited Matlab family planning experiment in Bangladesh, exposure to family planning reduced fertility among women and raised schooling attainment among their children (Meghir, 2023). But the Bangladeshi context poses markedly different constraints on fertility than the African context. Perhaps most notably, population density has been at least 25 times higher in Bangladesh than in SSA throughout the post-1950 period (UNDESA, 2019). Land abundance may reduce child costs and schooling returns. Within Africa, no study examines the question exactly, but related research on user fees for maternal and child health services is relevant. In South Africa, the elimination of these fees led to lower fertility among women and higher schooling among their children. Still, many questions remain open on how the supply side of family planning affects human capital.

The supply side of schooling provides another way to break the negative correlation between fertility decline and child investment growth. In recent decades, many African countries have sought to expand access to schooling by eliminating school fees (UNICEF, 2009) and constructing new schools (Theunyck, 2009). Section 1.3 discussed the substitution effect from the first of these policies—decreasing the price of schooling—in which parents decrease fertility and increase schooling per child. The mapping of the second policy—school construction—to the conceptual framework—is less clear. If new schools are free, they can be seen as increasing children's human capital endowment (q), which would increase fertility. In this sense, enrollment gains from expansion in the supply of schools can push back against fertility decline. Here again, the abundance of land may play an important role; schooling rises with access, but with little consequence for the fertility calculus. This view would argue that other forms of child investment, for example in the form of nutrition or health, might be more likely to rise as fertility falls. But the de-coupling of school enrollment remains relevant to schooling and population policy.

4. Costs-of-Inaction in Terms of Lost Future Income of Not Investing Sufficiently in Early Life Human Capital in SSA and Losses Due to COVID-19 Pre-school Shutdowns in SSA

4.1 Evidence on Long-Term Impacts

Behrman and Vazquez (2021) briefly summarize empirical evidence on long-term impacts on adult human capital and earnings of three interventions to support human capital development of children of pre-school ages: nurturing care through age two through home visits, nutrition before age two, and pre-school programmes generally for ages three to five. Studies following-up children to learn about the long-term impacts in adulthood are scarce, particularly in developing countries and especially so in SSA.

Home visits: Gertler et al. (2014) estimate the casual effects on earnings of a programme that gave stimulation through home visits to undernourished toddlers living in poverty in Kingston, Jamaica. The study enrolled 129 stunted children aged 9 to 24 months who were randomly assigned to stimulation (or nurturing care) interventions, macronutrient interventions, both or a control group. The stimulation intervention consisted of two years of weekly one-hour play sessions at home, designed to improve mother-child interactions and the quality of parenting. They find that average earnings at age 22 were 25% higher for the simulation treatment group than for the control group.

Nutritional programmes: Most studies on impact of nutritional programmes in LMICs are on fairly short-term effects, usually after one-three years. There are, however, a few studies on longer-term impacts on human capital and on adult labour market outcomes that Behrman and Vazquez (2021) review. Behrman and Vazquez (2021) summarize such studies of interventions, and then studies of the impact of stunting or retarded linear growth.

Interventions and long-run human capital: Maluccio et al. (2009) estimate the impact of community randomly-assigned exposure (intent-to-treat) to protein-enhanced nutritional supplements on adult human capital. They followed-up in 2002-04 on 1,471 individuals who participated in a nutritional-supplementation trial in Guatemala in the late 1960s and early to mid-1970s when they were less than seven years of age. These persons were traced as adults between 25 and 42 years of age. They find increases of 1.2 schooling grades completed for women and about one quarter Standard Deviation on standardized reading comprehension and non-verbal cognitive ability tests for both women and men a quarter of a century after the supplements for those who were exposed to the programme for their entire first two-three years of life.

Nandi et al. (2020) evaluate the effect of India's Integrated Child Development Services (ICDS), a national programme of supplementary nutrition and health services that is the largest programme of this type in the world, on schooling attainment for young and middle-age adults. Using national survey data from 109,041 households in 2005–6 and employing age-state and village or city-ward fixed-effect regressions, they find that

non-migrant 15- to 54-year-old men and 15- to 49-year-old women who were exposed to an ICDS centre during their first three years of life completed 0.1–0.3 more grades of schooling than those who were not exposed, with stronger effects for women than for men.

Field, Robles and Torero (2009) examine the effect of repeated distribution of prenatal iodine supplementation in several districts of Tanzania on school progression 10 to 14 years later. The intervention began in 1986 in the most affected districts of the country and continued until the mid-1990s. In the 25 treatment districts, all women of child-bearing ages were targeted to receive ionized oil capsules once every two years. The actual coverage rate across all districts and years was 64% on average. They used regression analysis with district-fixed effects to estimate the effect of programme participation on grade attainment. Their findings suggest that adequate maternal iodine in utero is associated with 0.35 years of additional schooling on average for their children. This result was driven by the sub-sample of girls (0.59 years). When district-level coverage rates were incorporated, the effect of supplementation rose to 0.56 years on average and 0.82 years for girls. The gender difference may be due to sex-specific sensitivity to iodine deficiency in utero.

In addition to interventions, other exogenous circumstances such as weather and market conditions during early childhood have been shown to have long-run impacts on human capital in LMICs. Behrman and Vazquez (2021) do not review these in general but note one example from SSA related to a different form of adult human capital, mental health. Adhvaryu, James and Anant (2018) show that psychological well-being in adulthood varies with circumstances in early life. Combining a time series of real producer prices of cocoa with a nationally representative household survey in Ghana, they find that a one-Standard Deviation rise in the cocoa price in early life decreases the likelihood of severe mental distress in adulthood by 3 percentage points (half the mean prevalence) for cohorts born in cocoa-producing regions relative to those born in other regions.

Interventions and earnings: Hoddinott et al. (2008) estimate the effect of exposure to a protein-enhanced nutritional supplement in early childhood in Guatemala on incomes more than 25 years later using data on 1,424 individuals who participated in the same nutritional supplementation trial as studied in Maluccio et al. (2009). Participation in the programme before age three years was associated with higher hourly wages, but only for men. Exposure to the nutritional supplementation from zero to two years increased average wage rates by 46%. Note that the implications together of these two studies using these Guatemalan data include that: (1) the human capital impact on earnings is not necessarily through schooling attainment, which indeed was not significantly affected for males, but through learning as measured by cognitive tests; and (2) the earnings' impacts of early life human capital investments are likely to depend on the nature of labour markets when children become adults, which may differ for different demographic groups, in this case for males versus females apparently because of strong gender differences in occupations.

The Jamaican programme described above regarding home visits also had a macronutrient element in which households were provided with regular supplements. Gertler et al. (2014) report no significant effects of those macronutrients on earnings at age 22. This contrast with the Guatemalan results may, however, be due to the different

age ranges of the children (the median age at which the Jamaican intervention was initiated was 17 months, which is near the end of the period of sharp growth retardation in countries with high undernutrition (Victora et al., 2010)46 and that the supplements were not delivered to the children but to their families where they probably were shared with other household members.

Retarded linear growth and human capital and economic outcomes: Alderman, Hoddinott and Kinsey (2006) investigate the impact of pre-school malnutrition on subsequent human capital formation in rural Zimbabwe. They use a maternal fixed effects—instrumental variables estimator with long-term panel data with civil war and drought shocks to identify differences in pre-school nutritional status between siblings. Greater pre-school height-for-age is associated with more completed grades of schooling, and increased young-adult height. They note that had the median pre-school child in their sample had the stature of a median child in a developed country, by adolescence she would have completed an additional 0.85 grades of schooling and would be 3.4 cm taller.

Hoddinott et al. (2013a), using the same Guatemalan sample as above, estimate relations between early life height-for-age z scores (HAZs) and stunting at age two years and adult human capital, marriage, fertility, health, and economic outcomes using instrumental variables, including the experimental allocation of nutritional supplements to control for the behavioural choices determining early life nutritional status. A one Standard Deviation increase in HAZ was associated with more schooling (0.78 grades) and higher test scores for reading and non-verbal cognitive skills (0.28 and 0.25 SDs, respectively), increased household per capita expenditure (21%) and lower probabilities of living in poverty (10 percentage points). Conversely, being stunted at two years was associated with less schooling, lower test performance, lower household per capita expenditure, and increased probabilities of living in poverty.

Pre-primary programmes: Once again, most of the available studies are of fairly short-run impacts of pre-primary programmes, including, for example, a randomized controlled trail for an experimental pre-primary teacher training programme in Ghana that suggests some promising impacts on children at least in the short-run (Wolf et al., 2019).

The Perry Pre-school Programme (PPP) is a well-known, probably the best known, pre-primary programme evaluation. PPP randomly assigned pre-school-age children to treatment and control groups, followed them into adulthood and has been extensively evaluated. The PPP identified short- and long-term effects of high-quality pre-primary education for children living in poverty. A sample of 123 low-income African-American children was identified in Michigan, USA and 58 of them were randomly assigned to a programme group that received intensive services delivered by well-trained staff. The remaining 65 were in a control group that received no programme. The project collected data on both groups at ages 3 to 11, 14, 15, 19, 27, and 40, with a missing data rate of only 6% across all measures. Different studies analyzing these data find positive effects on earnings at age 40, suggesting that participants earned 13%-14% more than they would have otherwise (Manning and Patterson, 2006; Garcia et al., 2020).

4.2 The Costs of Inaction

Behrman and Vazquez (2021) build on the literature to illustrate the economic rationale of early childhood development investments by simulating the Cost of Inaction (COI) of the three interventions discussed in the previous section. The COI is the net economic benefits foregone for not investing in specific early-childhood programmes. Potential future benefits of undertaking an ECD intervention affecting a certain number of children are discounted, added, and the total costs of the intervention are subtracted (Behrman et al., 2020).

The fact that nutrition and early stimulation programmes can increase adult productivity has driven different economic evaluations in terms of the estimation of benefit-cost ratios. Hoddinott et al. (2013b) use conservative estimates of the impact of stunting on earnings from Hoddinott et al. (2013a) together with country-specific projections regarding future labour markets and costs of reducing stunting to estimate benefit-cost ratios for stunting reductions in 17 countries in Asia and SSA with high prevalence of undernutrition. Among the included SSA countries, their estimated benefit-cost ratios are 3.8 for the Democratic Republic of Congo and over 10.0 for Ethiopia, Kenya, Madagascar, Nigeria, Sudan, Tanzania and Uganda. Engle et al. (2011) simulate that the potential long-term economic effects of increasing pre-school enrolment to 25% or 50% in every low-income and middle-income country has a benefit-to-cost ratio ranging from 6.4 to 17.6, depending on pre-primary enrolment rates and discount rates. The COI is closely related to benefit-cost ratios but also incorporates the number of children not yet covered by the programme being evaluated, and thus the COI is larger, all else equal, the larger the number of uncovered children prior to the initiation of the programme.

Methodology: The Behrman and Vazquez (2021) general model follows a common approach to monetize the benefits of social programmes increasing human capital through their impact on earnings over the life cylce. In the parentheses in Equation (3), the expected additional earnings, adjusted by age-specific survival and employment probabilities, are discounted and summed over the years in which income is expected to be affected and compared to the per child programme cost for children in the programme in each country.

$$COI_i = \left(\sum_{j=a}^{t+a} \frac{PCI_{ij} \times i^m \quad \times s_{ij}^m \times e_{ij}^m}{(1+d)^j} - c_i \right) \times {N_i}^m \times {n_i}^m$$
$$+ \left(\sum_{j=a}^{t+a} \frac{PCI_{ij} \times i^f \quad \times s_{ij}^f \times e_{ij}^f}{(1+d)^j} - c_i \right) \times {N_i}^f \times {n_i}^f \qquad (3)$$

Where *t* is the span of time considered to capture benefits (i.e, the working life), *a* is the number of years after the intervention when children enter the labour market, *d* is the discount rate, *i* is the intervention-specific impact (proportional increase) in individual earnings due to the programme, *s* is the survival probability, *e* is the employment rate, *N* is the total population

in the intervention-specific age group, *n* is the additional coverage, *PCI* is the gross domestic product per capita expressed in constant international dollars per person (purchasing power parity or PPP), *c* is the intervention-specific cost per child, the index *j* indicates the year since the intervention, and the index *i* indicates the country. The first term in the numerator corresponds to boys (males, *m*) and the second to girls (females, *f*).

In estimations by Behrman and Vazquez (2021), they considered a discount rate (*d*) of 3%, a starting age for work of 18, and a work time horizon (*t*) of 45 years for all countries. A relatively low discount rate of 3% is widely used in *ex-ante* economic evaluations of social programmes to discount benefits that accrue in the long-term back to the present, and the assumptions for the starting age and time horizon for work reflect average observed behaviours. Employment rates are ILO-modelled estimates, the survival probabilities are UN data, and gross domestic product per capita are the IMF's longest projections.

The assumptions on the impacts of programmes on adult earnings are based on the empirical causal investigations on long-term effects discussed in the previous section. However, since those rigorous evaluations are based on high-quality small-scale pilots, Behrman and Vazquez (2021) adjusted downwards the estimates found in the experimental studies to address concerns about the external validity of those estimates for scaled-up programmes of (probably) lower quality. To be conservative, in the base scenario of their simulations Behrman and Vazquez (2021) take about half of the point estimate for each intervention: for the COI of not extending home-visit programmes they consider an impact on adult earnings (*i*) of 15%, for nutritional programmes they use 23%, and for pre-primary programmes they consider an 8% increase in earnings because of the intervention.

Regarding the number of children affected by the intervention, in the case of nutritional programmes Behrman and Vazquez (2021) simulate the COI of not implementing these programmes for all stunted children under two years. For home visits, Behrman and Vazquez (2021) consider as the target group children aged 3 to 5 years that have a delay in their development.[5] For pre-primary programmes, aligned with SDG Target 4.2, Behrman and Vazquez (2021) simulate the COI of not reaching universal coverage for children 3 to 5 years. Finally, for per child costs (c) their estimates assume an average cost of US$ 102 for nutritional programmes based on the estimates on the budgetary costs of scaling-up nutritional interventions in high-burden SSA countries (Bhutta, 2013). In the case of home visits and pre-primary programmes, since country estimates on actual costs were not available for many SSA countries, the Behrman and Vazquez (2021) model the annual average cost of these programmes based on the following assumptions. For pre-primary programmes, the conservative values in terms of COI implications assigned to parameters were: 10 children per caregiver, ECCE wages equal 90% of the mean earnings of all female

5 Although younger children could benefit from this intervention, the scenario of targeting all children 0 to 3 does not seem feasible in the current context of low coverage of home-visit programmes. For this reason, the target population is focused on delayed children based on ECDI scores, available for children 36 to 59 months.

employees in the educational sector, and caregivers' wages are 60% of total costs of pre-primary programmes, including infrastructure, materials, and administrative overhead. For home-visits programmes: 20 children attended per counsellor with two individual visits per month for one year, counsellors' wages equal 80% of the mean earnings of all female employees in the educational sector, and counsellors' wages are 70% of the total costs of programmes including training, materials, and administrative overhead. The calculated costs for individual countries are presented in Behrman and Vazquez (2021) Table A.12 in the Appendix. They are based on harmonized labour force survey data, downloaded from ILOSTAT, on the mean nominal monthly earnings of employees by sex and economic activity converted to US dollars as the common currency using 2017 purchasing power parity (PPP) rates for private consumption expenditures.

Assumptions and limitations

The model assumptions imply that estimates by Behrman and Vazquez (2021) on the COI are likely to be conservative. First, they do not include other benefits associated with ECD programmes that are hard to monetize (i.e, non-labour market productivities, physical health, mental health, crime). Second, they only consider private returns in the form of wages, omitting possible externalities to other individuals or productive factors in the economy and any fiscal impacts that may be generated by changes in transfers and in tax revenues.

The methodology by Behrman and Vazquez (2021) has some limitations. First, they assume critical parameter values for the impact of ECD programmes on earnings based on a few studies estimating the impact of these programmes on labour market outcomes. To explore the uncertainty regarding the value of i, they perform sensitivity analysis of the results of the simulations assuming lower values for this parameter. Second, they do not consider the impact of currently unknown future shocks. Such shocks may be either negative or positive. If they are negative, they may not only have transitory negative effects, but they alter downward in a more permanent fashion earning trajectories – but if they are positive they may do the opposite. Third, they do not explicitly consider general equilibrium effects in the model. In case there are general equilibrium considerations that reduce the relevant wages, the alternative simulations with the assumption of a lower impact on earnings may capture those effects. They do not consider equilibrium effects that might work in the opposite direction if the interventions result in greater increases in supplies of labour with given schooling levels than in demands for such labour. Finally, the model considers the direct costs that are incurred at the time of the intervention, although it may be the case that there are indirect costs (for example, transportation costs or opportunity costs for parents) or costs incurred later. For example, if the intervention leads to greater subsequent schooling, there are likely to be subsequent costs of providing that schooling.

Results

Table 15 presents the prevalence of stunting by sex and age, and the estimates of the COI as a share of GDP of not implementing nutritional programmes for all stunted children 0-2 years of age. As shown in the table, these COI are very high, representing close to a fifth of GDP in some countries with high prevalence of stunting (rows are highlighted for those high-burden countries).

Table 15: Stunting prevalence by sex and age (in months) and COI of not implementing nutritional programmes for all stunted children 0-2.

Sub-region	Country	Stunted girls (%)		Stunted boys (%)		COI[1]	Sensitivity analysis	
		<12	24-Dec	<12	24-Dec	(% GDP)	i=15%	i=10%
Easter Africa	Burundi	29.8	49.5	40.4	58.9	18	11.6	7.6
	Comoros	19.7	31.7	26.9	43.7	6.6	4.3	2.8
	Ethiopia	14.5	39.1	19.3	41.4	17.6	11.4	7.6
	Kenya	10.9	26.1	16.1	36.2	8.4	5.5	3.6
	Madagascar	19.5	39	31.3	52.5	18.3	11.9	7.9
	Malawi	21.2	32.8	34.2	50.5	18.5	12	7.9
	Mozambique	21.2	39.4	26.9	52	18.8	12.2	8.1
	Rwanda	21.3	31.5	34.8	47.4	22.1	14.4	9.6
	Tanzania	14.6	34	17.7	41.6	19.8	12.9	8.6
	Uganda	12.5	31.9	15.7	39.6	16.3	10.6	7.1
	Zambia	16.4	34	27.8	48.5	13.6	8.9	5.9
	Zimbabwe	9.2	24.7	13.9	35.6	7	4.5	3

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Table 15 Continued

Sub-region	Country	Stunted girls (%)		Stunted boys (%)		COI[1]	Sensitivity analysis	
		<12	24-Dec	<12	24-Dec	(% GDP)	i=15%	i=10%
Middle Africa	Angola	19	38.4	23.6	51.8	15.2	9.9	6.6
	Cameroon	15.9	31.7	20.5	40.5	13.4	8.7	5.8
	Central African Republic	15.5	35.1	22.7	47.9	11.3	7.3	4.8
	Chad	11.9	39.5	14.9	41.1	20.7	13.4	8.9
	Dem. Rep. of the Congo	17.5	35.3	22.5	44.7	9.8	6.3	4.1
	Equatorial Guinea	20.9	42.4	26.9	40.9	6.8	4.4	3
	Gabon	8.1	16.5	14.5	25.4	5.3	3.4	2.3
	Sao Tome and Principe	11.1	16	16.3	22.2	3.9	2.5	1.7
Southern Africa	Botswana	23.8	32.7	27.7	47.4	9.4	6.1	4.1
	Eswatini	11.3	25.5	19.6	37.8	5.5	3.6	2.4
	Lesotho	18.9	37.5	25.5	51.4	9.9	6.4	4.3
	Namibia	10.1	22.2	9.2	29.8	4.8	3.1	2.1
	South Africa	18.6	32.6	30.5	40.1	4.2	2.7	1.8

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Table 15 Continued

Subregion	Country	Stunted girls (%)		Stunted boys (%)		COI[1]	Sensitivity analysis	
		<12	24-Dec	<12	24-Dec	(% GDP)	i=15%	i=10%
Western Africa	Benin	15	27.9	22.8	39.2	14.1	9.2	6.1
	Burkina Faso	10.1	22.9	13.8	33.2	8.3	5.4	3.6
	Côte d'Ivore	9.9	18.5	13.4	25.6	5.7	3.7	2.4
	Gambia	12.8	12.4	8.5	17.8	6.3	4.1	2.7
	Ghana	8.2	14.1	9	23.3	6.3	4.1	2.8
	Guinea	18.4	29.4	23.8	38.9	10.8	7	4.7
	Guinea-Bissau	13.7	24.7	15.3	35.1	10.2	6.7	4.4
	Liberia	17.4	27.6	29.1	28.4	8.6	5.6	3.7
	Mali	12.9	27.6	15	32.7	10.9	7.1	4.7
	Mauritania	15.1	22	20.7	29.7	5.9	3.8	2.6
	Niger	27.4	53.6	36.7	60	24.2	15.7	10.4
	Nigeria	17.9	34.1	24.1	42.5	10.1	6.6	4.4
	Senegal	14	17.5	20.9	21.1	6.9	4.5	3
	Sierra Leone	11.8	26.7	22.6	37.1	8.1	5.3	3.5
	Togo	9.7	18.7	14.9	31.1	9.7	6.3	4.2

Source: Vogl (2021), Figure 12

The last two columns in Table 15 present sensitivity analysis of the results to changes in the assumption for the parameter i in Equation (1). After significant reductions in the assumed impact of nutritional programmes, the COI estimates are lower but still important in all countries. Table A.13 in the Behrman and Vazquez (2021) appendix reproduces Table 15, but the last two columns analyze the sensitivity of the results to different assumptions on the discount rate. Increases of one and two percentage points in the discount rate imply lower COI estimates as a share of GDP (of around 27%-30% in the first case and 45%-49% in the second), but the figures are still substantial in all countries.

Table 16 presents the shares of children 3 to 5 years considered developmentally not on track and the COI as a share of GDP of not expanding home-visit programmes to all those delayed children. The average COI for the countries in Table 16 is 8.4% of GDP, with important variations across countries and sub-regions. The last two columns present sensitivity analysis to changes in the assumption for the parameter i in Equation (1): after significant reductions in assumed impact of home-visit programmes, the COI estimates are lower but the patterns remain. Table A.14 in Behrman and Vazquez (2021) appendix columns analyzes the sensitivity of the results to different assumptions on the discount rate. Increases of one and two percentage points in the discount rate imply lower COI estimates, but still positive and considerable for some countries.

Table 16: COI of not expanding home-visit programmes to delayed children 3 to 5 years by country – Sensitivity analysis to changes in the impact on adult earnings

Sub-region	Country	Not 'on track' (5)		COI[1] (% GDP)	Sensitivity analysis	
		Girls	Boys		i=10%	i=7%
Eastern	Burindi	54.5	66.4	10.4	6.6	4.3
	Madagascar	32.0	35.0	7.6	5.0	3.4
	Rwanda	26.9	31.3	8.3	5.5	3.8
	Uganda	34.1	35.9	10.3	6-8	4.6
Middle Africa	Cameroon	36.7	40.9	8.6	5.7	3.9
	Central African Republic	49.8	56.1	7.3	4.1	2.2
	Chad	65.1	69.8	21.9	14.1	9.4
	Sao Tome and Principe	44.6	46.3	4.9	3.1	2.1
South Africa	Lesotho	22.3	31.9	3.4	2.2	1.4

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Table 16 Continued

Sub-region	Country	Not 'on track' (5)		COI[1] (% GDP)	Sensitivity analysis	
		Girls	Boys		i=10%	i=7%
West Africa	Benin	44.1	48.5	10.7	7.0	4.7
	Cote d'Ivoire	35.2	39.0	5.3	3.5	2.3
	Gambia	31.0	34.8	7.0	4.6	3.2
	Ghana	22.4	30.1	5.8	3.9	2.7
	Mali	36.6	40.2	8.2	5.3	3.6
	Senegal	30.8	35.8	5.6	3.6	2.4
	Sierra Leone	45.0	52.3	6.4	3.9	2.4
	Togo	44.6	50.3	11.0	7.1	4.8

[1] Children are assumed to enter the labour market at age 18 and benefits are captured during 45 years. Impact on earnings was assumed to be 15% . Information on mean earnings by economic sector was not available for the following countries and average cost per child in BV Table A.12 was imputed. Djibouti, Kenya, Sao Tome and Principe, Lesotho, Senegal, Sierra Leone, Benin, and Cabo Verde.

Source: From Behrman and Vazquez (2021), Figure 13

Table 17 presents the gross enrollment rates in pre-primary and the COI as a share of GDP of not reaching universal coverage in pre-primary as stated in SDG Target 4.2. The COI estimates are, on average, 5.2% of GDP and are, as expected, very low for countries that are very close to reaching the target (i.e., Mauritius) and effectively are zero for those countries for which the GER are greater than 100% (i.e. Ghana, Liberia). The last two columns present sensitivity analysis to changes in the assumption for the parameter i in Equation (1), and Table A.15 in the appendix provides sensitivity analysis to changes in the parameter d.

Table 17: COI of not reaching SDG target 4.2 for pre-primary by country – sensitivity analysis to changes in the impact on adult earnings

Sub-region	Country	Gross Enrollment Rates (%)[1]		COI[2] (% GDP)	Sensitivity analysis	
		Girls	Boys		i=7	i=6
Eastern Africa	Burindi	15.7	15.1	4.7	3.6	2.6
	Comoros	22.2	21.5	2.6	2.1	1.6
	Djibouti	7.7	8	4.3	3.6	2.9
	Kenya	74.7	76.8	1.9	1.6	1.3
	Madagascar	41.4	37.8	6.3	5.4	4.4
	Mauritius	98.7	97.5	0.1	0.1	0
	Rwanda	22.8	22.1	10.7	9.2	7.7
	Tanzania	41.4	41.4	11.7	10	8.2
	Uganda	14.7	14.1	11.7	10	8.2
	Zambia	7.9	7.3	2.3	1.1	-0.2
Middle Africa	Angola	37.3	41.9	5.7	4.9	4.1
	Cameroon	34.8	34.1	6.7	5.7	4.7
	Chad	0.9	1	12.3	10	7.8
	Sao Tome and Principe	52.6	48.1	1.9	1.5	1.1
South Africa	Lesotho	39.8	38.1	2.6	2	1.5
	Namibia	34.8	33.6	2.7	2.1	1.5
	South Africa	24.7	24.6	1.7	1.3	1

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Table 17 Continued

Sub-region	Country	Gross Enrollment Rates (%)[1]		COI[2] (% GDP)	Sensitivity analysis	
		Girls	Boys		i=7	i=6
West Africa	Benin	25.9	25	7.2	6	4.8
	Burkina Faso	4.3	4.4	4.5	3.3	2.1
	Cabo Verde	73.5	73	1.3	1.1	0.9
	Cote d'Ivoire	8.3	8.1	5.4	4.5	3.5
	Gambia	42.9	40.5	5.7	4.8	4
	Ghana	115.6	113.6	n/a	n/a	n/a
	Liberia	125.7	124.6	n/a	n/a	n/a
	Mali	7.1	6.8	8	6.6	5.2
	Niger	8.3	7.8	7.1	5.6	4.2
	Senegal	17.5	15.6	5.2	4.2	3.2
	Sierra Leone	14.6	13.1	1.9	1	0.1
	Togo	23.2	22.5	7.4	6.1	4.8

[1] Pre-Primary Gross Enrollment Rates in 2018 (2017 if 2018 not available).GER = total enrollments of all ages relative to number of children of pre-primary school age, so it may exceed 100. Source: UNESCO Institute for Statistics (UIS) http://data.uis.unesco.org/

[2] Children are assumed to enter the labour market at age 18 and benefits are captured during 45 years. Impact on earnings is assumed to be 8%. Information on mean earnings by economic sector was not available for the following countries and average cost per child in Table A.12 is imputed: Djibouti, Kenya, Sao Tome and Principe, Lesotho, Senegal, Sierra Leone, Benin, and Cabo Verde.

Source: From Behrman and Vazquez (2021), Table 14

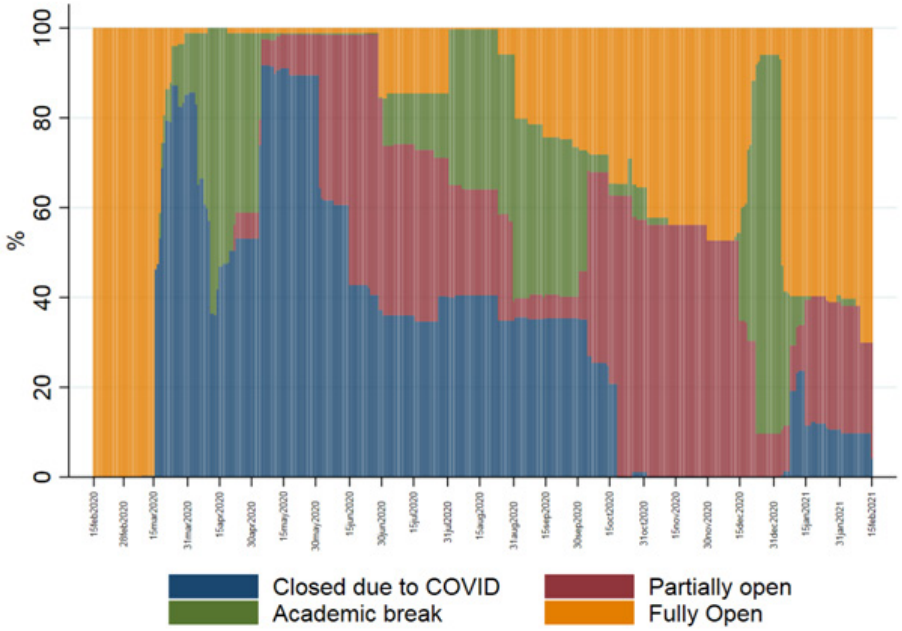
Losses due to COVID-19

The COVID-19 pandemic and the measures taken by governments around the world to prevent the transmission of the virus involved the closure of pre-primary programmes during much of 2020. This may have impacts on children both immediately and in the long-run. Behrman and Vazquez (2021) use the COI model to estimate the long-run economic losses associated with pre-primary closures in SSA countries due to the pandemic.

Figure 13 presents the daily distribution of the 15.4 million children enrolled in pre-primary programmes in 31 SSA countries according to the different status of school closures in each country from mid-February 2020 until mid-February 2021, showing an important reduction in pre-primary participation during those 12 months. Table A.13 in the Appendix shows the number of days by country in which schools were closed to contain the spread of the virus, in academic breaks, partially open (i.e, open/close in certain regions of the country and/

or open with reduced in-person class time) or fully open. The share of days with schools closed is the variable we use to simulate the long-run losses in terms of earnings due to COVID-19 pandemic using the COI model with assumptions as outlined above. This strategy is conservative, since the category of "partially open" also implies reduced participation, in particular for the pre-primary age group for whom distance learnings is less likely.[6]

Figure 13: Distribution of preprimary children in 31 SSA countries according to the status of school closures in their country



Source: From Behrman and Vazquez (2021), Figure 4

Table 18 presents the pre-pandemic gross enrollment rates in pre-primary programmes by sex and the share of days schools were closed due to COVID-19. The last five columns present the future earnings foregone when children become adults as percentages of GDP due to declines in pre-primary programme participation during 2020 for different assumptions regarding the parameters *i* and *d* in the model. Losses are particularly high in Ghana (6.8% of GDP for the base scenario in terms of pre-primary impact and discount rate), Tanzania (6.8%), Kenya (6.2%), Liberia (6.1%) and Gambia (4.2%), where life-long losses in earnings from the closure of pre-primary programmes exceed what these countries invest per year in all education levels. This is due, in part, to the greater pre-pandemic pre-primary programme participation in those countries and/or larger restrictions to schooling due to COVID-19.

6 Also, academic breaks were extended in some countries due to public-health situations.

Table 18: Pre-pandemic Gross Enrollment Rates (GER) and estimates of the % of GDP lost due to reduction in pre-primary programme participation

Sub-region	Country	GER in 2018 (%)		% days closed	% GDP lost		
		Girls	Boys		i=8%	i=7%	i=6%
Eastern Africa	Comoros	22	21	53	1.1	0.9	0.8
	Kenya	75	77	53	6.2	5.4	4.7
	Madagascar	41	38	5	3.7	3.2	2.8
	Mauritius	99	98	13	3.3	2.9	2.5
	Rwanda	23	22	52	2.3	2.0	1.7
	Uganda	15	14	67	1.9	1.7	1.4
	Tanzania	41	41	20	6.8	6.0	5.1
	Zambia	8	7	15	0.7	0.6	0.5
Middle Africa	Angola	37	42	53	2.9	2.5	2.2
	Cameroon	35	34	15	3.4	3.0	2.5
	Central African Republic	3	3	25	0.2	0.2	0.2
	Chad	1	1	44	0.2	0.1	0.1
	Sao Tome and Principe	53	48	16	2.7	2.4	2.0
Southern Africa	Lesotho	40	38	21	1.5	1.3	1.1
	Namibia	35	34	26	1.9	1.6	1.4
	South Africa	25	25	29	0.8	0.7	0.6
Western Africa	Benin	26	25	8	2.6	2.3	2.0
	Burkina Faso	4	4	18	0.4	0.4	0.3
	Côte d'Ivoire	8	8	13	0.6	0.5	0.4
	Gambia	43	40	39	4.2	3.6	3.1
	Ghana	116	114	19	6.8	6.0	5.1
	Liberia	126	125	29	6.1	5.4	4.6
	Mali	7	7	24	0.8	0.7	0.6
	Senegal	18	16	24	1.3	1.1	1.0
	Sierra Leone	15	13	20	1.1	1.0	0.8
	Togo	23	23	20	2.8	2.5	2.1

Source: From Behrman and Vazquez (2021), Table 15

5. Policy Implications and Research Needs

5.1 Economic Rationale for Policies

The general economic rationale for policies include inefficiencies and distributional concerns. Inefficiencies are undesirable because if they are lessened, consumption for everyone in principle could be increased with the same resources and technologies. Distribution is relevant because society may want to assure, for example, that no one lives in poverty. There are two general causes of inefficiencies: (1) *Market failures* in which markets are inefficient in that the marginal social benefits of an action differ from the marginal private benefits, or the marginal social costs of an action differ from the marginal private costs so that private incentives are to undertake the action to a different degree than is socially desirable. For example, if education benefits not only the individual educated but also has positive spillover benefits for others than are not transferred through markets, the private incentives are to educate that individual less than would be desirable from a social point of view; (2) *Policy failures* may increase inefficiencies and/or have negative distributional impacts. For example, policies may put a cap on the prices of basic nutrients with the objective of enabling consumers of those nutrients to be able to consume them more cheaply, but with the added impact of discouraging provision of those nutrients. For another example, policies may subsidize public providers of human capital related services (e.g., health clinics, pre-schools, schools) in hope of improving efficiency and/or distribution, but in so doing create reduced incentives for other providers of these services. *Distributional concerns* should be taken into account in policies in that even if there are no market or policy failures, the distribution of outcomes such as consumption is viewed as socially undesirable. For example, society may be concerned about people whose ownership of productive resources is inadequate to avoid living in poverty and therefore implement policies to increase such individuals' purchasing power and their consumption.

Of course there may be trade-offs among these concerns in that, say, policies to increase efficiency may have negative distributional consequences. But there also may be "win-win" possibilities if distributional concerns are about improving the welfare of the poor, in which policies that reduce inefficiencies by, for example, improving credit or information markets might benefit particularly the poorer members of society who are likely to be most subject to such market failures.

Finally, the political economy of determining policies might further complicate the choice of the best policies. Policies that attempt to increase the welfare of the poor, for example, may be more acceptable to the population as a whole if they also have effects on the middle class, so that their political constituency includes a larger share of the population (in the spirit of "median voter" concerns) or if they are seen as having an appropriate *quid pro quo* (e.g., positive commitments from the recipients as in conditional cash transfer programmes).

5.2 Policy Recommendations

Improving data collection and administrative records: To understand what the situation is regarding fertility, early life human capital investments and schooling in SSA and what are likely to be high priority policy areas, good data are essential. Some important characteristics of good data include: representativeness (either covering the whole relevant population or representative sub-samples of the relevant population); timeliness so that problems can be investigated or addressed without great delays; coverage of individual, familial and service-provider characteristics (including the quality of services); covering data on costs and those necessary to estimate impacts; and, for some purposes, longitudinal data in which individuals and/or service providers are followed to ascertain dynamic patterns and results. There are costs, of course, for collecting high-quality data. But the potential gains in terms of better understanding and better policy designs are considerable. Such data are likely to have substantial public-goods components that would lead to inefficient data collection if left to private markets, so that public-sector support is likely to be essential for assuring adequate collection of such data.

Allocate resources to early life and fertility-related investments that reflect the apparently relatively high rates of return to those investments: Based on the reviews and the COI estimates above, there are some potentially high-return investments in reproductive health and early life that merit serious consideration in SSA, including in fertility regulation, pre-and-post natal maternal and infant care, early life nutrition, early life stimulation and nurturing care, and pre-primary programmes. Though the evidence is limited, it is perceived that such private investments are constrained by imperfections in capital and information markets that are particularly severe for poorer members of society. Thus, such investments may be desirable both from an efficiency and a pro-poor distributional perspective, and from a human rights perspective. It would seem that the expected rates of return in many cases are likely to be high in comparison with many alternative uses of resources. But it is important that good examples from other contexts not be followed blindly, but that they be adapted to the particular contexts of particular SSA countries and be carefully monitored and evaluated, perhaps on pilot project basis through sequentially randomly rolling-out new programmes, and adjusting or abandoning them if monitoring and evaluation suggests that is appropriate. The focus on improving access should not neglect the dimensions of quality and equity. While Vogl (2021) does not present estimates of the returns to investments to enhance fertility control and women's schooling, the associations that he presents suggest that the rates of returns to such investments might be fairly high, and therefore consideration should be given to whether such investments might be warranted in addition to investments in early life human capital.

Lessen or eliminate barriers to females exploiting their full potential: Formal or informal barriers to women exploiting their full potential in education, labour markets and other activities are likely to reduce incentives to reduce fertility and to invest in females' human capital in early life and thereafter. Therefore reducing, or better yet, eliminating such barriers is likely to lead to greater productivity, greater efficiency and greater equality, in part through inducing reduced fertility and in part through inducing more investments in females' human capital over their life course.

Coordination across sectors and stakeholders: Reproductive health and early childhood development are multidimensional by nature and services from different sectors need to be integrated and well-coordinated. However, in many countries, relevant functions are allocated to different ministries, such as for health, education and welfare. Inadequate coordination is likely to lead to inefficiencies since different relevant decisions are made by different individuals facing different constraints. Therefore, coordinating mechanisms may need to be developed, such as inter-ministerial committees focusing on child development broadly and with high-level political mandates. If the programme is at scale, coordination between different levels of government is also important, as some functions typically fall to the national government (for example, the establishment of quality assurance mechanisms and guidelines, monitoring and evaluation) and others remain in local administrations (provision of services, hiring and training staff). Budget stability and programme institutionalization (for example by law or other norms) are critical for the coordination schemes to consolidate and evolve successfully.

Incentives for good decisions by governmental officials and individuals in private entities: Governments and other entities in economies are large, complicated institutions with multiple decision-makers facing varied constraints. Therefore, it is important that the processes in which these institutions and the individuals in them make decisions are as transparent as possible. Also, it is important that these institutions and the individuals in them face incentives, whether in monetary form or in terms of recognition or in terms of longer-run access to resources, to enhance the achievement of societies' objectives to increase welfare by enhancing efficiency and obtaining distributional goals.

5.3 Research Agenda

Following are discussions of some important components of general research agendas for fertility and schooling and early life investments in SSA. The best strategies for any particular country, of course, will depend on country-specific contexts, data, existing programmes and administrative and research capabilities.

Fertility and schooling: Combined with findings from past research, the patterns documented by Vogl (2021) that current adult women's schooling shapes Africa's demographic future, but perhaps not vice versa, are central and pivotal for research at the intersection of population and human capital. Projections of women's schooling attainment already weigh heavily in controversies about SSA population projections (Vollset et al., 2020; Gietel-Basten and Sobotka., 2020). Simulations of the economic consequences of fertility decline in SSA depend on the strength of the schooling response (Ashraf et al., 2013). Triangulating among the theory in Section 1.3, several open questions emerge for future research from Vogl's (2021) findings from the DHS, and the existing evidence. The most glaring relate to the interdependencies of child quality and child quantity. How have family planning programmes in SSA affected child investment? How have schooling expansions shaped fertility trends? Beyond these questions are more basic ones about the role of preferences and women's empowerment in driving fertility decline, and about the mechanisms through which women's schooling reduces fertility. Answers to these questions will help policy makers better integrate population policy with schooling policy in the region destined to become the world's most populous

within half a century (UNDESA, 2019). A major question is how to improve the quality of schooling, not only the quantity. Vogl (2021) and Behrman and Vazquez (2021) do not address this question, nor the related question for pre-schooling, but the literature suggests that teacher training is one possibly important channel (for pre-schooling, see Meghir et al., 2023; Wolf et al., 2019) 81,89 and that incentives for teachers and students tied to student performance might be another (for schooling, see Behrman et al., 2015).

Using existing data to understand better the nature of early life investments in children in SSA: The paper by Behrman and Vazquez (2021) gives a broad overview of a number of important dimensions of early life human capital investments in SSA, in the major sub-regions of SSA, and in individual countries in SSA, particularly in the seven project-focus countries. But there is need to investigate, in greater depth, the situation in particular countries of concern. Data sets such as the Demographic Health Surveys and the UNICEF MICs, and administrative data and a number of other surveys provide rich information that can be used to learn what are patterns in early life investments in children and how do such patterns relate to family socio-economic status, urbanization, parental schooling attainment, gender, age, ethnicity, climate change and extreme weather. Such descriptions are valuable in informing the need for policy designs to address gaps and inequities.

Moreover, existing data can be informative in learning about how programmes and policies, weather, political or market shocks early in life might work through fertility and early life human capital investments to have long-run impact on human capital and earnings. We summarize above, for example, a study that finds that cocoa prices during early childhood affected adult mental health for children living in Ghanaian cocoa-growing regions (Adhvaryu et al., 2018). Recent work shows similar long-run effects in adulthood for the 1949-1950 famine and early life weather conditions in Malawi (Ciancio et al., 2021; Behrman et al., 2021). New studies could investigate similar long-run effects in other SSA contexts and hopefully elucidate the channels, including early life human capital investments, through which these long-run effects occurred.

Investigating barriers to females exploiting their full potential and how such barriers may be reduced: SSA exceptionalism with regard to limited fertility reductions despite considerable increases in female schooling attainment may reflect limited school quality and, therefore, limited learning and may reflect barriers that females face in fully using and gaining returns from their human capital. Therefore, for the concerns of this paper and for broader concerns, research is valuable into what are these barriers and how they might be lessened or eliminated. How important, for example, is gender discrimination or limitations on women's labour force participation due to inadequate childcare and maternal leave? Would changes in childcare and maternal leave policies enhance women's returns to their human capital? Or would they be ineffective because of the large informal sector or even counterproductive because they might induce less hiring of women in the formal sector? Might policies change social norms about women's activities and about gender sharing of caregiving activities? If so, how should one think about the welfare consequences of changing norms? How does one know whether individual welfare is reduced or increased if preferences are changed? Can economies

be made more resilient and resistant to negative shocks that may reduce human capital returns and investments in the human capital of the next generation? How effective are social network programmes such as transfer and employment programmes in limiting the deleterious effects of negative shocks?

External validity and evaluating programmes within specific contexts: The COI estimates presented above suggest the definite possibility of there being early life investments with high long-run returns in various countries in SSA, as noted above with respect to policy. But there is considerable heterogeneity in SSA, and between countries in SSA and in other LMICs. And, as Pritchett (2021) recently has emphasized, "the supposed benefits of using rigorous evidence for 'evidence based' policy making (in other contexts) depend critically on the extent to which there is external validity." Therefore, for any possible early life intervention, it is important to evaluate it to the extent possible within particular country contexts, as also is noted above. For starters, it is possible to evaluate how sensitive the COI estimates are to different assumptions about the underlying parameters, which is an easy, quick and cheap exercise given the online COI tool (https://www.ecdan.org/). This can be very helpful in learning about alternative possible interventions and how sensitive their expected outcomes are to different assumptions about impact, costs and discount rates and different developments such as in labour markets. But it is also important to systematically monitor and evaluate new programmes with baseline information and longitudinal follow-ups, probably initially on a pilot basis with randomized assignment of the programme since it is difficult to introduce instantaneously a new programme on a national scale in any case (the seminal Mexican conditional-cash-transfer programme PROGRESA/Oportunidades/Prospera is an excellent example of such a strategy). Also, because contexts matter, it may be very difficult to select a priori the best intervention for a particular context so that it may be desirable to pilot the evaluations of a range of interventions in what Prichett (2021; 2018; and 2017 calls "crawling the design space" by exploring programme tweaks and alternatives. Such evaluations are likely to lead to insights about what works, what needs to be modified and what might best be abandoned. While there are costs to undertaking such evaluations, they are likely to be small relative to the resource costs of the programmes themselves that are at risk of being used poorly in the absence of evaluation.

Building on recently evolving literature on fertility, early childhood and schooling investments in LMICs: The focus above has been on long-term effects of investments in fertility, pre-school children's human capital and schooling in LMICs. These are the effects of ultimate interest. But focusing on the long-run ignores the rapidly expanding research on shorter-term effects of such investments. It is valuable, of course, to continue to collect and analyze data on children who were exposed to pre-school interventions, as is being done, for example, for children exposed to pre-school teacher training enhancements in Ghana (Wolf et al., 2019)[89]. But it is also useful to undertake new short-term evaluations of programme variations that appear promising in LMICs and to investigate the linkages between indicators of short-term outcomes and longer-run outcomes to simulate longer-run effects. There are a number of examples of recent studies on short-term outcomes related to early childhood investments in LMICS that

might be fruitfully adapted and undertaken in SSA contexts. Grantham-McGregor et al. (2020), for instance, find that group visits on average are as effective as home visits in improving child outcomes in the first three years of life – and less than a third as costly – using local women to provide parental training in rural India. Ahmed et al. (2020), for another example, find that nutritional education linked to conditional cash transfers are cost-effective means of improving pre-school nutritional status in rural Bangladesh. Wang et al. (2023), for yet another example, find results consistent with parents using reference points regarding child height, which means that easily understandable information about child growth such as the growth charts used in Peru may effectively induce parents to invest more in their children's nutritional status. Meghir et al. (2023) find investments in child development in the first two years of life or during the pre-school years to have enhanced impact on learning and socio-emotional development in rural India, but that there are no significant complementaries between the two so that it appears earlier investments have sustained impact and later investment permit catch up.

Timing of interventions versus timing of impacts: Ideally, one would like baseline data before fertility, pre-school-age and school-age interventions with follow-ups during and subsequent to the interventions through the working lives of initially pre-school-age children directly affected by the interventions, which means longitudinal data over 40-60 years. Such data are very rare and, if new efforts are started now, will require decades before permitting analyses. There are a few longitudinal datasets that have started with early life and have been ongoing for about two decades into late adolescence or early adulthood in SSA – The Birth to 20+ Cohort in South Africa and the Young Lives Younger Cohort in Ethiopia are two noteworthy examples. And, as noted above, it would be very valuable to establish more of such datasets throughout SSA. But for researchers and policy makers who want better knowledge to guide policies in the short- and medium-runs, the primary options are likely to range between: (1) Establishing new data collection at the time of interventions to be evaluated and following them as long as possible and then linking intermediate outcomes to longer-run impact (e.g., early life cognitive skills through schooling attainment to adult wages by using estimates of such links from studies on other datasets that cover later life-cycle segments). This has the advantage of the intervention being rooted in present knowledge and in a present context and much more information being collected on conditions prior to, during and immediately subsequent to the intervention. But it has the disadvantages of requiring focus on one or a very few of a number of possible interventions, not all of which are necessarily and particularly promising in a specific context, and of requiring strong assumptions about early life outcomes and outcomes over the life cycle; (2) Starting with existing or new data on adults and linking with administrative data from the time that these adults were of pre-school age on various services (e.g., pre-school programmes, health and nutritional programmes), markets (e.g., key prices, basic commodity supplies), civil (e.g., unrest) and natural conditions (e.g., weather, particularly extreme events). This has the advantage of having relatively good information on long-run outcomes within current contexts and permitting reduced-form direct assessments of some important long-run impact of early life interventions and exploration of some possibly important intermediary channels (e.g., schooling attainment). But it has disadvantages in having limited information on the interventions and depending on what interventions were actually implemented decades

ago in different contexts than the current contexts. Thus, both of these approaches, and approaches that blend these two, have important strengths and limitations and both probably should be considered in most of SSA.

Cost of interventions: A lot of the literature on human capital investments in general, including reproductive health, pre-school investments, and schooling is focused on impact over various time periods. But from the point of view of deciding among interventions, the real resource costs are equally important as are the impacts. An intervention with a given expected impact may be very desirable if resource costs are moderate, but infeasible if they are very high. The costs that matter are the resource costs, which are NOT the same as the financial outlays by the government (or NGOs or other supplying organizations) because the financial outlays do not include private (user) costs and may include transfers. If private costs are ignored in the cost representation, true resource costs will be understated and there will be incentives for policy makers to shift the burden from the suppliers to the users, who often are poor women. Shifting is not only likely to be inefficient but also regressive. If transfers are included as if they are true resource costs, the relative merits of programmes with such transfers, such as conditional cash transfers, will be understated. The usual focus is on the resource costs incurred at the time of the intervention. But there may be subsequent resource costs that are induced by the intervention that should also be incorporated into the analysis. For example, if early childhood interventions induce extended schooling, then the marginal resource costs of the additional schooling should also be included. In any case, it is important to investigate resource costs, not just impact, to evaluate interventions.

Considering alternative approaches for undertaking new research on fertility, early childhood investments and schooling in SSA: There are multiple approaches that merit considerations: (1) Randomized controlled trials (RCTs): There are strong advocates for using RCTs to evaluate policy options, and questions regarding whether their use is oversold (Pritchett, 2021; 2018; Banerjee and Duflo, 2009; Duflo et al., 2007; Deaton, 2010). Well-conducted RCTs with careful collection of resource costs and of impact through long-run follow-ups can be informative about the impact of particular policies in specific contexts, and results are easy to interpret and communicate due to the low data manipulation by the researchers. However, there are a number of limitations of RCTs. First of all, typically due to cost constraints, only a relatively small set of policy options are considered, which may result in premature lock-in of particular interventions without exploring what ex post may be preferable alternatives. Second, if adjustments are made in the policies in response to what is learned by the investigation as seems desirable if useful early insights are made, the final evaluation effectively is not of the original experiment, but of the hybrid that resulted from such adjustments. Third, as noted above, it is costly, at least in terms of time, to follow-up on RCTs for fertility or early life interventions to investigate long-run impact such as on adult productivities. Therefore, usually inferences about such impact must be made from linking short-term outcomes with longer-term outcomes using other studies. Other potential limitations for RCTs include small sample sizes due to resource constrains and therefore low-powered designs, and selective attrition that threatens internal validity; (2) Quasi-experimental

methods: These methods include using "natural experiments" such as policy changes, weather, civil unrest or natural disasters to make "before and after" difference-in-difference comparisons or as instruments in instrumental variable estimates that attempt to purge the estimated impact of unobserved variable biases, propensity-score matching on observed characteristics, and regression-discontinuity estimates that compare entities right below and right above some usually policy-related cut-off such as a poverty line for eligibility for programme benefits. These approaches may be valuable in situations in which RCTs are not possible or not effective, for example, in assessing the impact of current adults of early life interventions undertaken long ago. They also may be undertaken with new interventions, but with similar shortcomings as RCTs for such purposes and, in addition, typically stronger assumptions about the nature of un-observed variables; (3) Structural models: Much less common than RCTs and quasi-experimental methods are the estimation and use of structural models of the underlying behaviours, but there are several prominent examples of such an approach that evaluate social programmes in LMICs after validation by comparing with experimental data (Todd et al., 2006; Attanasio et al., 2012). At the costs of specifying and estimating the underlying structural relations, the advantage of this approach is that it can be used to consider contexts different from those actually experienced (e.g., with different labour markets) and counter-factual policies (e.g., with different transfers for CCTs). The basic point is that there are a number of tools in economists' tool boxes and researchers should consider the pluses and minuses of alternatives in light of resources available for the research, including existing data.

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3

Human Capital Accumulation in Africa: Drivers, Consequences, and Way Forward

Germano Mwabu

Introduction

The Sub-Saharan African region has a young population and most people in the labour force are working but poor (Fields, 2000). The poorer African nations lag behind in the formation of human capital, which in this paper is restricted to the accumulation of health and education stocks. The wage returns to job experience are generally low in SSA, suggesting that workers in the region do not benefit as much from the on-job-training as in comparable regions, such as Latin America and South Asia. Some studies suggest that education human capital, enhanced by technology or technical knowledge (Papadavid et al., 2021) are key to growth in SSA. In a similar vein, Behrman et al. (2017), demonstrate that higher wages and agricultural incomes are driven by accumulation of education capital rather than by nutrition or physical strength (brawn), while also showing that child health improves labour productivity in adult life, but via its effects on schooling and learning.

The determinants and effects of human capital accumulation (HCA) are well studied (see, e.g., Schultz and Strauss, 2008). However, little is known about latent constraints to HCA, such as the intention-action gaps and wedges. Equally lacking, is evidence on policies to address these hidden constraints (Leonard, 2021). Furthermore, systematic information regarding effects of HCA on inequality and shared prosperity have been documented only in a few countries in SSA (Epo et al., 2021), but the mechanisms behind the effects generally remain unknown. The paper makes a small step towards addressing these issues, especially in the formation of education and health human capital in Sub-Saharan Africa drawing mainly on recent AERC research (Pritchett,2021), Lucas (2023), and on a small number of studies outside the AERC work (see, e.g., Pritchett, 2001; Schultz and Strauss, 2008).

The remainder of the paper is structured as follows. Section 2 examines the role of foreign direct investment in promoting school enrollments at primary through tertiary levels (roughly at ages 6-25 years), and in reducing neonatal and infant mortality rates (i.e., at ages 0-28 days, and 0-1 year, respectively). Section 3 presents a conceptual discussion of latent barriers to HCA, with illustrations from AERC work (Leonard, 2021) and related literature. Section 4 briefly looks at trends in HCA and its consequences on household income, poverty, inequality and shared prosperity. Section 5 summarizes and concludes the paper.

1. Effects of foreign direct investment (FDI) on education and health

FDI and Education Capital

Papadavid et al.(2021) focus on the role of foreign direct investment (FDI)in promoting human capital accumulation in SSA taking into account the fact that the accumulation also induces FDI flows into the region. The authors use data from 31 Sub-Saharan African countries for the period 1970-2019.

FDI stimulates education achievement in a host country by enabling the youth to acquire on-the-job training, i.e., to learn by doing, and via provision of tax revenues that the government can use to construct schools and fund scholarships and research. Multinational firms provide incentives for skill acquisition because workers know they must be highly skilled to work for foreign- owned enterprises, which pay higher wages than local firms, and further offer better working conditions. However, the education stimulus from a FDI depends on the host country's capacity to absorb the investment. Critical to the absorption is the previous skill accumulation in the receiving country, as well as local workers' ability to adapt to production technologies of multinational firms.

FDI-led education expansion is robust when FDI supports structural transformation, such as when new methods of transporting goods are developed or new manufacturing plants are constructed. The education effects of FDI are weak or negative when the investment is of an enclave type, such as that designed to exploit natural resources or to displace local firms in labour-intensive activities. Since in Africa, a large portion of FDI has been engaged in natural resource extraction or in the take-over of telecommunications firms, employment incentives that attract high level skills, such as those taught in tertiary institutions have not occurred on the continent in recent times, since 2000. Employment incentives for workers with secondary education became strong after 2005, perhaps due to supply chains of multinational firms that benefited the informal sector where the majority of school leavers with secondary education work. Papadavid et al. (2021) generally find no effect of FDI on primary enrollments. Although the majority of workers with primary school certificates in Africa are in agriculture and the informal sector, there is suggestive evidence that skills of this category of workers are not matched with the activities of multinational firms. However, even workers or sectors not in contact with foreign firms can still gain from FDI. In particular, labour mobility can transmit the experience and training gained inside foreign firms throughout the entire local economy. Moreover, the knowledge gained from foreign firms is often used to start new businesses or to enhance labour productivity. However, this firm-level spillover effect depends on the origin of FDI. There is evidence that Chinese engagement in African economies has had little productivity spillovers into local firms in Africa (Papadavid et al., 2021). Nonetheless, the potential for FDI to enhance high level human capital in SSA through research collabouration with African universities is large. An additional benefit of multinational firms is that they introduce sophistication in the production of high quality exports, thus laying a solid foundation for industrialization. However, the same process can be a source of inequalities in the distribution of human capital because it can encourage undue allocation of education resources to tertiary institutions. Papadavid et al. (2021) provide evidence in support of this argument and summarize their study as follows: In Africa, FDI does (i) not substantially increase enrolments in primary schools; (ii) has had a large impact on secondary education enrolments since 2005, but not before; (iii) substantially increases enrolments in tertiary education; (iv) FDI-led enrollment expansion depends on skill levels in a country prior to the entry of foreign firms; (v) investments in low-skill sectors (e.g., mining and construction) have been the target of major investments from UK and China, which however have disincentivized the up-skilling of the African labour force.

FDI and Health Capital

Immurana et al. (2023) report effects of FDI on neonatal mortality and infant mortality for 39 African countries for the period 1980-2018, approximately the same time window (1970-2019) as that covered by Papadavid et al. (2021). Since some of the FDI metrics in these studies are similar (see Immurana et al., (2023) p. 5 and Papadavid et al., 2021 Appendix 1), the HCA effects of FDI reported by the two studies over this period are comparable. It is worth noting that nearly 50% of under-five deaths in Africa occur in the first 28 days of life (WHO, 2019, as cited by Immurana et al., 2023).

Immurana et al. (2023) find that a percentage increase in FDI is associated with a 0.17% decrease in neonatal mortality and with a 0.64% decline in infant mortality. The authors argue that FDI enhances people's ability to afford child health inputs, thus reducing child mortality. The key findings of Immurana et al. (2023) are as follows:

(i) FDI improves the health of neonates and infants, thereby increasing life expectancy at birth.

(ii) Child health improvement is through the economic growth induced by foreign direct investment.

(iii) Growth (in a closed economy) has a strong *negative* effect on child mortality.

(iv) Thus, in an open economy (*with FDI*) growth is higher, and child mortality is much lower as a result – because domestic and external forces combine to improve both the health system and the economy.

(v) Secondary education (a poxy for *health knowledge* of mothers) significantly reduces child mortality, as in Kovsted et al.(2002) study in Guinea Bissau.

(vi) In the Kovsted et al., reduction in child mortality is achieved through the health knowledge of mothers, whereas in Immurana et al., the causal mechanism is the growth in national income.

(vii) FDI strengthens the negative effect of education on child mortality via its positive effect on secondary enrolment; see Papadavid et al. (2021) for a positive effect of foreign direct investment on education at all levels except primary.

(viii) FDI supplements domestic healthcare resources in the accumulation of health capital.

In a plenary presentation of this paper (March 30, 2023) in Nairobi, some scholars felt that FDI is a form of foreign direct assistance by developed countries to SSA, and therefore has all the disadvantages associated with aid. Indeed, since one objective of foreign aid is to transform a developing country into a high productivity economy, aid can be given in form of foreign direct investment to stimulate accumulation of certain forms of human capital and to diffuse particular production technologies into a network of local firms. Such aid-based spread of new production technologies can encourage high

value exports and accelerate poverty reduction by raising incomes of both low- and high skilled workers in the manufacturing firms, and in local chains of transportation, digital and insurance industries that emerge to meet the needs of exporters. Thus, as in the case of aid, policy makers should ensure that foreign direct investment is in line with national development priorities and that it promotes local content even as it increases opportunities for exports.

2. Observable and Latent barriers to accumulation and utilization of human capital

The easily observable barriers to human capital accumulation include lack or shortages of health and education facilities or personnel; malfunctioning of health and education systems; poor incentives, such as low pay; insufficient working capital, and poor public transportation and communications infrastructure. The above clusters of factors determine the quantity and quality of human capital inputs, and thus the desired stocks of human capital outcomes over time. Regarding social expenditure on these facilities and systems, as a means for promoting human capital formation, Pritchett (2021, fig. 3 & 4) has shown that spending on facilities is not the same thing as investing in human capital if the outlay of interest, say, on schooling is not accompanied by a return, e.g., learning or literacy. This is an important consideration that should always be taken into account in social expenditures designed to enhance the quality of the population.

Latent barriers to health capital formation and its application

Leonard (2021) has argued that latent factors that constrain both the formation and utilization of human capital accumulation are at least as important as physical and institutional barriers. Key among them include: (i) intention – action gaps or wedges; (ii) knowledge – performance gaps; and (iii) effort – performance gaps.

Leonard (2021, pp. 2-3), states that "…many sub–Saharan African countries are sitting on a vast pool of untapped human capital…". He elabourates this as follows: "… health facilities stocked with the right medicine and staffed by qualified personnel provide little effective health care because the staffs are absent from their posts"… "students attend schools with qualified teachers, but these teachers reserve their efforts for private … tutoring sessions… Mothers who know that they should vaccinate their children, delay the trip to the health facility at significant risk to their children".

Leonard characterizes discrepancies between what is desired and what exists in practice – within the health and education sectors – as gaps and wedges. He proceeds to explain these concepts as follows: "The Know-Do gap is when someone does less than they know how to do or than they know they should do". He notes that this gap is generally referred to in the literature as the "intention-action gap". Leonard observes further that a gap is not as valuable in policy-making as a "wedge." A wedge occurs or emerges "when increased knowledge or increased intentions to act do not lead to increases in practice or action. With a gap, performance is lower than knowledge (i.e.,what can be accomplished with that knowledge), but increased knowledge can still increase performance. With a gap,

people do less than they intend to do, but if you increase their intentions, they will do more." (The underlined text not in the original). Thus, gaps occur in a static context while wedges emerge in a dynamic setting, whenever intentions or knowledge increase but without a corresponding increase in effort or performance, thus making gaps larger over time. A wedge can also describe a gap that becomes narrower over time, as increases in intentions or knowledge lead to higher levels of efforts or actions but which, nonetheless, fall short of expectations.

The third-party aspect in the production of human capital

An important aspect of human capital production is that it involves cooperative efforts among three actors (i.e., persons with self-interests but who also care about others): an *individual* (student or patient); a *service provider* (teacher or healthcare worker), and a *regulator*, i.e., a supervisor of a source of the required production inputs. This three-actor relationship arises because of the complexity of human capital production (Schultz and Strauss, 2008). The service provider knows more about the production process than the producer, and thus often acts as the latter's agent when treatment or instruction is in progress. The regulator plays the role of government, ideally ensuring that the inputs are of the required quality and are delivered on time. In practice, however, self-interests of the regulator and the provider that are not aligned to those of the producer complicate the third-party relationship. Moreover, in practice, government's capacity to regulate service delivery in developing countries, especially in Sub-Saharan Africa is quite low.

In a different vein, Leonard (2021, p.4) has observed that "even without the regulator, health service providers want to provide services. The problem they have is not that of lack of effective supervision but that of intention-do gaps and wedges."

Diagnosing gaps and wedges: neoclassical and behavioral economics tools

Constrained optimization assumption on people's behavior rules out the possibility of a discrepancy between people's intentions and actions: What people determine (*know*) to be the best for themselves, is what they *do*. There are neither know-do gaps (wedges) nor intentions –actions gaps. However, when acting naturally (not always optimizing), people can have intentions that they never carry out or accumulate knowledge or work-competencies that they never use (Leonard, 2021).

Both the standard economics and the behavioral model are needed in equal measure in the analysis of gaps and wedges. Behavioral economics is used to identify discrepancies between intentions and actions, with neoclassical model helping to quantify the gaps by defining optimal values, e.g., the maximum levels of healthcare services that can be provided with the available medical skills and technologies. The end result of gaps and wedges is a lower standard of living than can be justified given the accumulated capital.

Closing the gaps and wedges

One reason for the gaps is that people have *self control problems* (Leonard, 2021; Thaler and Shefrin, 1981). Generally, people renege even on their own intentions. Thus, there is need for mechanisms to help people align their performance with their intentions. In particular, the policy makers need to address self-control problems of workers, students, teachers, doctors…and of *themselves*. Regarding intention-action gaps in policy-making, and implementation of policies, it is worth noting that development plans should not be mere intentions. One approach to overcoming these gaps is to use nudges– encouragement devices that help people implement their own plans or intentions voluntarily. An example of such a device, in a healthcare setting, is a health insurance scheme, established such that everyone who is not a member of an employment-based scheme joins it automatically but pays premiums voluntarily. Such a scheme would be a default insurance plan, in which people remain automatically enrolled, unless they opt out. People can be asked to pay agreed amounts periodically according to income brackets, say, every three months or whenever their economic situations improve, e.g., during harvest seasons. The advantage of this nudge is that people who would otherwise not have been insured would get some health insurance even if many of the enrollees happen to opt out of the default scheme. This nudge has three parts to it: (i) enrollment is easy; (ii) premium payment is easy because it is voluntary; (iii) authorization for medical care under the scheme should happen with a minimum of bureaucratic procedures and the medical care facilities should be easy to access. Similar nudges can be designed to encourage the financing of education.

A recent nudge in Kenya (especially as it relates to taxation) is a digital payment platform on which payments for all government services can be made – including the payment of land rates and rents via mobile phones and other electronic devices. The digital nudge has in all probability bridged intentions-actions gaps for many taxpayers and users of government services in Kenya; still, research evidence on this issue is needed. This payment platform, known officially as the *eCitizen.go.ke Digital Payments Platform*, "is integrated with all available electronic payment platforms in Kenya, including mobile money telephone payment services" (Republic of Kenya, December 2022,*Gazette Notice No.16008*). Although this digital payment platform has arguably closed intentions-actions gaps for many taxpayers, the gap between actual and potential performance of the policy makers would increase if they do nothing with the newly collected tax revenue or the revenue is used inefficiently. In other words, closure of one gap is not enough for optimal performance of an economy. Over time, all gaps and wedges must close. Nudges to close economy-wide gaps and wedges could be developed and implemented by national level nudge teams; see, e.g., Halpern (2016).

Addressing human capital utilization shortfalls

- Examples of relevant questions here include:
- Why is the available stock of human capital not fully utilized?
- Why are qualified doctors or teachers not employed?
- Why are those employed absent from work stations?

Common and valid answers to these questions range from lack of jobs, insufficient incentives, to a mismatch between jobs and skills. Additional factors compounding the underutilization of human capital include:

(i) lack of effective supervision, which leads to low effort levels among workers within the human capital industry;

(ii) failure to use peers as supervisors to leverage on the Hawthorne effect (see below); (iii) use of wrong incentives, e.g., monetary rewards, when the issue is lack of complementary inputs.

Regarding the Hawthorne effect, Leonard (2021, p. 15) states that …*"The most obvious impact …from peer observation is the Hawthorne effect, the fact that health care workers do more when they are observed by a peer. The original idea of the Hawthorne effect was that people would work harder when observed. However, health care workers are always observed by their patients. They do not work harder when anyone observes them; they work harder when a peer observes them. And, in a classic pattern, when the peer observes them but provides no reaction, they reduce their effort…".* Thus, effective supervision within the health and education systems can be enhanced by creating supervision or management teams that comprise peers of supervisees as team members.

There is evidence that enforcement of regulations or creation of stricter institutional rules to regulate behaviors of teachers or health workers when target expectations have not been met due to other factors can only worsen gaps and wedges (Leonard, 2021, p. 3). In other words, managers and supervisors of health and education systems need to avoid enforcement of work-rules or strengthening of performance expectations on top of missing complementary inputs or in a context of poor staff motivation.

3. Human capital accumulation and socioeconomic outcomes

Human capital stocks and returns

This section presents approximate effects of human capital accumulation on household income, poverty, inequality and shared prosperity. The effects are measured using survey data from selected Sub-Saharan African countries and from the most up to date macro data. As already noted, the analysis of socio-economic consequences of human capital formation is based on existing studies. The survey data-sets are from Cameroon, 2007-14; Ethiopia, 2013-2018; Kenya, 2005-2015; Nigeria, 2010-2015; and Uganda, 2005-2015. The macro data sets (1960-1985) are from the Barro and Lee (1993), as cited in Pritchett (2001, p. 371).

Table 1: Health and Education Stocks in Selected Countries

Country	Health Stocks, Index	Education Stocks: Primary School Enrollment Ratios
Cameroon (2007-2014)	0.732	0.328
Ethiopia (2013-2018)	0.807	0.270
Kenya (2005-2015)	0.823	0.249
Nigeria (2010-2015)	0.862	0.209
Uganda (2005-2015)	0.682	0.225
Mean	0.781	0.256
N	6,040-4,817	

Table 1 shows human capital stocks in selected SSA countries for the period, 2005-2018. The health index is for health status of sick persons conditional on seeking treatment from dispensaries, health centers, hospitals, or doctors' clinics. The construction of the *health index* is done assuming that patients who sought care from hospitals or health professionals (doctors) received better care than those receiving care from lower cadres of health workers or from lower levels of the health system. Thus, this health index amounts to an index of health service utilization, adjusted for service quality. Generally, sick persons who received care are assumed to be in better health than those receiving none. Evidence from a small SSA sample supports this assumption (Mwabu, 2022).

The health index was constructed using multiple correspondence analysis (MCA). Education enrollment ratios were computed using responses to the question: have you ever attended school? Generally, the data used to calculate enrollments does not reflect the enrollment rates for the survey period (2005-2018) as they are for a much earlier period, roughly, 1965-90. See, Angrist et al. (2021) for adjusted enrollment ratios and for *Learning Adjusted Years of Schooling* (LAYS) that capture quality of schooling. Table 1 indicates that the SSA health index is quite high in all countries, especially in Nigeria, Kenya and Ethiopia, while school enrollments are low, suggesting that generally the respondents had only primary level education.

The information presented in Table 1 is supported by the evolution of UNDP's *Human Development Index* over the period, 2011-2022. In SSA, the mean years of schooling was 4.5 in 2010 (slightly above the lower primary), but by 2021, this mean had increased to 6 years (consistent with upper primary education). It is worth noting that the maximum number of the average years of schooling for each country is 15-18, i.e., a duration that allows an individual to obtain a master's degree (UNDP, 2022). Progress in the accumulation of health capital was faster but the associated health flows over the study period were much smaller than the flows for education, as evidenced by the percentage increases in both stocks. In 2010, life expectancy at birth was 54.4 years, while by 2021 it had risen to 60.1 or by 10.5% (UNDP, 2011 and 2022). This achievement should be evaluated relative to the fact that the maximum life expectancy at birth for each country is 85 years (UNDP, 2022). Meanwhile, the education

stock grew by 25% (from 4.5 to 6 years). However, a detailed look at the *Human Development Index Reports* for 2011 and 2022 shows human capital stocks in sample countries (Epo et al., 2021) increased except in Kenya, where schooling fell from 7 years to 6.7. This decline can be larger or smaller if expressed in terms of Learning Adjusted Years of Schooling (LAYS); see Lucas, 2023. A decline might also emerge in other countries if changes in education capital are measured in terms of LAYS (see Lucas, 2023). Tables 2 and 3 look at returns to human capital accumulation, in Africa using micro and macro data, respectively. The returns are extracted from previous studies (Epo et al., 2021) and Pritchett (2001).

Table 2: Consequences of HCA on Household Income in five African countries: Micro Level Effects

Human capital Inputs	Dependent Variable: Log Household Expenditure per Adult Equivalent				
	Cameroon	Ethiopia	Kenya	Nigeria	Uganda
Health Index	0.415***	0.320***	0.334**	0.814***	2.653***
Primary Education	0.017	0.082***	0.146***	0.095***	0.107***
Secondary Education	0.089***	0.293***	0.282***	0.231***	0.209***
Tertiary Education	0.287***	0.529***	0.440***	0.588***	0.596***

Notes: *** Statistically sig at 1% level; N=6040-34817.
Source: Epo et al. (2021), Table 2.

The main finding from Table 2 is that human capital accumulation increases household income in each of the five countries. The health effects are strong across the board. The education effects are equally robust, and rise steadily with levels of schooling. In Cameroon for example, individuals who sought treatment conditional on reporting sickness had 41% higher incomes than household members who did not seek treatment. Furthermore, in Cameroon, individuals with tertiary schooling had 28.7% higher incomes than persons without schooling, compared to a return of about 60% in Uganda. The unusually large income effect of better health in Uganda (265%) is plausible because sickness can wipe out a household's income, especially in an agricultural setting. There is further evidence that better health in childhood boosts labour productivity in adult life through the education channel (see Behrman et al. (2017).

In Table 3, the share of human capital in total wage bill reflects its productivity relative to that of other inputs, ignoring the intensity of all inputs or alternatively, assuming that the shares are for a per unit of each input category. The striking result in Table 3 is that the largest share in total wage bill is for persons with 'no schooling'. This share arguably captures the role of effort, nutrition, and health in production. These aspects of human capital are fully treated in Pritchett (2001) and in Behrman et al. (2017). It is worth noting that if 'No Schooling' is an empty human capital category (i.e., the type that captures absence of skill, nutrition, strength, and health), the share of that input in total wage bill would be zero, in accordance with its contribution to the gross domestic product. In Pritchett (2001, p. 370, equation 4), the return to schooling (education capital)

is computed using the expression: *share_schooling* = 1-($\mathbf{w_0}$/$\mathbf{w}$), where, $\mathbf{w_0}$ is the average wage for unskilled workers (those with no education), and $\mathbf{w}$, is the average wage of all workers so that $\mathbf{w_0}$/$\mathbf{w}$ is the share of low-skilled ('no-schooling') in the total wage bill and the residual is, therefore, the share of skilled workers, i.e., those in different education categories, as shown in Table 3.

Table 3: Consequences of HCA on Income: Wage Shares of Education Capital in Total Wage Bill in LDCs and SSA: Macro Level Evidence

Schooling Level	LDCs (Mean share=36%)	SSA (Mean share=26%)
'No Schooling'(Effort/Nutrition/Health)	49.7	48.1
Some Primary	21.3	33.2
Primary Complete	10.1	8.7
Some Secondary	8.7	7.7
Secondary	5.9	1.6
Some Tertiary	1.4	0.2
Tertiary	3.0	0.8
Average Years of Schooling	3.56	2.67
	Education shares fall with schooling, rising sharply at tertiary level	

Notes: Pritchett (2001, Table 1, p. 371); data source: Barro and Lee, 1993.

In contrast to a convex profile of returns for education capital shown in Table 2, Table 3 depicts a profile that generally falls with schooling but rises sharply for persons with tertiary education. There are several ways to reconcile the conflicting information shown in Table 2 (micro-based table) and Table 3 (macro table). To start with, Table 3 could be capturing reductions in returns due to increases in supplies of education capital at different schooling levels, but this effect of education accumulation is not captured in Table 2. Furthermore in Table 2, there are no controls for rents associated with schooling (Pritchett, 2001), especially at higher schooling levels, where wages probably depend more on signaling of workers' abilities than on productivity of accumulated education capital, an issue that is fully addressed in Prichett's paper.

Human capital equalization, poverty, inequality and shared prosperity

While human capital accumulation can be shaped by market forces, its speed and concentration in society can also be influenced by public policy. For example, governments can progressively use policy instruments, such as the universal health coverage or universal primary education to improve human capital distribution in the population. We examine the effects of human capital equalization on poverty, income distribution and shared prosperity using actual and counter-factual micro simulations (Epo et al., 2021), but without indicating the specific policies behind the redistribution analyzed.

Table 4: Consequences of Human Capital Equalization on Poverty

Poverty rates with and without equalization of human capital	Headcount ratios				
	Cameroon (2007-14)	Ethiopia (2013-18)	Kenya (2005-15)	Nigeria (2010-15)	Uganda (2005-15)
Factual (without equalization)	0.375***	0.210***	0.361***	0.361***	0.214***
Counterfactual (with)	0.355***	0.098***	0.285***	0.184***	0.254***
Change (counterfactual minus factual)	-0.020***	-0.112***	-0.076***	-0.176***	0.040***
N	20982	11763	34817	8794	6040

Source: Epo et al. (2021); *** Statistically significant at 1%.

Table 4 shows that poverty falls except in Uganda where it rises by 4%, due perhaps to a fall in human capital returns driven by higher supplies of marketable skills.

Table 5: Consequences of Equalizing Human Capital on Inequality

Inequality measures without and with capital equalization	Income Inequality Indicators: Palma Ratios (incomes of top10% earners)/(income of bottom 40%)				
	Cameroun 2007-14	Ethiopia 2013-18	Kenya 2005-15	Nigeria 2010-15	Uganda 2005-15
Factual	2.03	3.09	2.53	2.64	12.7
Counterfactual	2.10	2.67	2.34	5.11	45.0
Change	0.07	-0.42	-0.19	2.47	32.3
N	20982	11763	34817	8794	6040

Source: Epo et al. (2021).

Table 5 shows that once human capital is equalized (thus removing the effect of effort on incomes), income inequality falls in Ethiopia and Kenya but rises moderately in Cameroon, while nearly doubling in Nigeria and increasing sharply in Uganda. Probably, the differentials in equalization effects reflect the structure of each nation's economy. Equalization of human capital refers to a hypothetical situation where all households are given the same endowments of health and education. This policy scenario has implications for labour productivity across economic sectors, and for inter-household income transfers. If, for example, the return to schooling is low in agriculture (where schooling is also low) relative to non-agricultural activities, equalization of education capital would lower average incomes and reduce inequality by compressing earnings in activities with high returns to schooling. However, with a fall in average income and a decline in inter-household transfers, the poverty rate can increase, which is the case in Uganda (Table 4).

In the case where the non-agricultural sector has a higher return to human capital, and more stocks, an equalization policy that improves human capital in agriculture, *ceteris paribus*, would increase average incomes, and reduce poverty while increasing income inequality. The poverty reducing effect of such a policy seems to be evident in Cameroon, Ethiopia, Kenya and Nigeria (Table 4), while its inequality-increasing effect is probably at work in Nigeria and Uganda (Table 5). Generally, the welfare consequences of human capital equalization depend on country-specific contexts. This argument can further be used to interpret the findings presented in Table 6.

It is instructive to compare the results of the *pro-growth poverty reduction strategy* (Thorbecke and Ouyang, 2022), with the human capital equalization approaches shown in Tables 5 and 6. Implicit in both cases is a large injection of subsidies into an economy. In the case of the *virtuous spiral* (Thorbecke and Ouyang, 2022), the subsidies are in the first instance used to reduce poverty, thereby enabling the poor to engage in investments that enhance their human capital formation and entrepreneurial activities, which in turn enable the poor to participate in the growth process, contrary to the case of a *pro-poor growth* strategy that can ideally benefit the poor without them participating in income generating activities. The Thorbecke and Ouyang (2022) strategy reduces income inequality because the transfers increase the incomes of the poor, in the first instance. In the case of Epo et al. (2021), the subsidies reduce human capital inequality by funding human capital investments of the poor, in the first instance. However, whether or not the additional human capital raises the incomes of the poor and/or of the non-poor, depends on a country's labour market conditions, because the extra *healthy time* available for deployment or employment might not be demanded by firms, or on farms, and would therefore remain idle (Ajakaiye and Mwabu, 2012).Moreover, income inequality can rise sharply, as in Uganda and Nigeria (Table 5),depending on the structure of an economy (e.g., size of agriculture vs industry), and on other factors, such as the extent of trade openness or historical and regional circumstances, e.g., lack of roads, market centers or a legacy of conflict. Apart from the possibility of the average incomes falling, as noted above, the incomes of the poorest groups can also fall, contrary to the prediction of the virtuous spiral, e.g., as in Uganda and Ethiopia (see Table 6).

Table 6: Consequences of Equalizing Human Capital on Shared Prosperity (Income Growth of Poorest 40%)

Policy scenarios	Growth in income among the poorest 40%				
	Cameroon (2007-14)	Ethiopia (20013-18)	Kenya (2005-15)	Nigeria (2010-15)	Uganda (2005-15)
Income growth without equalization(%)	1.6	18.0	9.86	10.1	116.5
Growth with Equalization (%)	3.04	16.6	10.2	34.0	62.4
Change(%)	1.35	-1.4	0.34	23.9	-54.1
N	20982	11763	34817	8794	6040

Source: Epo et al. (2021).

Table 6 shows that after human capital equalization, incomes of the poor increase slightly in Cameroon and Kenya, while rising considerably in Nigeria; but incomes of the poor fall drastically in Uganda and marginally in Ethiopia. The large fall of incomes for the poorest 40% of the population in Uganda could be capturing the opportunity cost of equalizing human capital in an agricultural economy with low returns to education, due for example, to non-changing production technology (T. W. Schultz, 1964, 1975; Foster and Rosenzweig, 1996). That is, had the resources been spent differently, e.g., invested in sectors with new technological diffusions, the poor in Uganda might have benefited more. However, there is need to note that in that circumstance, the poor could also have been much worse-off, had they not been endowed with the skills necessary to take advantage of the new technologies. This observation is an important aspect of an economic structure to consider when implementing redistributive policies whether via subsidies or by way of enhancing productive capacities of the population.

4. Summary, Way Forward and Takeaways

Summary

The health index for the five Sub-Saharan African countries in the Epo et al. (2021) study is 78% of its upper bound. Interestingly, for SSA as a whole, the life expectancy in the region in 2021 was 60.1 years or about 71% of the upper bound, i.e., 85 years (UNDP, 2022). However, achievements in the area of education are less impressive. The education enrollment ratio for the five country sample during the period, 1970-90, was 26% of its upper bound (Epo et al., 2021). Again, the SSA as a whole, based on the Barro-Lee data set, the region's schooling level for the period – 1960-85 –averaged 2.67 years (Pritchett, 2001) relative to a maximum of 15-18 years. By 2021, schooling in SSA had nearly doubled to 6 years, but this amounted to a mere 33.3% of its upper bound (UNDP, 2022). Thus, SSA region has a long way to go before reaching its education capital frontier, which currently, is the number of years it takes an individual to obtain a master's degree. The distance is even longer, if learning achievements are considered (see, Lucas, 2023, Tables 2 and 3).

Foreign direct investments are strong drivers of both health and education stocks in Sub-Saharan Africa. The association between schooling and learning in the region is low but positive. On this point, Lucas (2023, Tables 2 and 3, p. 2) demonstrates that "broadly, countries with more quantity of schooling also have more learning, but the relationship is not purely linear. Some countries deliver more learning for each additional year of education". And globally, Singapore has the highest return to a year of schooling, while Kenya has the highest return in the African region.

Health service utilization improves health (reduces probability of sickness reporting in the general population), but not in all countries (Mwabu, 2022). Household survey data sets show a strong positive correlation between human capital formation and household income, but this evidence is based on a tiny sample of countries. The wage share of human capital in Sub-Saharan Africa is 26-38% relative to a share of 62-73% in developed economies (Pritchett, 2001, Table 1), which indicates that the contribution of human capital to growth in SSA is far below its potential. Human capital accumulation is not enough for initiation and sustainability of high growth rates in Africa. In addition, complementary inputs and incentives to stimulate full utilization of the available capital are needed.

The effects of equalization of human capital on poverty, inequality and shared prosperity are mixed but this evidence comes from a small and selective sample of countries. Under-performance of citizens and policymakers in human capital accumulation and in its utilization can be addressed using nudges, peer-based supervision, and short message service (SMS) – an electronic nudge. These kinds of nudges complement effort and other inputs in the production of human capital, especially in the restoration of health (Wagstaff et al., 2019) and in the recapturing of previous levels of learning, particularly after its erosion by pandemics and climate shocks.

The productivity of health and education systems are probably constrained more by motivation, supervision and management problems than by lack of skilled staff or facilities. Moreover, policy mechanisms to ensure that health and education systems are equitable and fair in the process of accumulating human capital are lacking. As a consequence, any high-quality services offered by these systems are generally inaccessible by the poor. There is little evidence in SSA on how these issues can be addressed.

Way Forward and Takeaways

In using foreign direct investment to accumulate human capital in Africa, account should be taken of the fact that the benefits of this investment critically depend on structures of national economies. The type of the investment inflow also determines the form of human capital accumulated. Spending on human capital accumulation should be guided by a return to schooling, e.g., learning, and by a return to health-service provision, e.g., a cure or prevention of illness or disease.

Managers of health and education systems need to develop nudging mechanisms to help both service providers and service users to cope with self-control problems as they engage in human capital formation activities. Nudges should be used to complement or supplement managerial, supervisory and administrative tools, e.g., smoking bans, school rules, and financial incentives that can be used to make a difference in people's lives by implementing even small aspects of the existing government policies (Halpern, 2016). The designs of nudges for the top policy makers are complicated because these actors do not have supervisors, but the designs or nudges could be in-built into political processes through which they are appointed or into institutional structures under which they work. In a plenary discussion of this paper, Professor Olu Ajakaiye distilled the takeaways from it in respect of the design and implementation of effective education and health policies in Sub-Saharan Africa, and highlighted the following:

- Firstly, human capital comprises the knowledge, learning and skills acquired via education, training, culture, and socialization, plus the health capital that people accumulate through better nutrition, quality medical care, routine vaccinations, ability to control disease pandemics, and engagement in good lifestyles.
- Secondly, *utilization* of the available human capital stocks, complemented by other factors of production enables individuals to realize their human potential as productive members of society, and thus helps them move towards the WHO's (1948) notion of *health* as a proxy for 'complete physical, mental and social well-being'.

- Consequently, there is need for African policy makers to:
  - intensify and sustain provision of quality, affordable, accessible, and equitable healthcare services.
  - improve the quality of primary education to maximize *learning* for each year of schooling.
  - significantly increase primary and tertiary education attainments in order to meet the high-skill requirements for national and continental development agenda 2063 for a prosperous Africa, characterized by inclusive and sustainable high rate of growth.
  - Increase availability of schools to enhance schooling in the general population, especially since schooling and learning are generally positively correlated (Pritchett, 2021; Lucas, 2023), and also since, availability promotes enrollment (Foster and Rosenzweig, 1996).
- However, the realization of the above potential benefits is not automatic, as a lot depends on the structure of African economies, ample and decent employment opportunities, especially for the youth; and an enabling environment for efficient and effective utilization of all the factors of production, not just the human capital.
- In particular, there is need to:

  --seriously consider and address micro-level and workplace constraints to human capital formation.
  - implement system-wide and economy-wide policies for ensuring that human capital development is targeted at meeting existing and emerging needs in all population deciles and geographic regions.
  - implement demand driven human capital development strategies to ensure that the accumulated stock is efficaciously utilized and that its production is both cost-effective and equitable.
- Finally, although foreign direct investment has been shown to be an important driver of human capital accumulation in Africa, success in this area critically depends on:
  - suitable local content activities and policies.
  - well negotiated profit repatriation policies and practices.
  - appropriate legal and institutional frameworks which protect all stakeholders.
  - articulate and enforceable labour and property laws.
  - peaceful and business friendly local environment.

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4

Education in Africa: Career Progressions, Gaps in Learning Outcomes, and Responding to the Learning Crisis

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Introduction

Schooling and the development of human capital are essential contributions both to individuals' livelihoods and country-wide economic growth and development. In the mid-1990s, Sub-Saharan Africa had a crisis of low enrollment rates with only 54% of primary school-aged students in school in the lower- and middle-income countries of Sub-Saharan Africa. The lack of schooling access, i.e., schooling quantity, has been replaced by a crisis of learning quality. As barriers to schooling have fallen, the primary school net enrollment rate is now over 80% (UNESCO, 2019). Yet, in many cases, schools are continuing to fail the children they are supposed to serve by not imparting them with adequate knowledge to be successful. As an example, in Kenya, Tanzania, and Uganda about three-quarters of grade 3 students cannot read a simple sentence (World Bank, 2018). This "learning crisis" of students being in school but not learning is acute. The scale of this problem was recognized and codified in Goal number 4 of the Sustainable Development Goals' focus on "quality education," and not just number of years of schooling.

Many scholars have posited causes and proposed solutions. As part of the African Economic Research Consortium's research project on Human Capital Development in Africa, three teams developed framework papers that deeply studied some of the issues behind this lack of learning. This paper first summarizes the findings from these three teams and then provides a summary of common themes.

Gaps in Learning Outcomes

One of the challenges in understanding how to increase quality education is understanding the extent of the problem. Data on years of completed schooling are readily available across countries. A much more complicated issue is measuring actual learning. A second challenge is to understand the potential differences between what is stated in policy and what happens in practice. In "Two Big Gaps in the Supply of Human Capital" (2021), Noam Angrist and Stefan Dercon (AD henceforth) tackle both the quantity-quality gap (the difference between the time spent in school and the amount of knowledge learned) and the policy-practice gap (the difference between the policies as stated by the ministries of education and the actual services received by households).

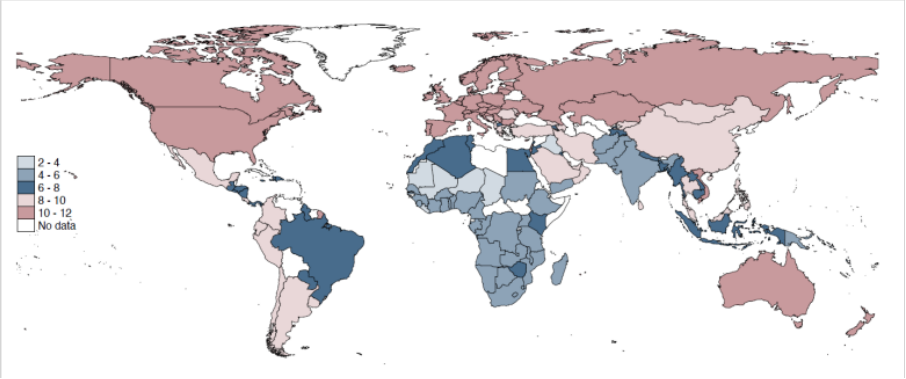
The Quantity-Quality Gap

The quantity-quality gap codifies that schooling and learning are not the same. Just because a child completes a year of school, that child might not have learned all the necessary competencies.

Comparable data on the quantity of schooling, i.e., years of education, across countries are readily available from the United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics (UIS). The data on learning outcomes are more sparse. Angrist et al. (2021) harmonized data collected by twelve separate international tests from 2000 to 2017 across 164 countries – the country with the most coverage has data for only 10 years and some countries, e.g., Ethiopia, only have data for one year over the entire time span.

AD (2021) combine learning and schooling into a Learning Adjusted Years of Schooling (LAYS). Intuitively, LAYS adjusts each year of schooling acquired relative to a "high-performance benchmark" that represents the amount of learning that would have been acquired in a year in a high performing schooling system.

Figure 1: Learning-Adjusted Years of Schooling



Source: AD (2021), Figure 2

Based on this LAYS metric, children in many Organization for Economic Co-operation and Development (OECD) countries are expected to attain 10-12 years of schooling, more than twice the level in parts of South Asia and Sub-Saharan Africa. In parts of South Asia and Sub-Saharan Africa, the average child attains only the equivalent of 2 to 6 years of high-quality schooling. Both Kenya and Zimbabwe outperform their Sub-Saharan peers with LAYS averaging between 6 and 8 years.

The difference between the expected years of schooling and the LAYS reflects the degree to which schooling systems are not delivering the amount of learning possible for each year that a child is in school. The schooling system that delivers the highest quality is Singapore. Within Africa, the country that has the highest learning return for each year of schooling is Kenya.

The difference between the quality of schooling and the quantity of learning is the largest in Sub-Saharan Africa. This difference can be thought of as the efficiency of the schooling sector – the amount of learning that students acquire for each year spent in school. When adjusted for learning acquired, the 8.2 median years of expected schooling in Sub-Saharan Africa decreases by 3.3 full years to 4.9 years, a decrease of over 40%. In other words, children in Sub-Saharan Africa are only getting about 60% of the learning that they should for each year that they spend in school.

The differences between countries within Sub-Saharan Africa are wider for years of schooling than they are for LAYS, reflecting different levels of learning efficiency across countries within the same region. Broadly, countries with a greater quantity of schooling also have more learning, but the relationship is not purely linear. Some countries deliver more learning for each additional year of education. Ghana, Indonesia, and Vietnam all have average expected attainment of about 12 years of schooling, yet their students

score very differently on a common test, demonstrating differences in learning across the three countries. Ghana scores below what is considered minimum achievement. Vietnam scores over two standard deviations higher. Indonesia scores between the two. Other countries with test scores such as Ghana's report about 5 years of schooling compared to Ghana's 12. At the same level of test scores as Indonesia are countries with expected years of schooling as low as 7 and as high as 13. Vietnam has test scores that are more like countries with 14 years of expected schooling.

As with expected years of completed schooling, richer countries, on average, have higher LAYS, but again, the relationship is not purely linear – Vietnam (VNM) and Kenya (KEN) have higher LAYS than expected based on their levels of per capita income and South Africa (ZAF) and Qatar (QAT) have lower levels of LAYS than expected (Figure 2).

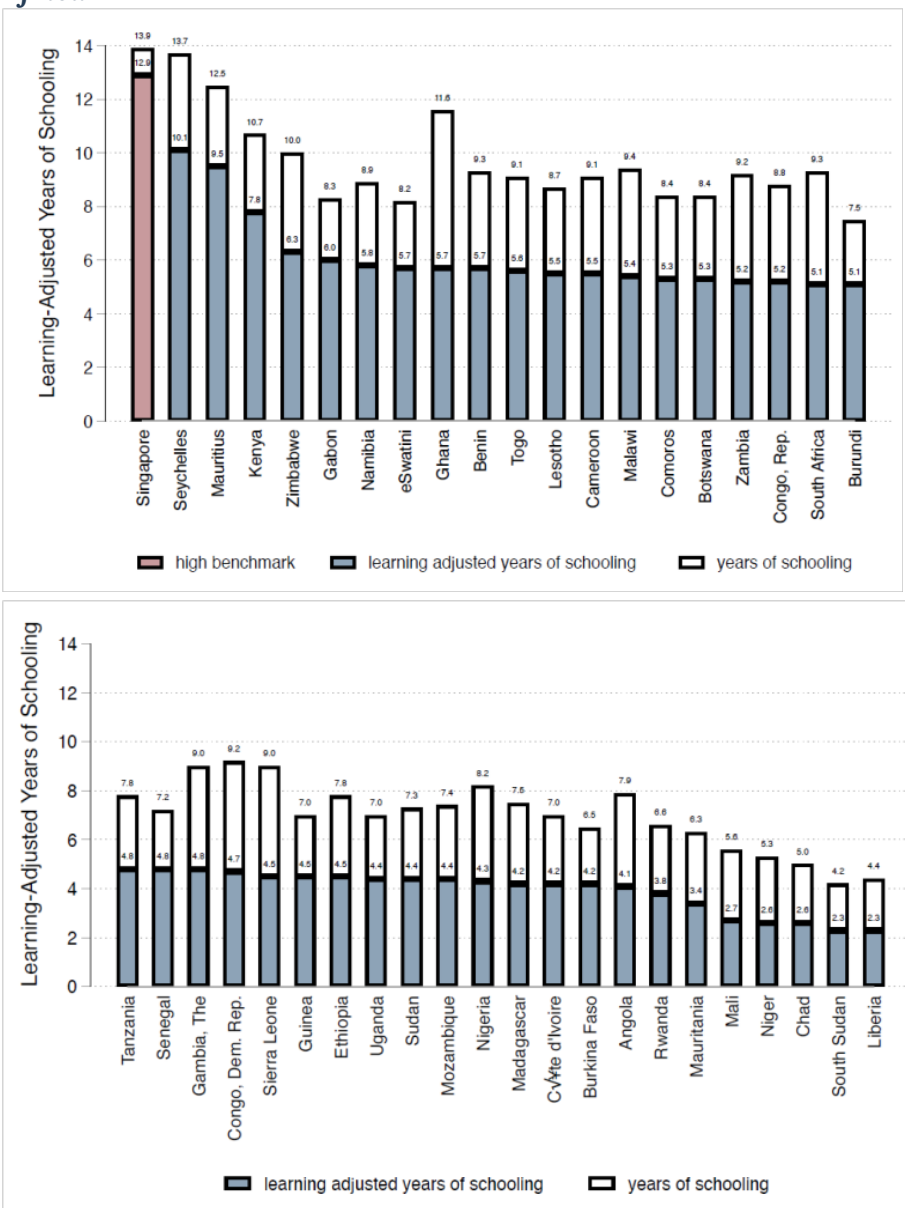
Figure 2: LAYS relative to a county's GDP per capita

Source: AD (2021), Figure 5

Sub-Saharan Africa has both one of the over-performers (Kenya) and under-performers (South Africa) relative to income level. Therefore, the broad variation between average years of completed schooling and average learning is not surprising. Figure 3 ranks countries in the region by LAYS and includes Singapore for comparison as a high benchmark.

On average, countries with more years of schooling have higher LAYS. Ghana stands out as an exception, having the third highest years of schooling (11.6 years) but only the eighth highest LAYS (5.7 years), tied with other countries who have only 8.2 (eSwatini) and 9.3 (Benin) years of schooling. Some countries have both low years of schooling and low LAYS. South Sudan and Liberia have fewer than 5 years of completed schooling and a LAYS of 2.3. In addition to South Sudan and Liberia, Mali, Niger, and Chad all have LAYS below 3.

Figure 3: Learning Adjusted Years of Schooling in Sub-Saharan Africa



Source: AD (2021), Figure 6

Between 2010 and 2020, some countries in the region made meaningful progress in increasing their LAYS. Overall, the region increased at a slow rate of 0.05 LAYS per year, or half of a year over the decade. Again, this hides substantial heterogeneity in the region: Botswana and Chad did not increase their LAYS at all (steady at 5.1 and 2.8, respectively). In contrast, in Togo, LAYS increased by 1.5 years from 4.5 to 6.

The period between 2000 and 2020 is also a period in which many countries in Africa implemented universal or free primary education (UPE or FPE). These programmes could have exacerbated pre-existing sector deficiencies or created new ones with which the education sectors continue to grapple.

Promising interventions exist to increase the amount of learning that children achieve while in school, making each school year more efficient. Some interventions increase learning by 3 LAYS per US$ 100 (Angrist et al., 2020). A particularly promising set of reforms include differentiating instruction for students of different learning levels (e.g., Banerjee et al., 2007; Banerjee et al., 2010; Banerjee et al., 2017; Duflo, Kiessel and Lucas, 2022; and Beg, Fitzpatrick, and Lucas, 2023). Differentiated Instruction is part of the broader classification of structured pedagogy, which has also shown promising results on student learning (e.g., Piper et al., 2018).

The Policy-Practice Gap

One challenge with any reform is to implement within existing systems at scale in a sustainable way. Having official policies in place that should increase learning is good, but are households experiencing the benefits of those stated policies? As with the *Quality-Quantity Gap*, understanding the *Policy-Practice Gap* is a data-intensive exercise.

To collect data on the official policies, AD (2021) surveyed 40 countries across Latin America, Sub-Saharan Africa, South Asia, and Eastern Europe. AD (2021) compare these data to responses from household surveys from the same countries about the educational services that households receive.

Remote learning due to the COVID-19 crisis is a particular case to compare policy vs practice. Many countries implemented remote education services through TV or radio while schools were closed. Households did not uniformly access these services. Over three-quarters of households in the sample of Latin American countries with remote learning options accessed remote learning. In contrast, in the sample of Sub-Saharan African countries, fewer than 50% of households reported accessing the content, except for Kenya where over 75% of households accessed the content.

This case study does not necessarily indicate that the TV or radio broadcasts did not occur as intended. Instead, it shows that households either did not elect to access the provided content, whether because of lack of interest, not having the correct level of technology or Internet access necessary to access the content, or that the content might not have been of sufficient quality or convenience for households to deem it worthy to access. Finally, school-aged children may have had other demands on their time, or parents might not have been available to support their children in accessing the content.

The provision of remote learning opportunities was positively correlated with existing levels of expected years of schooling and higher levels of learning. The larger the gap between policy and practice, the lower the expected years of schooling and learning levels. Countries in which children spend more years in school and acquire more learning were those that were both more likely to implement distance learning opportunities and those for whom the policies enacted were more likely to be used by households. The relationship between the policy-practice gap and the level of learning is stronger than that between the same gap and the years of schooling – systems that deliver more learning are more likely to implement policies with less of a policy-practice gap.

Countries implemented COVID-19 learning mitigation interventions quickly and in response to a crisis. Whether the patterns would be the same for other policies that countries implement in a more typical manner, such as universal primary education, is an open question.

Responding to the Learning Crisis

Given the low levels of learning in many countries, what can be done? In "Responding to the Learning Crisis: Structured Pedagogy in Sub-Saharan Africa," Benjamin Piper and M.M. Dubeck (2022) (henceforth PD) focus on structured pedagogy.

In lower primary classrooms, poor instructional methods such as whole class, teacher-centred instruction and adherence to a curriculum that might be at a level unsuited to the learning levels of the children in the classroom hamper learning. One solution is to update the teaching and learning environment through structured pedagogy. Structured pedagogy programmes typically include student books and materials, teachers' guides with structured daily lesson plans, teacher training, and continuous support to teachers through coaching and teacher communities. Previous studies have found that providing books alone without the other accompanying aspects of structured pedagogy does not necessarily increase student learning (e.g., Glewwe et al., 2004; Banerjee et al., 2017). While not specific to structured pedagogy, a related and important issue to consider is the optimal number of hours per day of instruction and whether it varies based on the format of teaching.

History of Structured Pedagogy

Teachers as varied as the Ethiopian Orthodox Church and European schoolmasters have been using structured pedagogy for hundreds of years. Today, its standardization is a key feature in many curriculums in high-income countries.

Opinions about structured pedagogy are mixed. Critics point out that it manipulates teachers and students and removes teacher discretion in what and how to teach. In contrast, supporters point out that it can provide a framework for new teachers, return joy to teaching when students learn the material, and, with basic lesson plans in place, teachers can focus more on being creative and engaging their students.

Characteristics of Structured Pedagogy

Structured pedagogy includes teacher guides with lessons plans, student materials, teacher training, and ongoing teacher support. The teacher guides also share the common elements of explanation, modeling, guided practice, independent practice, formative assessment, discussion, and monitoring.

Structured pedagogy can vary on the degree of teacher autonomy, from having every word scripted to providing a menu of activities. Figure 4 provides a graphical representation of this spectrum.

Figure 4: Continuum of teacher autonomy

Source: PD (2022), Figure 2

Depending on the model, teachers can be encouraged or discouraged from adjusting plans based on their own discretion.

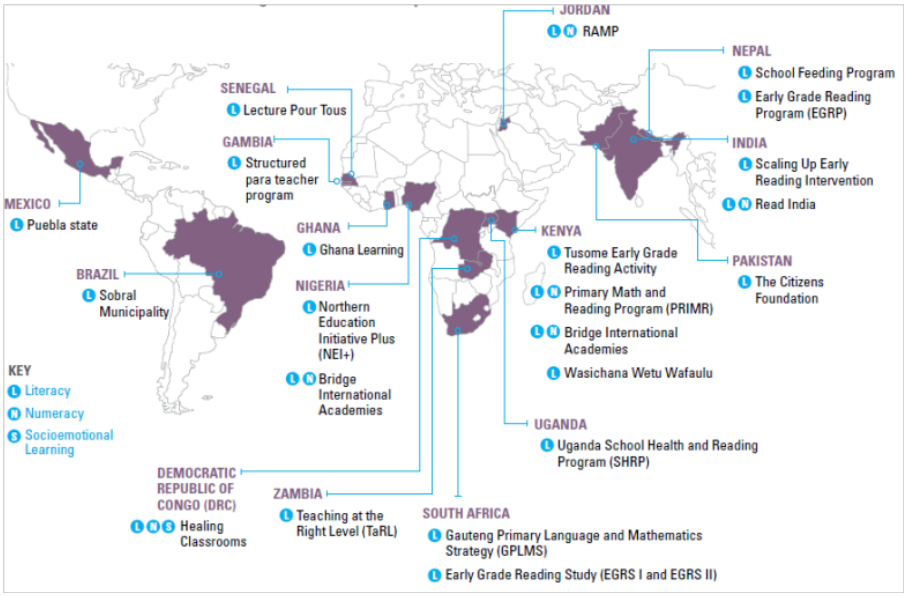
Evidence on Structured Pedagogy

Since the 2010s, evidence has been accumulating on the effect of structured pedagogy programmes in low- and middle-income countries (LMICs). Meta analyses conducted prior to 2015 provided some of the first muti-study evidence on its successes, but many of the studies were based on small scale trials. Since 2015, three meta-analyses drew on studies of much larger sample sizes and consistently found positive effects on learning from structured pedagogy.

Relative to studies in the US, structured pedagogy programmes in LMICs have effects that are twice the size, on average Cohen's 0.44SD relative to 0.22SD in the US. These effect sizes put this class of intervention among the 90th percentile of effect sizes of programmes designed to increase learning in Sub-Saharan Africa.

Numerous cross-study syntheses espouse the successes of structured pedagogy. The Global Education Evidence Advisory Panel considers structured pedagogy a "Good Buy" because it can increase learning in a cost-effective way at scale (GEEAP, 2020). Seven of the eight most effective large-scale interventions in the Learning at Scale study feature Structured Pedagogy (Dubeck et al., 2019). Figure 5 shows the wide geographic dispersion of recent large-scale structured pedagogy programmes in low- and middle-income countries.

Figure 5: Large-scale structured pedagogy programmes in LMICs



Source: PD (2022), Figure 3

The success of structured pedagogy on increasing average test scores does not necessarily indicate that these programmes lead to large increases in the number of children who are meeting government benchmarks. Interventions that increase student test scores from very low levels can show large effects even if the students are still testing well below grade level.

Implementing Structured Pedagogy Programmes

To work at scale, PD (2022) note that programmes should have five characteristics:

1. Be a government priority
2. Communicate this priority throughout the system
3. Use the system to monitor implementation
4. Have government leaders responsible for the programme
5. Be institutionalized as part of normal activities

Designing Structured Pedagogy Materials

PD (2022) propose a series of best practices in designing materials. Designing materials is "an informed, collabourative, and iterative process" that starts with a needs assessment,

ends with print-ready materials, and takes at least six to twelve months. After materials are developed, they should be piloted, adjusted, and formally approved. Context-specific constraints or opportunities, e.g., geography and cultural values towards education, should be considered throughout the path.

PD's (2022) steps along the path to developing materials include

1. Understanding the strengths of the existing government curriculum, which can come from the perceptions of teachers and members of the curriculum department, reviews of the existing documents, and classroom observations.
2. Creating a small team from personnel in curriculum, policy, and teacher education to make key technical decisions.
3. Making initial key technical decisions, e.g., appropriate grade levels, subjects, languages, learning proficiencies, types of materials, and amount of structure in the materials.
4. Creating a map of the structured pedagogy based on the determined scope and sequence of skills and content.
5. Developing the materials.

A successful team should have clearly defined roles and include pedagogy experts, reviewers, writers, graphic designers, a production manager, and administrative support. The right sized team will carefully develop useful materials. A large team might develop materials more quickly, but the materials might be of overall lower quality.

The student book and the teacher guide must be coordinated, and must complement each other, ideally developed through a staggered production process. Many decisions go into their design including the page layout, amount of content per lesson, instructional routines, and extent of the activity bank and suggested uses.

Structured Pedagogy Programme Training and Support System

The potential promise of even the best materials cannot be realized if they are not effectively and correctly used. Teachers need to learn how to use the materials and improve their use of the materials over time.

An important component of structured pedagogy are high-quality in-service teacher training sessions, guided by a concise, well organized training manual with direct reference to the accompanying teaching and learning materials. These trainings should consist of "teacher practice, skills modeling, discussion, and lecture, ideally in decreasing quantities." Small groups, i.e., groups of 2 or 3, are ideal for practice, with larger group time used for skilled teachers to model pedagogical activities. Discussion can provide self-reflection and self-evaluation. Trainers should minimize lecture time to maximize time that teachers can improve their skills in implementation.

Selecting and training the trainers is also important. The suggested ratio is two trainers for every thirty teachers. Recently trained teachers are ill-equipped to train their school peers who were unable to attend the formal training. Head teachers or school principals should similarly receive training to understand how to support and implement the programmes in their schools.

Once materials are developed and initial training complete, teachers need to receive ongoing support, including observation, constructive feedback, and self-reflection. Potential mechanisms for this support are an in-school coach, external coaching visits, school-level teacher learning groups, cluster-level teacher learning groups, and support through digital technology. Regardless of how support is provided, it should be sustainable using only government resources and focus on having a constructive and not punitive role.

Data Systems and Accountability in Structured Pedagogy Programmes

Data are important at multiple steps in the design, implementation, and sustainability of a structured pedagogy programme. Data are used to justify the programme, inform the design of the programme, understand how the programme is working, and improve the programme as appropriate.

Data should be collected to understand how and whether the programme is working based on the established theory of change. Data collection should be imbedded in existing government structures and systems, using technology that is both appropriate and maintainable. The person reporting the information should have an interest in collecting the most accurate data possible instead of having a narrow self-interest in ensuring that the data create a particular narrative, even if false. For example, having teachers collect student data that could influence their own pay or promotion could create unintended incentives for the teachers to report inaccurate data or encourage students not to participate in testing.

Upon collecting, data should be analyzed and used for reporting to improve programme quality. Government officers can be overwhelmed by data that are not relevant to their decision-making scope or level. Therefore, officers should receive data that are salient to their portfolio of decision-making in a simplified way. Effective data use improves programmes and can create demand for additional data collection and use.

Limitations and Additional Research Required

Structured pedagogy programmes can be controversial. They have been accused of deprofessionalizing the work of teachers. Critics are also wary of programmes that are pushed upon teachers without designers understanding the relevant context and experience.

Even though structured pedagogy can increase learning in primary school, whether these gains persist into later life outcomes and increased economy-wide productivity is unclear. Recent research has shown the potential for structured pedagogy to increase test scores multiple years after the intervention. Students whose teachers were trained in a structured pedagogy programme in Ghana had higher test scores two years after the

end of the programme, even after the students had transitioned out of primary school into junior high school and suffered 10 months of COVID-19-related school closures (Beg, Fitzpatrick, and Lucas, 2023).

An additional open question is whether structured pedagogy programmes are long-term solutions or only for systems that are performing poorly. Increased teacher autonomy could be important once systems reach a higher level of performance. Regardless of the competency within a system, novice teachers might particularly benefit from the guidance and direction provided by structured pedagogy.

A final challenge is that not all studies of structured pedagogy include cost effectiveness analysis.

Career Progressions

Two potentially under-studied actors in the learning crisis are the school leaders and school inspectors. Responding to the learning crisis involves an entire system, and systems are much more than teachers and students, as the papers on structured pedagogy and the policy-practice gap elucidate. Nevertheless, much of the existing research focuses on the latent characteristics of and interventions that target teachers and students. Any successful transformation of the learning environment cannot happen by only engaging these two elements of the education production function. In "Selection and Training of Principals and School Supervisors" (Lucas, 2022), I summarized the existing literature on the relationship between leaders and student learning, pointed out some of the most recent work to improve student learning by engaging leaders, and combined existing qualitative and quantitative evidence on how the leaders were selected, their training, and demographic characteristics. Engaging and harnessing the power of this layer of civil servants to improve learning is complicated. Yet, outsourcing school management to the private sector can have many unintended and undesired consequences (e.g., Romero, Sandefur and Sandholtz, 2020).

The Relationship between Principals and Supervisors and Student Learning

School leaders set the tone for the entire school, much like managers in firms affect the productivity of many employees. An extensive literature has documented the correlation between management practices and productivity in private sector firms. Also noted in this literature is the extensive heterogeneity between levels of productivity between firms, even firms in the same sector in the same country.

Considering school leaders as akin to managers in the private sector is a more recent undertaking. As with private sector firms, higher quality school management is positively correlated with higher productivity. In the case of the education sector, a particularly salient measure of productivity is student test scores. Of course, students attend schools for many reasons and schools confer many benefits to students. In addition to test scores, schools can improve non-cognitive outcomes. In contexts in which students take high-stakes cognitive tests to advance to higher levels of schooling, cognitive outcomes are especially salient. As a result, much of the research on school productivity has focused on cognitive test-score based outcomes.

Based on data on schools from seven middle- and high-income countries in the Americas and Europe, management quality both within countries and between countries is heterogeneous (Bloom et al., 2015). School management quality is more correlated between schools within the same country than private sector management, pointing to sectoral differences between countries as being an important determinant of school level management quality. Relative to fully government schools, autonomous government schools, i.e., schools that are funded by the government but enjoy some autonomous management structures, have on average higher management quality (Bloom et al., 2015). Whether this is something about the autonomy itself or selection of the personnel who work in autonomous government schools is unknown. Nevertheless, it shows that government-funded schools can have high quality management. Additional evidence from Andhra Pradesh, India, found that private schools had both higher management quality and higher student value added (Lemos et al., 2021). Again, whether this is selection or causal is unknown. Despite this strong positive relationship between management and test scores, the strength of the relationship differs between countries. In higher income countries, the estimates can be as high as a one Standard Deviation increase in management quality being related to 0.4 Standard Deviation higher student test scores. In contrast, two estimates from Sub-Saharan Africa are much lower: 0.06 Standard Deviation test scores in Uganda and 0.15 Standard Deviation test score in Ghana from a 1 Standard Deviation higher management quality (Crawford, 2017; Beg, Fitzpatrick and Lucas, 2023).

Research to Improve School Management

One approach to improving school management is to remove it entirely from existing civil servants and outsource school management to private providers. Other approaches have tried to increase school management using existing personnel. The results across these different models are mixed. Management training can improve management quality, but these improvements do not always translate into increases in student test scores. Beg et al. (2023) show that not all aspects of management are equally important for student achievement, highlighting the importance of management that changes what happens in the classroom.

Just as structured pedagogy programmes assess students to understand their weaknesses in designing appropriate curriculum, trainings focused on improving the knowledge and productivity of head teachers and school supervisors should understand the current levels of knowledge and productivity. Scant data exist on the standards or characteristics of head teachers and school supervisors.

Who are Head Teachers and School Supervisors?

Table 1 is based on qualitative reports on 31 countries in Africa. All countries required some level of teaching experience from “some” to 11 years or more. Only 19% of countries required that these former teachers receive any head teacher specific training prior to assuming the post, and almost half did not even make such training available.

Table 1: Requirements to become a head teacher

	Count	Percent (%)
Panel A: Required Years of Teaching Experience		
"Some"	18	64
1 to 5 years	5	18
6 to 10 years	4	14
11 to 15 years	1	4
Panel B: Training		
Neither Available Nor Required	15	48
Available, Not Required	10	32
Required	6	19

Source: Lucas (2022), Table 1

Qualitative information on school supervisors is even more rare, resulting in a sample of only 15 countries. A summary of the findings appears as Table 2.

Table 2: Requirements to become a school supervisor

Requirement	Percent
Require Teaching Experience	90%
Require Leadership Experience	40%
Require Training	31%

Source: Lucas (2022), Table 2

Almost all countries promote teachers or head teacher to the school supervisor role. Only about one third require training for this supervisor role.

Limited data are systematically collected about large samples of head teachers. Based on data from nine Sub-Saharan African countries, head teachers are on average 44 years old with a range from 37 in Mozambique to 50 in Liberia (Table 3). Only 23% of head teachers are women, ranging from 8% in Morocco to 44% in Madagascar. Other variables are not collected across all countries. Additional characteristics with coverage across at least four countries are total years of experience, averaging 19, and data on teacher observations. About 50% of teachers reported that they were observed by their teachers once a week and about 76% reported that they were observed at least once a month.

Table 3: Demographics, training, and experience of head teachers

Characteristic	Ghana	Kenya	Liberia	Madagascar	Morocco	Mozambique	Nigeria	Tanzania	Uganda	Average
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Age	42	46	50	45	47	37	46	41	45	44
% Female	16%	25%	11%	44%	8%	14%	30%	33%	28%	23%
% with Teaching Experience	96%									
Years Teaching Experience	9.6									
Years Principal Experience	6.8		4.9							
Total Years Experience	16.4	22.7		19.8		14.2	20.5	15.8	20.8	18.6
% Without Any Principal-specific Training	28%									
% of Teachers Observed At Least Once per Week				71%	46%	14%		71%		50%
% of Teachers Observed At Least Once per Month				91%	70%	52%		90%		76%

Source: Lucas (2022), Table 3

The data on school supervisors are even more scarce, appearing as summary statistics of two recent randomized controlled trials (RCTs), one in Ghana and one in Tanzania. Relative to the school leaders from the same sample, supervisors were older and less likely to be women – 18% on average across the two countries. About two thirds of the supervisors in each country had previously been head teachers.

Key Policy Messages

Across the three papers, a few key themes emerge

1. Any solution to increase low student achievement needs to take a system-wide approach.
2. Solutions will need to involve not just the teachers and students but include stakeholders all the way up to the national level decision-makers.
3. Because of lack of systematic data collection, the full extent of the problem and any within and between country differences are unknown.
4. Data collection elucidated the learning crisis – better data collection on other actors in the system are needed to understand existing limitations and potential solutions.
5. Once collected, data also needs to be shared in meaningful ways to incite action.

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