Integrating Indicators of Education Quantity and Quality in Six Francophone African Countries

By

Adaiah Keren Lilenstein

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Supervisors: Nicholas Spaull and Ingrid Woolard

COMPULSORY DECLARATION

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

Signature: Signed by candidate Date: 15 Feb 2016

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Abstract:

Research and policy-making in education have historically focused on quantitative measures of education when assessing the state of education across countries. Recently, large-scale cross-national tests of cognitive skills have emerged as one way of moving beyond mere quantitative indicators of education, and instead allow researchers to incorporate qualitative elements of education, most notably what students know and can do. Notwithstanding the above, research and development initiatives too often assess these complementary aspects separately, which can lead to biased conclusions. To resolve this issue, the research presented here follows the method developed by Spaull and Taylor (2015) and provides composite measures of educational quantity (grade completion) and quality (learning outcomes) for six Francophone African countries. These composite measures are termed access to literacy and access to numeracy for literacy and numeracy rates respectively. This work also explores quantity and quality indicators separately to ascertain whether problems of access to schooling, or problems of quality among those already enrolled, is a more pertinent development issue. Finally, this work also contributes to understanding the extent and nature of inequalities, by looking at gender and socioeconomic status groups separately when considering (1) access, (2) learning outcomes, and (3) a composite measure of access and learning. Results of this work point to an education crisis within these African countries where both non-enrolment and a lack of learning within schools are contributing to dismal educational outcomes, even at the grade 2 level but especially at the grade 5 level. For example, only 18% and 25% of the grade 5 cohort investigated have access to literacy and access to numeracy, respectively, in Togo. Furthermore, inequality within socioeconomic groups is extremely large resulting in near zero estimates of competency levels for the most economically disadvantaged in some countries. Gender discrimination is dwarfed by economic discrimination but mean estimates suggest that while educational opportunities are similar for males and females at a grade 2 level, gender discrimination may already be visible at the grade 5 level.

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List of Abbreviations

ASER	Annual Status of Education Report Survey
BBC	British Broadcasting Corporation
CONFEMEN	Conférence des ministres de l'Education des Etats et gouvernements de la Francophonie (Conference of Ministers of Education of African Countries and Madagascar in French)
DHS	Demographic and Health Survey
DRC	Democratic Republic of the Congo
INLEPS	International Association for Language Education Policy Studies
MCA	Multiple Correspondence Analysis
MDG	Millennium Development Goal
MICS	Multiple Indicator Cluster Survey
NAR	Net Attendance Rate
NER	Net Enrolment Rate
PASEC	Programme d'Analyse des Systèmes Educatifs de la CONFEMEN (Programme for the Analysis of Education Systems of CONFEMEN countries)
PCA	Principal Component Analysis
PISA	Programme for International Student Assessment
SACMEQ	Southern and Eastern Africa Consortium for Monitoring Educational Quality
SARUA	Southern African Regional Universities Association
SDG	Sustainable Development Goal
SERCE	Second Regional Comparative and Explanatory Study
SES	Socioeconomic Status
TLF	The Lingua File
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNICEF	United Nations International Children's Emergency Fund

Chapter 1 Introduction and Rationale

Access to education which is of a reasonable quality can have broadly positive effects on multiple systems, both for individuals as well as for nations. For individuals education is associated with better living conditions such as higher wages (Ashenfelter & Krueger, 1994; Bedard & Ferrall, 2003; Hanushek & Zhang, 2009; Heckman, Stixrud, & Urzua, 2006; McIntosh & Vignoles, 2000), better mental and physical health (see Murrell & Meeks, 2002 for an overview of this literature), and higher levels of subjective life satisfaction (Melin, Fugl-Meyer, & Fugl-Meyer, 2003; Murrell & Meeks, 2001), among a myriad of other benefits. As a nation, better educated individuals means higher labour productivity and, relatedly, higher growth (Altinok, 2007; Appleton, Atherton, & Bleaney, 2013; Barro & Lee, 2013; Bils & Klenow, 2000; Ciccone & Papaioannou, 2007; Cohen & Soto, 2007; Coulombe & Tremblay, 2006). For these reasons education has long been considered a human right as well as a crucial aid to, and goal of development. Unfortunately however, many countries struggle with providing access to education to their citizens and when this education is provided it is often of extremely poor quality (Beatty & Pritchett, 2012; Michaelowa, 2001; Spaull & Taylor, 2015; Uwezo, 2014). Unsurprisingly, women and the socioeconomically disadvantaged often face the greatest challenges when access to education and quality education are scarce commodities (Spaull & Taylor, 2015).

This landscape of multiple beneficial consequences of education coupled with the scarcity of this commodity in many countries provides the rationale for including educational goals in national agendas. Similarly, it also provides the rationale for including an educational goal as one of the 17 Sustainable Development Goals (SDGs) which form part of the UN's 2030 Agenda for Sustainable Development[1]. The educational goal of the SDGs has an explicit focus on both quality and equality and the reaching of this goal by 2030 will require reliable data on both access and quality of education. While data on access to education has been widely available for a long time, data on the quality of education in developing countries is relatively new. However, both data sources are insufficient and result in biased indicators of the educational landscape when used in isolation and most research using these data to look at education systems have used them in this way.

This dissertation will also analyse these two educational outcomes in isolation, to determine their individual characteristics, but will also look at them simultaneously in order to determine the actual state of education in six Francophone African countries. Both analyses provide new insights and a greater understanding of the problems that face policymakers in these regions. Both analyses will also look specifically at gender and socioeconomic disparities in the state of education in these countries. The remainder of this chapter elaborates on the rational presented above, as well as listing the specific aims and research questions addressed in this dissertation. Chapter 2 provides background information on the six countries that form part of this study, Chapter 3

[1] For an overview of these goals visit https://sustainabledevelopment.un.org/?menu=1300

discusses the data used, while Chapter 4 addresses the methodology behind this work before presenting the results in Chapter 5. Chapter 6 gives a final discussion and conclusion.

A note on terminology is useful before continuing: Access to education and the quality of education represent different levels of analysis. When measuring education researchers are usually either looking at the *quality* of education or the *quantity* of education. One way of measuring the *quality* of education is by looking at learning outcomes – in this case the learning outcomes used will be the results of cross-national cognitive achievement tests. The *quantity* of education can be measured by looking at outputs of the schooling system – in this case access to education or grade completion rates more specifically.

1.1 The Importance of Combining Quantity and Quality Indicators of Education

Theoretically, measures of education quantity such as years of schooling, enrolment rates, and completion rates are different to measures of education quality such as results on tests of cognitive skills. Schooling itself does not guarantee the acquisition of cognitive skills (see Filmer, Hasan, & Pritchett, 2006; Hanushek & Woessmann,2008; Pritchett, 2013; Spaull & Taylor, 2015; Taylor & Spaull, 2015) and the acquisition of cognitive skills by the in-school population clearly does not guarantee universal access to schooling. Both are important indicators of the success of the education system but the complementary nature of the two measures, leading to biased assessments when looked at separately, has not been widely discussed.

Access measures of education overestimate the success of the education system because they ignore the quality of education within schools. Looking only at access to schooling is especially problematic when many of those who have access to school do not learn even basic skills. This work, for example, will demonstrate how it can be the case that fewer than half of those in school acquire basic literacy and numeracy skills. Cleary the education system cannot be said to be working adequately for these students.

On the other hand, learning outcomes as measures of the success of the education system also generally overestimate this success. The right context to use these results in is an analysis of the effectiveness of education within the schooling system. In the presence of below-universal enrolment and/or completion rates however, any attempt to use these results to say something about the education level of the population as a whole is problematic. This is because cognitive tests administered through the schooling system only test students who are in school and therefore ignore the out-of-school population[2]. Those who are not in school are likely to have a lower level of learning than their in-school peers, especially in developing countries, thus resulting in an overestimate of the level of education overall. Selection effects which result in those who

[2] Some cognitive tests do overcome this problem however, notably Uwezo in East Africa and ASER in India which sample from households and not from schools. ASER stands for the Annual Status of Education Report Survey and Uwezo means 'capability' in Kiswahili. Both run regional assessments on cognitive achievement in their respective areas.

are most able to attend school, or those that do the best in school, being the ones who are actually in school contribute to this effect.

Interestingly, studies that only look at learning outcomes but make comparisons over time actually underestimate, rather than overestimate, the progress that countries are making toward universal quality education. This is because they often see test scores stagnate or decrease but do not recognize that this is partly due to the influx of more disadvantaged individuals into the schooling system over time. The fact that most developing countries have vastly increased their primary school enrolment and completion rates in the last few decades (Barro & Lee, 2013) means that analyses conducted over time which look at learning outcomes of primary school children will almost inevitably underestimate progress in the educational quality of the schooling system.

While the above issues are certainly relevant in a national context, they are also relevant when making cross-national comparisons. It is clear that access levels cannot be compared across countries when the quality of schooling is not taken into account if the goal is to make a meaningful comparison of the different schooling systems. Similarly for learning outcomes. In fact, it has been demonstrated that the average level of cognitive ability observed on international school assessments varies inversely with the enrolment rate of the population in developing countries (Mullis et al. 2003; Postlethwaite, 2004 as cited in UNESCO, 2005), thus leading to the erroneous conclusion that these countries (with lower enrolment rates) have better schooling systems. These issues when looked at in an international context are especially relevant when countries have widely varying enrolment or completion rates, and when countries have widely varying levels of educational quality. Both are likely to be the case in developing countries, especially those in Africa.

1.2 Literature and Research Aims

As already discussed by Spaull and Taylor (2015), and implied above, the literature on education is mostly bifurcated into studies looking at education quantity and studies looking at education quality. To date it appears that only six exceptions to this bifurcated literature exist. In 2001 Michaelowa conducted a study which used PASEC[3] data from 1996 to create a single indicator of educational quality and quantity. This statistic can be termed *access to learning*, although the term itself was not used by Michaelowa in 2001 as it was only introduced by Spaull and Taylor in 2015. This dissertation also uses PASEC data (the more recent versions) with the same aim. However, Michaelowa used UNESCO's[4] Net Enrolment Rates (NERs)[5] to estimate education quantity which, according to Spaull and Taylor (2015) as well as UNESCO themselves (UNESCO Institute for

[3] Programme for the Analysis of Education Systems of CONFEMEN countries (or in French, Programme d'Analyse des Systèmes Educatifs de la CONFEMEN) which was established by CONFEMEN to support cross-national student assessments in Francophone African countries. CONFEMEN is the Conference of Ministers of Education of African Countries and Madagascar in French (or in French, Conférence des ministres de l'Education des Etats et gouvernements de la Francophonie).

[4] The United Nations Educational, Scientific and Cultural Organization.

[5] Published in UNESCO's Global Monitoring Report and available for most countries.

Statistics, 2010), can potentially lead to large biases in estimates. It's likely that Michaelowa's results, despite showing very low levels of access and access to learning (for example, only a 34% enrolment rate and a 20% access to learning rate for Burkina Faso), are actually overestimates of the proportions of students enrolled as well as overestimates of the proportion of individuals who acquire basic literacy and numeracy skills.

The remaining five papers on this topic all combine Demographic and Health Survey (DHS) data with at least one cross-national student assessment. Filmer et al. (2006) estimate the proportion of 15 year-olds who achieve basic learning standards in a number of developed and developing countries. Unfortunately, they do not include any West African countries in their analysis, nor do they aim to combine access and learning rates into a single statistic. Similarly, Pritchett (2013) estimates learning achievement in a number of developing countries but also does not create a single measure of educational quantity and quality. Hanushek and Woessmann (2008), however, do combine measures of quantity and quality into a single measure of educational success, or access to learning. Unfortunately, the sample used only included a small number of developing countries, three of which are in Africa and none of which are investigated in this dissertation.

Finally, Spaull and Taylor (2015) formalise a method for combining access and learning indicators and apply their method to 11 Sub-Saharan African countries. In their follow-up paper, Taylor and Spaull (2015) take ten of these countries and compare changes in their learning profiles over time.
Spaull and Taylor's (2015) method of creating indicators take both measures of education quantity (completion rates) and measures of education quality (test scores) into account and they use DHS grade completion data to estimate levels of education quantity, which they argue is the most rigorous method of doing so. They combine measures of quantity and quality in a single indicator and term this *access to learning*, or *access to literacy* and *access to numeracy* for language and mathematic skills respectively. The purpose of the current paper is to extend Spaull and Taylor's (2015) method to six Francophone African countries (five in West Africa and one in Central Africa) by using the data from PASEC studies, something that has not been done before. The six countries investigated are Benin, Burkina Faso, the Democratic Republic of the Congo (DRC), the Ivory Coast, Senegal, and Togo.

This dissertation has three main aims: (1) to provide composite measures of education quality and quantity that can overcome the bias of looking at these measures separately, (2) to determine whether access to education, quality of education, or both, present as issues that countries need to be dealing with, and (3) to investigate the existence of gender and socioeconomic gaps in access to education, receipt of quality education, and access to quality education (the latter represents the combined access-quality measure that will be created). This work can contribute to determinations of what indicators of development goals for education quality should look like, as well as be used to more accurately specify cross-country growth models, or in any other work that should make use of completion-corrected measures of a country's cognitive skills. It can also allow countries (and donors) to determine where their development focus should lie in terms of

education improvement, as well as help countries (and donors) to eliminate inequalities where they occur.

1.3 Contributions to Development Goals

The Sustainable Development Goals, which were officially adopted by the UN in September 2015, are a follow-on from the UN's Millennium Development Goals (MDGs) which expired in the same year. These 17 goals are broadly designed to end poverty and improve the lives of poor people but they have many specific focuses for action, one of which is improving education. The goal for improvement of education (goal four) is to, "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all." (United Nations, 2015a). This is an improvement on the previous education goal encompassed in the MDGs which was to, "Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling." (United Nations, 2015b). It is an improvement because it explicitly addresses quality and equality in education which the previous MDG did not do. The SDG also mentions lifelong learning which the MDG did not, but this aspect of the goal will not be focused on in this dissertation.

One of the criticisms of the MDGs (and specifically the second goal of universal education) was of the form that the goals took. It was noted that the MDGs prescribed a single end-point for all countries involved without prior recognition of the differences in starting points between nations (Beatty & Pritchett, 2012). This lead to a struggle for some countries – mainly in Africa – as the goal of universal education by 2015 seemed nearly impossible, and over time proved to be so. Thus as the end of 2015 drew near some of those looking forward to the post-2015 goals were advocating for the acknowledgement of starting points and the development of goals that give proportional end-points rather than absolute ones (Beatty & Pritchett, 2012). For example, a proportional end-point could be a 20% increase in the average scores on cognitive tests, rather than an absolute goal of all students acquiring a certain standard of achievement. Unfortunately, the SDGs have not incorporated this into the goals for 2030, meaning that some African countries may yet again fail to meet the universal goals prescribed.

While targets for each of the 17 SDGs have been set, indicators to assess progress toward these targets are only expected to be finalised in March 2016 (The Guardian, 2015). This work provides the first adjusted indicators of educational success in the six countries investigated here. It also provides the first in-depth analysis of gender and socioeconomic inequalities in access to, and quality of education in these countries. The results that will be discussed below indicate that there is an education crisis in these African countries. The development indicators of the 2030 SDGs for these countries need to be, based on the information in this dissertation, differentiated or set in proportional terms if they are to be taken seriously and if they are to be achieved.

1.4 A Note on Cognitive Outcomes as a Measure of Education Quality

Throughout this discussion, cognitive assessments have been likened to education quality almost synonymously. Regional assessments of cognitive skills such as PASEC usually focus on the testing

of math, language, and sometimes, science skills. An important question to deal with in light of this is whether measures of such skills are really the most appropriate measures of education quality. On the one hand, the fact that scores in these skills are found to be related to growth across countries (Altinok, 2007; Appleton, Atherton, & Bleaney, 2013; Gundlach, Rudman, & Woessmann, 2002) and individual wages within countries (Ashenfelter & Krueger, 1994; Bedard & Ferrall, 2003; Hanushek & Zhang, 2009; Heckman, Stixrud, & Urzua, 2006; McIntosh & Vignoles, 2000) suggest that they are a good measure of learning and have worth. However, even if the cultivation of these three skills are the main aim of education practitioners it is not clear that this *should be* what education institutions strive most to impart. Simply because these skills are related to growth and wages does not mean that other skills are not, or that other skills are not more related to some other worthwhile criteria of a country's success. Relatedly, such skills are often imparted through internalization of information and it is not clear that this information gathering and enhancing of the capacity for memorization are more important than the fostering of critical thinking and imaginative capacities, which are often neglected in the school system (Nussbaum, 2006).

In fact, Nussbaum (2006) goes as far as to argue that without critical thinking and imaginative skills there can be no true democracy:

> "Nothing could be more crucial to democracy than the education of its citizens.
>
> Through primary and secondary education, young citizens form, at a crucial age, habits of mind that will be with them all through their lives. They learn to ask questions or not to ask them; to take what they hear at face value or to probe more deeply; to imagine the situation of a person different from themselves or to see a new person as a mere threat to the success of their own projects; to think of themselves as members of a homogeneous group or as members of a nation, and a world, made up of many people and groups, all of whom deserve respect and understanding." – Nussbaum (2006, p.387)

Nussbaum (2006) goes on to argue that it is the development of critical thinking and imaginative skills that make the difference between primary and secondary school completers who have learned how to question as well as how to see themselves as part of a global society and those who have not. It would be difficult to argue that such capacities are not crucial aspects of the schooling system, yet they do not feature when questions of schooling quality are assessed with quantitative measures. Heneveld and Craig (1996 as cited in Spaull and Taylor, 2015) and UNESCO (2005 as cited in Spuall and Taylor, 2015) also point to other aspects of schooling that are critical for a quality education but not measured as part of regional assessments; some of these are the cultivation of empathy, democratic values, and egalitarian principles. Therefore although the advent of regional assessment initiatives provide a critical resource for research into the quality of schooling systems in both developed and developing countries, we must bear in mind that there remain other critical aspects of the schooling system and education which are being ignored.

This discussion has made a distinction between quantitative measures of educational quality and what would theoretically constitute quality education. In light of this, the subsection which defines the research questions of this work, *1.5 Research Questions*, makes a point of operationalising the research questions as relating to literacy and numeracy outcomes specifically, rather than quality outcomes in general as have been discussed until this point.

1.5 Research Questions

Based on the above discussions the following research questions will be under consideration in this paper, the categorisation of which is similar to that of Spaull and Taylor (2015):

(1) In each country what proportion of children
    a. never enrol,
    b. enrol initially but drop out before completing the relevant grade,
    c. enrol and complete the relevant grade but do so without having acquired grade-appropriate basic literacy and basic numeracy skills by this time, and
    d. enrol and complete the relevant grade having acquired grade-appropriate basic literacy and numeracy skills?

(2) Combining groups a., b., and c., from (1);
    a. what proportion of the population do not acquire grade-appropriate basic literacy and numeracy skills?

(3) In each country, how do completion rates and learning outcomes (of those in school) differ by the subnational categories of
    a. gender (males and females),
    b. wealth (poorest 40%, middle 40%, and richest 20%), and
    c. a gender-wealth interaction (poorest 40% of females compared to poorest 40% of males, middle 40% of females compared to middle 40% of males, and richest 20% of females compared to richest 20% of males)?

(4) In each country how does the proportion of children identified in (2) above differ by the subnational categories identified in (3) above?

These questions form the basis of this work and the remainder of this dissertation will be structured around answering them. Note that the 40/40/20 split for wealth categories was chosen following the work of Spaull and Taylor (2015), but also that of Filmer (2010).

Chapter 2 Background

Figure 1 below displays a map of Africa with the relevant countries given in colour. Five countries are located in West Africa – Benin, Burkina Faso, the Ivory Coast, Senegal, and Togo – while only the DRC is located in Central Africa. All of the West African countries are relatively small countries

by African standards. Benin, Burkina Faso, the Ivory Coast, and Senegal were all colonised by France while Togo was colonised by Germany and the DRC was colonised by Belgium (University of Cambridge, 2014). Although initially being colonised by Germany, Togo was captured by the French and English during the First World War. All countries achieved independence from their colonisers in 1960. The 2014 Human Development Report (United Nations Development Programme, 2014) ranked countries according to their Human Development Index – a composite statistic of the state of education, life expectancy, and per capita income in a country – and all six of the countries under review ranked in the lowest 15% of the 187 countries included.

Figure 1. Map of Africa with Relevant Countries Highlighted

2.1 Benin

In 2013 Benin had a population 0f 10 million people, a GDP of $8.3 billion, and a GDP growth rate of 5.6% (World Bank, 2015a). In 2011 Benin had a headcount poverty ratio of 36.2%, calculated at

national poverty lines (World Bank, 2015a). Benin was colonised by the French in 1872 under the name *Dahomey*, but after 88 years of French rule the country achieved independence on 1 August 1960 (Nations Online, 2015). At this time Benin's new constitution declared that primary school education would be compulsory (Klebelsberg Library, 2015). Primary school education in Benin is also free (Classbase, 2012). At independence Benin was recognised as having one of the lowest primary school enrolment rates worldwide, as well as "enormous" gender disparities (Overseas Development Institute, 2011). Statistics for the years 2000 through 2005 are encouraging as they show a marked improvement in Benin's education landscape (Agyeman, 2007); the primary school net enrolment rate over this period was 93% for males and 72% for females; the grade 5 net completion rate over this period was 69%. The gap that still existed in the net primary school enrolment rates between males and females at this time is notable. An important consideration, however, is that the above statistics are calculated from administrative data which are known to be unreliable and often inflated.

In Benin, French is both the official language as well as the language of instruction in schools, although indigenous languages such as Fon and Yoruba are also commonly spoken (Cotonou Benin, n.d.; Cercle Social, 2015).

2.2 Burkina Faso

In 2013 Burkina Faso had a population of 17 million people, a GDP of $11.5 billion, and a GDP growth rate of 6.5% (World Bank, 2015a). In 2011 Burkina Faso had a headcount poverty ratio of 46.7%, calculated at national poverty lines (World Bank, 2015a). Burkina Faso was colonised by the French in 1896 under the name *Upper Volta*, and achieved independence after 64 years of French rule in 1960 (Encyclopaedia Britannica, 2015). High population density and limited natural resources have resulted in Burkina Faso being one of the poorest countries in the world (Nations Online, 2015). Primary school attendance is compulsory in Burkina Faso in theory, but it is not always enforced in practice (Classbase, 2012). Primary school is generally not free (Burkina Faso US Embassy, 2015). The primary school net enrolment rate was 60.1% in 2005, with the male rate being 65.7% and the female rate being 54.5% (UNICEF, n.d. a). Dropout rates and grade repetition are also very high (UNICEF, n.d. a).

The official language in Burkina Faso is French but roughly 90% of the population also, or only, speak one or more of the native languages of the Sudanic family (Nations Online, 2015). The primary school education system in Burkina Faso uses a bilingual approach, allowing both French and native languages to be used as the medium of instruction in schools.

2.3 The Democratic Republic of the Congo (DRC)

In 2014 the DRC had a population of 75 million people, a GDP of $33.0 billion, and a GDP growth rate of 9.0%. In 2012 the headcount poverty ratio at national poverty lines was 63.6% (World Bank, 2015a). The DRC was colonised by Belgium as the *Congo Free State* or the *Belgian Congo* in the 1870s and achieved independence in 1960 after roughly 80 years of Belgian rule (BBC, 2015a).
Civil war in the DRC only really ended in 2003 and the country has been termed a "humanitarian

disaster" (Nations Online, 2015). Primary school education is free and compulsory in the DRC (SARUA, 2008). In 2013 the gross primary school enrolment rate was 113%[6] (World Bank, 2015a). For the period 2008-2012 the literacy rate of youth aged 15-24 was estimated to be 78.9% for males and 53.3% for females (UNICEF, 2013a).

Interestingly, for the period 2008-2012 administrative data estimated the survival rate to the last primary school grade as 54.5% while survey data estimated the same rate to be 75.3% (UNICEF, 2013a). It is usually assumed that administrative data is not only unreliable but usually leads to inflated estimates of these statistics, however the large difference between the two rates, and the fact that the statistic from administrative data is far smaller, definitely points to some sort of accounting problem from one or both of these sources. The survey statistic was calculated using Demographic and Health Survey (DHS) and Multiple Indicator Cluster Survey data (MICS). This work also uses DHS data and estimates grade 5 completion for 2013 (which should be higher than survival to the last primary school grade over 2008-2012) to be 83% for the DRC, which corresponds to the DHS results calculated by UNICEF[7]. The accounting problem therefore appears to be with the administrative data source (the alternative being that both the DHS and MICS data are inaccurate over multiple years), however it may be the case that DHS and MICS data over-estimate grade completion due to self-report bias. French is the official language of the DRC although students are generally taught in their native language in primary school and only switched to French instruction in secondary school (TLF, 2014).

2.4 The Ivory Coast

In 2013 the Ivory Coast had a population of 20 million, a GDP of $31.0 billion, and a GDP growth rate of 8.7%. In 2008 the poverty headcount ratio at national poverty lines was 42.7% (World Bank, 2015a). The Ivory Coast was colonised by the French in 1893 and achieved independence in 1960 after 67 years of French rule (BBC, 2015b). Independence was closely followed by civil contestation with violent fighting erupting in 2000 and with disarmament only really beginning in 2008 (BBC, 2015b). The civil war devastated the already fragile education system by putting education at the bottom of the national priority list and preventing thousands of students and teachers from gaining access to it (United States Institute of Peace, 2010). The intention of the Ivory Coast is that children enter the schooling system at 7 years old and complete six years primary schooling (Classbase, 2012), however in 2007 almost half of all primary school-aged children were not in school, with 59% of boys and 51% of girls aged 9-11 out of school (UNICEF, n.d. b). However in 2012 the gross primary school enrolment rate was 94% according to the World Bank (2015a), although this number can be over 100% due to over- and under-enrolment so this does not mean that the Ivory Coast had almost universal enrolment. The official language of the Ivory Coast is

[6] The gross enrolment rate refers to total number of children in primary school divided by the total number of children of primary school age in the population, and therefore it can be greater than 100% due to over- and under-age enrolment as well as grade repetition.
[7] The United Nations International Children's Emergency Fund.

French and the language of instruction is French as well, making no provision for native language speakers (Encyclopaedia.com, 2015).

2.5 Senegal

In 2014 Senegal had a population of 15 million people, a GDP of $15.6 billion, and a GDP growth rate of 3.9%. In 2010 the headcount poverty rate at national poverty lines was 46.7% (World Bank, 2015a). Senegal was colonised by the French in 1895 – although as with all colonies there was an extensive French influence in the area before this time. Senegal gained independence in 1960, after 65 years as a French colony (BBC, 2015c). Education is free and theoretically compulsory in Senegal. For the period 2008-2012 the literacy rate among youths aged 15-24 years was 74.2% for males and 56.2% for females. Again, DHS and MICS estimates of survival to the last grade in primary school is much higher than administrative data estimates of the same statistic (92.6% and 59.2% respectively; UNICEF, 2013b). In 2014 the gross primary school enrolment ratio was 84% according to the World Bank (2015a).

Despite having 20 national languages and a few attempts at including indigenous languages as languages of instruction in the schooling system, French is both the official language as well as the primary medium of instruction in Senegal (INLEPS, 2013).

2.6 Togo

In 2014 Togo had a population of 7 million people, a GDP of $4.5 billion, and a GDP growth rate of 5.7%. In 2011 the poverty headcount ratio was 58.7% at national poverty lines (World Bank, 2015a). Togo was colonised by Germany in 1894 but this ended during the First World War with the joint forces of the French and English. French *Togoland* became the independent Togo in 1960 (Nations Online, 2015). Civil unrest over the country's leadership has been persistent and resulted in periods of fighting over the years 1990 to 2005 (Nations Online, 2015; On War, 2015). Education is free and compulsory in Togo – although as in all of these countries the theory of free and compulsory education is not always implemented (Education Policy and Data Center, 2012a). According to the World Bank (2015a), the gross enrolment ratio in primary schools was 134% in 2013. The youth literacy rate among 15-24 year olds over the period 2008-2012 was 86.9% for males and 72.7% for females (UNICEF, 2013c). French is the official language and language of instruction in Togo but efforts are underway to replace French with the two other national languages (Éwé and Kabiyê) which are indigenous to Togo (State University, n.d.).

Chapter 3 Data

Creating access to learning indicators involves combining information from two sources of data; literacy and numeracy rates are derived from the most recent PASEC data and combined with completion rates which are derived from the most recent DHS data for each country involved.

3.1 PASEC

PASEC is the Programme for the Analysis of Education Systems of CONFEMEN countries[8], and CONFEMEN refers to Conference of Ministers of Education of African Countries and Madagascar in French[9]. PASEC is a program established by CONFEMEN which includes 15 member states. CONFEMEN established PASEC as a supporting tool for the monitoring of education systems in CONFEMEN member countries. In 2012 PASEC officially established international comparative evaluations but the program has been supporting African and Asian countries in conducting cross-national evaluations for over two decades (World Bank, 2015b). The international comparative surveys supported by PASEC test students in mathematics and French but also contain a wealth of background information on the home and schooling environments of students. These surveys provide the most recent and comprehensive data on education quality in Francophone Africa. PASEC samples follow a randomised stratification design and are conducted in classrooms of different grade levels – grade 2 and grade 5 – in primary schools. All PASEC tests considered here have a Cronbach's alpha[10] of >0.8 (Le Nestour & Seydou, 2007) which indicates a high degree of inter-item consistency and overall reliability. Practically this means that there is a high probability that carrying out the same tests again would lead to very similar results.

3.1.1 Selecting countries

Francophone African countries were included in this study if they met five criteria:

(1) The PASEC data was made available to me by the CONFEMEN team,
(2) the country participated in PASEC within the last 10 years,
(3) the PASEC data contains comparable French and Math scores,
(4) the PASEC data contains reliable weighting and strata variables,
(5) there is a reasonably matched DHS dataset available (i.e. matching dates).

Criteria four is actually a weak criteria as when this was not met the data were investigated further and used where possible – this is elaborated on below. Table 1 below displays the selection process visually, indicating which countries did and did not meet each criteria. Of the nine datasets which met the first criteria, eight passed the second, seven passed the third, and six passed the fourth. Five PASEC datasets passed the final criteria. These are Burkina Faso, the DRC, the Ivory Coast, Senegal, and Togo. Benin failed at the fourth criteria as it contains no sample structure (weight and strata) variables. This is due to an error during data collection that meant that these could not be calculated. The PASEC report itself does not use weighting and strata variables for Benin (Rahelimanantsoa & Grillet, 2005).

[8] Or in French, Programme d'Analyse des Systèmes Educatifs de la CONFEMEN.

[9] Or in French, Conférence des ministres de l'Education des Etats et gouvernements de la Francophonie.

[10] Cronbach's alpha is not a statistical test. It can be thought of as a coefficient of reliability. The coefficient measures the internal consistency of a survey. That is, how closely related a set of questions are as a group. A high value for alpha does not imply that the measure is unidimensional.

In the interest of including as many countries as possible the data for Benin were investigated for the effects of being unweighted; the results that will be presented in *Section 5.2* were re-calculated for each of the other four countries to see how much the results changed in the absence of weighting variables. These comparisons are given in Tables 1A to 4A in Appendix A. Most results changed only minimally with the exclusion of the sample weight, although there were some differences that fell outside of the confidence intervals for the original results. All but two of the instances of a difference falling outside of the confidence intervals occurred at the grade 2 level. This may simply be a coincidence or it may reflect grade 2 sampling procedures. Finally, there doesn't seem to be any pattern as to whether the lack of weights under- or over- estimate results. Given the paucity of research in this area it was decided that the analysis should be inclusive of Benin data, despite the issues that a lack of sampling information can cause. Note that the lack of strata variables means that no standard errors can be computed for Benin. With all this in mind, this research is conducted on six countries – Benin, Burkina Faso, the DRC, the Ivory Coast, Senegal and Togo. For each country there are two sets of data – data for grade 2 and data for grade 5.

Table 1. Selection of PASEC Data

	Inclusion criteria				
PASEC dataset	Available	<10 years old	Comparable scores	Reliable variables	Matched DHS dataset
Benin 2005	Yes	Yes	Yes	No	Yes
Burkina Faso 2006	Yes	Yes	Yes	Yes	Yes
Chad 2004	Yes	No	-	-	-
Chad 2010	Yes	Yes	Yes	Yes	No
Ivory Coast 2009	Yes	Yes	Yes	Yes	Yes
Mali 2012	Yes	Yes	No	-	-
DRC 2010	Yes	Yes	Yes	Yes	Yes
Senegal 2006	Yes	Yes	Yes	Yes	Yes
Togo 2010	Yes	Yes	Yes	Yes	Yes

3.1.2 Data reliability

One difficulty with using the PASEC data is that unfortunately there are no meta-data, manuals, or technical reports. However, each participating country does publish a PASEC report which documents results of the study as well as varying amounts of technical information[11]. To ensure that the data would provide reliable results the estimates derived from the micro data were compared to estimates presented in the country report. It is unclear to what extent the available data was cleaned before or after the reports were written, but it does appear that some cleaning

[11] All reports can be found at http://www.confemen.org/le-pasec/rapports-et-documents-pasec/les-rapports-du-pasec/

took place for at least some countries after the reports were published. This is clear given the fewer amount of observations present in at least one of the countries used (and more of the countries not used).

Tables 2-5 below show the test results as given in the relevant country reports alongside the same statistics derived from the datasets used here. Only Burkina Faso definitely has missing data, although the Senegal report does not state the number of students so it is not possible to tell in this case. Furthermore, even when there are no cases missing from the data, the estimates derived are not always exactly the same as those reported. However, as can be seen in the tables, whether there are missing data or not the estimates are often the same and almost always within the relevant confidence interval.

Specifically, the Benin and DRC estimates of the mean and standard deviation are exactly the same in all cases; the Ivory Coast estimates are exactly the same for the grade 2 data and negligibly different for grade 5; the Burkina Faso mean estimates for the grade 2 data are different from the Burkina Faso PASEC report but within the confidence interval given. For grade 5 the mean estimates are different and not within the confidence interval given. However, when these estimates are rerun without incorporating the sample weights the estimates for both grade 2 and 5 become far more similar to those reported – the grade 2 estimates actually become the same and the grade 5 estimates now fall within the confidence intervals. It appears likely that these – the unweighted means – are actually the means given in the PASEC report. This means that (1) the report did not take the sample-structure (weighting) into account – for the purposes of this paper weighted data is used throughout for all countries except Benin – and (2) the raw data actually matches the PASEC report well. For Senegal, the mean estimates are also either the same or similar enough to fall within the confidence interval given, while the Senegal estimates for the standard deviations are similar in grade 2, but different in grade 5. It is in Senegal's grade 5 standard deviation estimates that we see the biggest differences. This is likely due to missing data and hence the Senegalese grade 5 results need to be interpreted with caution. Finally, the estimates for Togo are the same or only negligibly different in all cases. Although every effort was made to contact the CONFEMEN team to clarify these differences, feedback was not forthcoming.

3.2 DHS

For the completion rates, DHS data is used. DHS data provide an important source of information for researchers in public health and social science fields and the data have been widely used in both areas (Spaull and Taylor, 2015). Spaull and Taylor (2015), who also use DHS data for their analyses, provide four compelling reasons for choosing to use this data source over administrative records from individual countries:

(1) Self-reported enrolment and completion rates are often more accurate than administrative records, the quality of which is known to vary widely between countries (UNESCO Institute for Statistics, 2010 as cited in Spaull and Tayor, 2015).

Table 2. Reliability of PASEC Data, Grade 2 French

	PASEC report					PASEC data				
Country	N	Score	St. Dev.	C.I. Lower	C.I. Upper	N	Score	St. Dev.	C.I. Lower	C.I. Upper
Benin[a]	-	35.0	24.8	-	-	1705	35.0	24.8	-	-
Burkina Faso	2141	43.1	-	40.0	46.3	2116	40.9	-	37.9	44.0
DRC	2426	55.3	23.0	52.1	58.6	2426	55.3	23.0	52.1	58.6
Ivory Coast	1949	38.5	24.5	35.6	41.4	1949	38.5	24.5	35.6	41.4
Senegal	-	45.0	23.3	40.8	49.2	1979	44.1	26.2	40.2	48.0
Togo	2276	34.1	23.1	32.0	36.3	2276	34.1	23.1	31.5	36.7

Note: St. Dev. Is the standard deviation. C.I. Lower and Upper are the lower and upper confidence intervals.

Values are missing only when they are missing in the relevant PASEC reports. [a]Estimates are run on the unweighted sample.

Table 3. Reliability of PASEC Data, Grade 2 Math

	PASEC report					PASEC data				
Country	N	Score	St. Dev.	C.I. Lower	C.I. Upper	N	Score	St. Dev.	C.I. Lower	C.I. Upper
Benin[a]	-	34.7	26.5	-	-	1705	34.7	26.5	-	-
Burkina Faso	2141	34.0	-	31.5	36.5	2116	33.2	-	30.8	35.6
DRC	2426	55.0	24.5	51.8	58.3	2426	55.0	24.5	51.8	58.3
Ivory Coast	1949	27.6	20.6	25.6	29.7	1949	27.6	20.6	25.6	29.7
Senegal	-	47.2	22.6	43.7	50.7	1979	47.2	25.8	43.8	50.5
Togo	2276	38.6	25.1	36.6	40.6	2276	38.6	25.1	36.2	41.0

Note: St. Dev. Is the standard deviation. C.I. Lower and Upper are the lower and upper confidence intervals.

Values are missing only when they are missing in the relevant PASEC reports. [a]Estimates are run on the unweighted sample.

Table 4. Reliability of PASEC Data, Grade 5 French

	PASEC report					PASEC data				
Country	N	Score	St. Dev.	C.I. Lower	C.I. Upper	N	Score	St. Dev.	C.I. Lower	C.I. Upper
Benin[a]	-	28.8	17.3	-	-	1823	28.8	17.3	-	-
Burkina Faso	2231	37.4	-	35.7	39.1	2221	33.1	-	31.37	34.81
DRC	2396	39.2	20.6	36.2	42.2	2396	39.2	20.6	36.2	42.2
Ivory Coast	1975	33.2	17.1	31.1	35.2	1975	33.3	17.2	31.2	35.4
Senegal	-	38.3	15.6	35.9	40.6	1910	38.3	18.0	37.5	39.1
Togo	2314	29.1	15.0	27.8	30.4	2314	29.1	15.1	27.1	30.7

Note: St. Dev. Is the standard deviation. C.I. Lower and Upper are the lower and upper confidence intervals.

Values are missing only when they are missing in the relevant PASEC reports. [a]Estimates are run on the unweighted sample.

Table 5. Reliability of PASEC Data, Grade 5 Math

	PASEC report					PASEC data				
Country	N	Score	St. Dev.	C.I. Lower	C.I. Upper	N	Score	St. Dev.	C.I. Lower	C.I. Upper
Benin[a]	-	32.4	17.2	-	-	1823	32.4	17.2	-	-
Burkina Faso	2231	36.8	-	34.9	38.8	2221	39.3	-	37.2	41.4
DRC	2396	45.2	18.9	42.5	47.9	2396	45.2	18.9	42.5	47.9
Ivory Coast	1975	27.8	12.4	26.3	29.2	1975	27.8	12.4	26.4	29.2
Senegal	-	41.8	14.8	39.7	43.9	1910	43.2	17.4	42.4	44.0
Togo	2314	33.7	14.9	32.2	35.1	2314	33.7	14.9	32.1	35.3

Note: St. Dev. Is the standard deviation. C.I. Lower and Upper are the lower and upper confidence intervals.

Values are missing only when they are missing in the relevant PASEC reports. [a]Estimates are run on the unweighted sample.

(2) Specifically, grade completion rates – which Spaull and Taylor (2015) regard as the most meaningful measure of quantity of education for the purpose of this analysis – cannot be calculated reliably using administrative education data.
(3) Unlike country-specific administrative data, the uniformity of the DHS survey means that the latter is more likely to be comparable across countries and over time.
(4) DHS data can be linked to household characteristics such as socioeconomic status and gender. Administrative records on the other hand can only be linked to gender.

Despite the now-obvious reasons for preferring DHS data over administrative records there are also important caveats at play when working with survey data, and DHS is no exception. The potential issues with survey data are well-known and as such will only be mentioned briefly here. Note that most of these issues also apply to PASEC survey data: the general limitations to working with survey data include sampling errors, household nonresponse, exclusion of homeless people from the sampling frame, measurement error, problems with capturing school attendance, and self-report bias (Spaull & Taylor, 2015).

However, the advantages of using DHS to calculate completion rates rather than, say, UNESCO's NERs, have already been discussed (see *Section 1.2 Literature and Research Aims*) and are well articulated in the technical appendix to Spaull and Taylor's (2015) methodological study. Spaull and Taylor also compared the use of DHS-estimated completion rates to using an age-specific Net Attendance Rate (NAR) as well as to estimates using Kaplan-Meier survival probabilities, and completion rates were argued to be the most accurate and reliable indicator of educational access (compared to all three of the above).

Finally, DHS data have been used in hundreds of peer-reviewed papers for a variety of analyses, including both educational attainment (Filmer & Pritchett, 1999) and enrolment (Hanushek & Woessman, 2008). Taking the above discussions together, Spaull and Taylor (2015) conclude that the limitations to using DHS data do not outweigh the serious issues inherent in the alternative options.

In addition, an update to the DHS sampling method in recent years also allows for more accurate and reliable analyses using this data. Previously DHS surveys only took place in households with a female present, at least for some countries (see for example the DHS report for Mali in 2001[12]), meaning that male-only households were excluded from the sample, and that there were fewer males than females represented in the data. This would cause generalisability problems if the characteristics of males in male-only households differ systematically from the characteristics of males in households with a female present. However, more recent DHS studies and specifically those used here, use a nationally representative sampling frame with roughly equal representation of males, females, and male-only and female-only households. Appendix B displays these figures for each country, weighted and unweighted.

[12] All reports can be sourced from http://www.dhsprogram.com/ once requested.

3.3 Matching PASEC and DHS Data

Matching PASEC and DHS data requires an age cohort to be settled on first. To ensure that the grade completion rate estimated includes all those who will ever complete the grade we must use an age cohort older than the actual age at which most children complete grade 2 or grade 5 due to the common practice of late enrolments in developing countries. For this study age cohorts were chosen independently for each country depending on the grade 2 or grade 5 completion rates within that country, derived from DHS data. Cohorts were chosen by looking at the youngest age at which less than 5% of the population were still enrolled in grades 1-2 (for the gr.2 cohort) or grades 1-5 (for the gr.5 cohort). Age cohorts for each country are displayed in Figures 2-7.

The DHS data were matched to the PASEC data based on these age cohorts and the ages at which students typically complete grade 2 or grade 5 in each PASEC country. The latter statistic was derived by looking at the average age in each class. PASEC tests students at both the beginning (pre-test) and end (post-test) of the year. Since the PASEC tests being used here were conducted at the end of the year (post-test data) the assumption that those who took the test also completed the year is not a far stretch. As an example of the matching process, the Benin PASEC data was collected in 2005 and the grade 2 age cohort based on the DHS data is 11-15 year olds. In 2005 the average grade 2 student was 7 years old. That 7 year old would be 11 years old in 2009 and 15 in 2013. There is a DHS dataset available which was collected in Benin over the years 2011 and 2012. This matches the PASEC data reasonably well as the years of DHS collection fall into the cohort years of 2009 to 2013. Figures 2-7 below display the PASEC-DHS matches for each country and for each grade. Grade 2 matches are shown in blue while grade 5 matches are shown in orange. Throughout this dissertation grade-specific information will be presented in this way.

Figure 2 shows the match for Benin grade 2s and grade 5s. The first circle in each diagram encircles PASEC information while the second circle in each diagram encircles DHS information. Within the first circles (on the left of each diagram), notice that both the blue and orange lines start at 2005 representing the year that PASEC was conducted. Below the blue line on the left is the number 7 which indicates the average age of students in grade 2 in the PASEC sample. Similarly for grade 5, there is a number 12 below the orange line indicating the average age of students in grade 5. For grade 2 we want an age cohort of 11-15 years according to the discussion above, which is indicated by the upward arrows toward the blue line at these ages. For grade 5 the cohort is 16-20 years and indicated in the same manner. As already discussed, the DHS dataset matches the PASEC data well as it overlaps entirely, which can be seen in the figure by the fact that the DHS years (encircled by the circle on the right) fall into the age cohort bracket.

Figure 2. PASEC-DHS Match – Benin

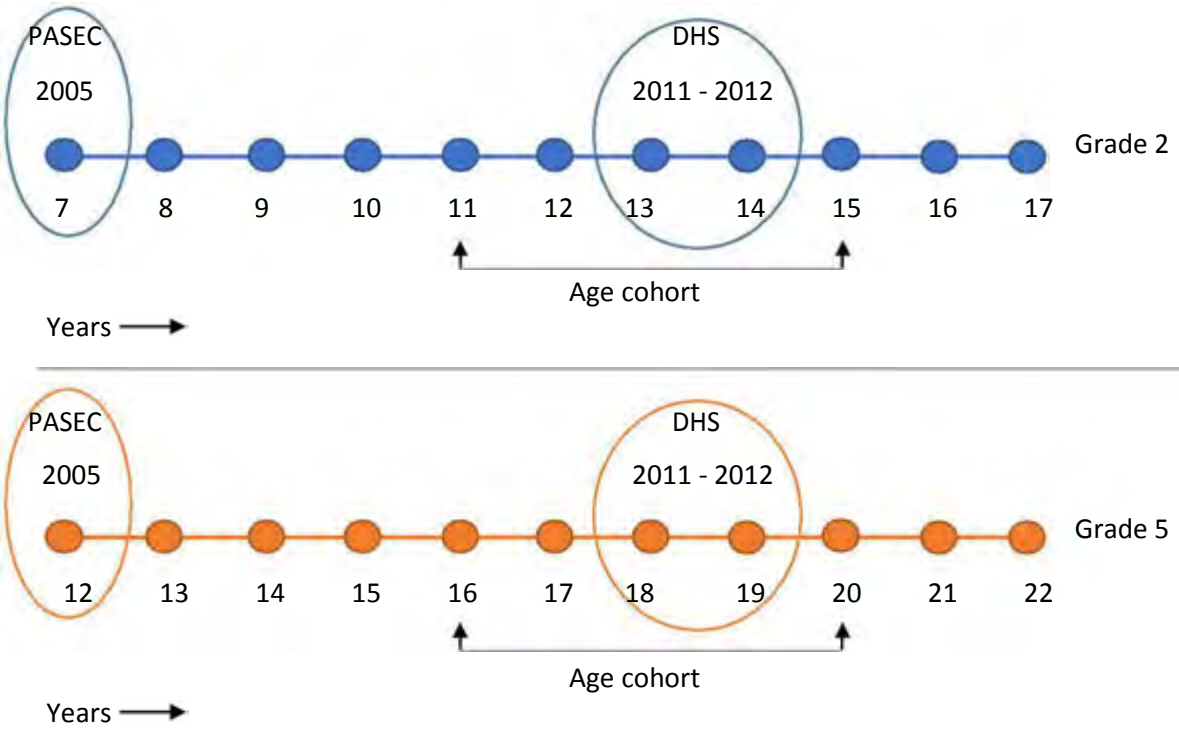


Figure 3. PASEC-DHS Match – Burkina Faso

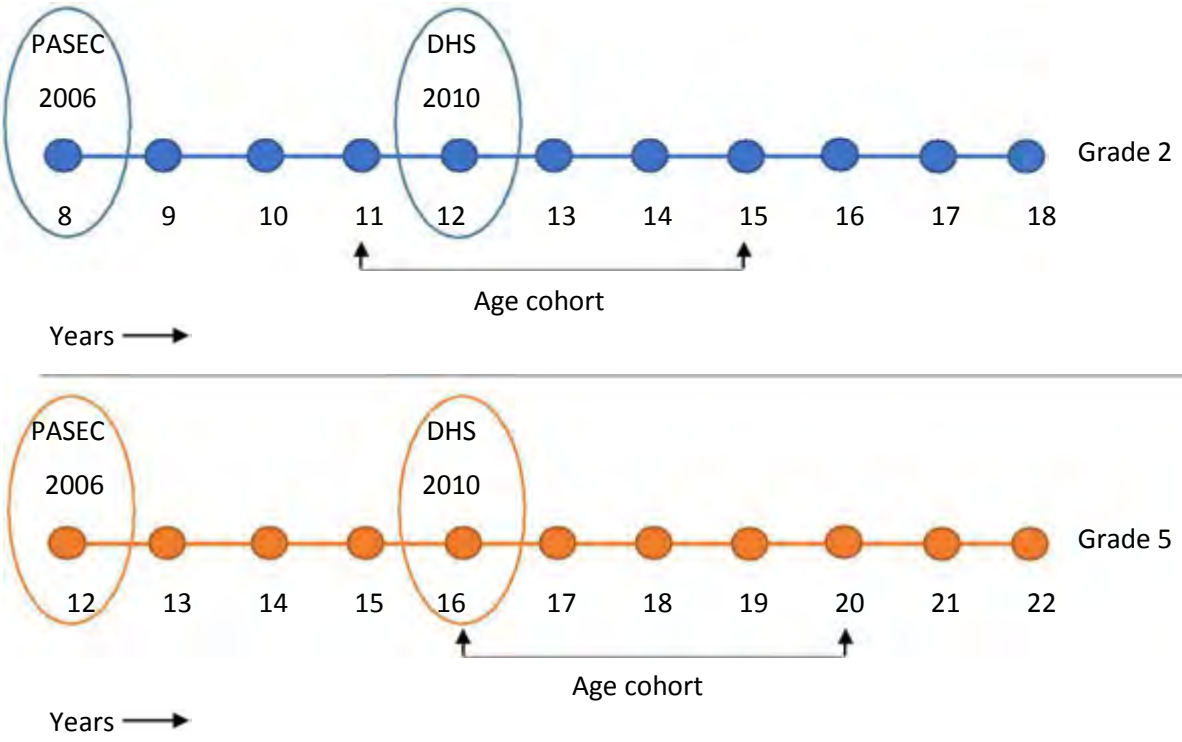


Figure 4. PASEC-DHS Match – DRC

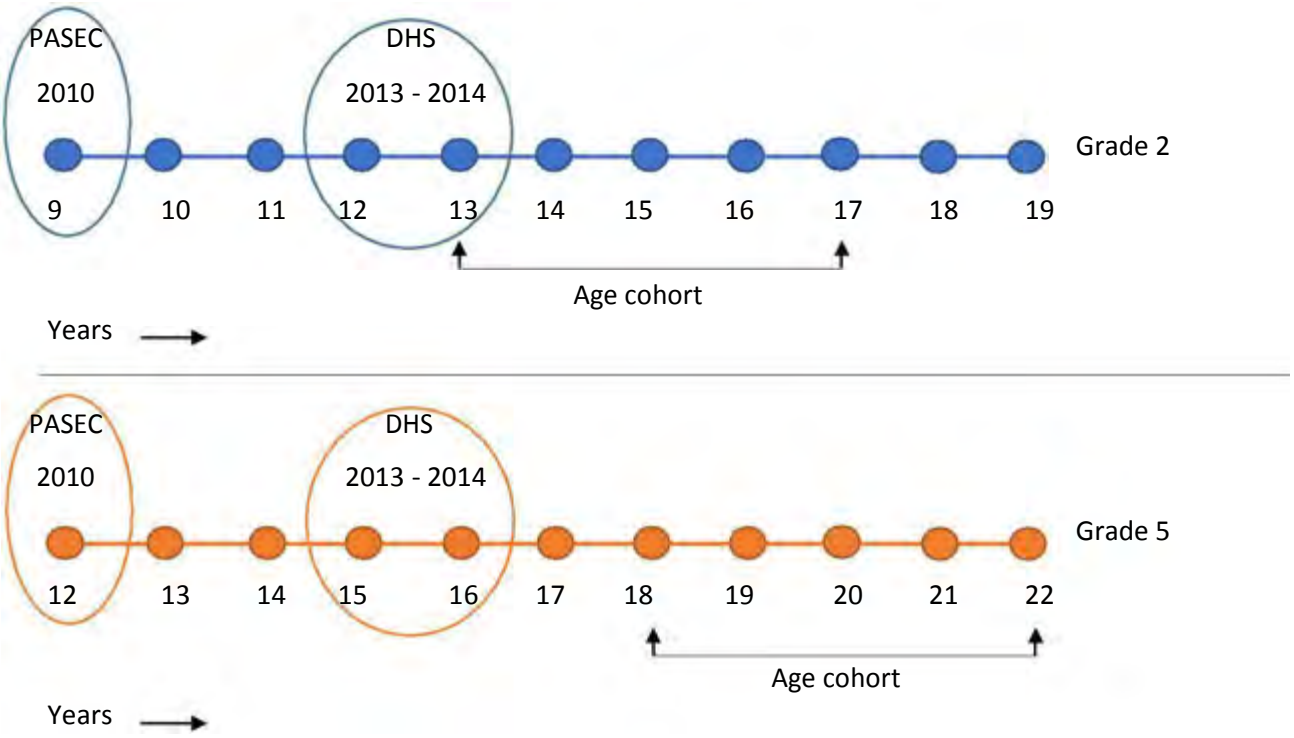


Figure 5. PASEC-DHS Match – Ivory Coast

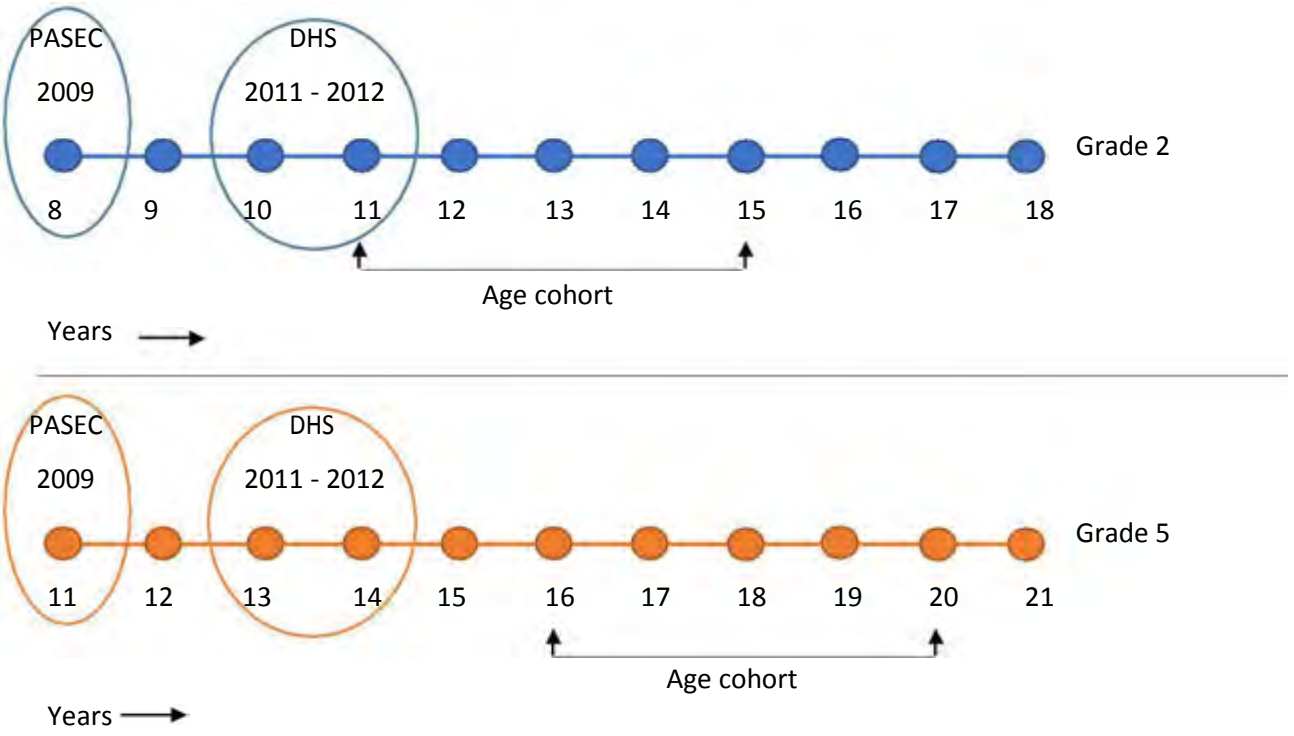


Figure 6. PASEC-DHS Match – Senegal

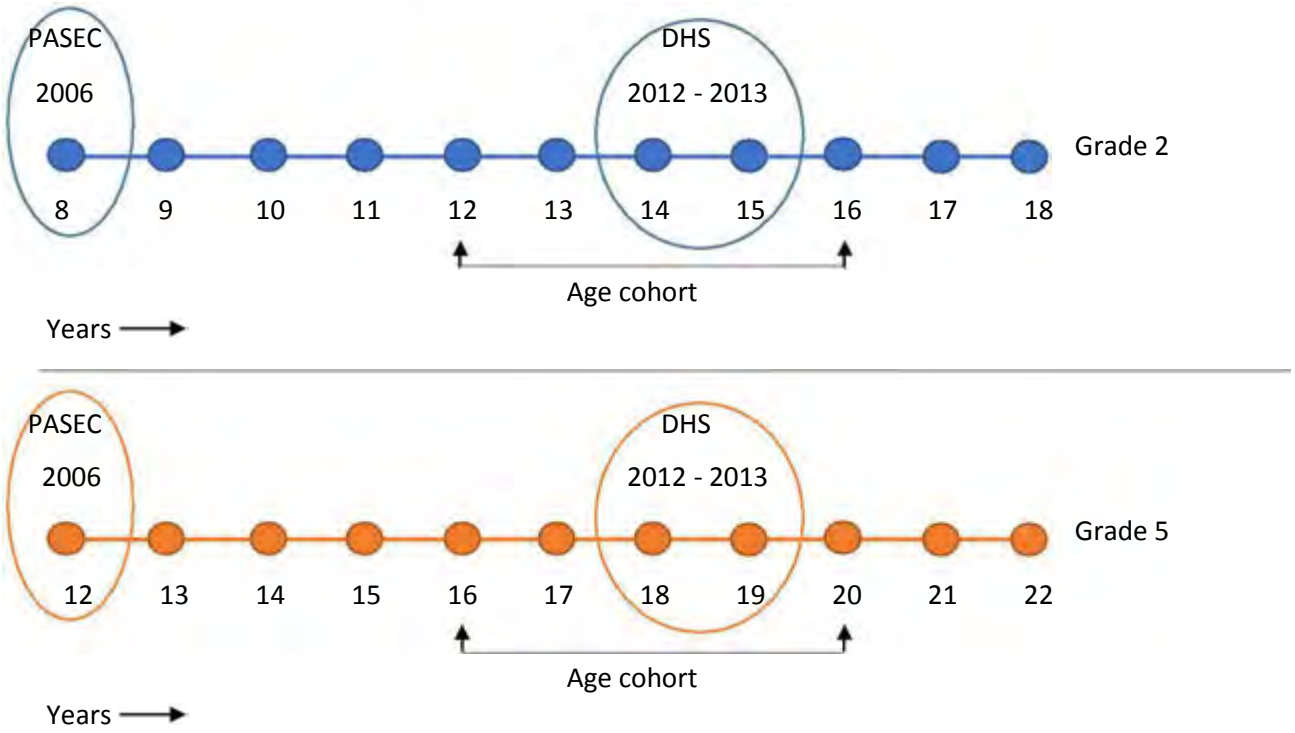
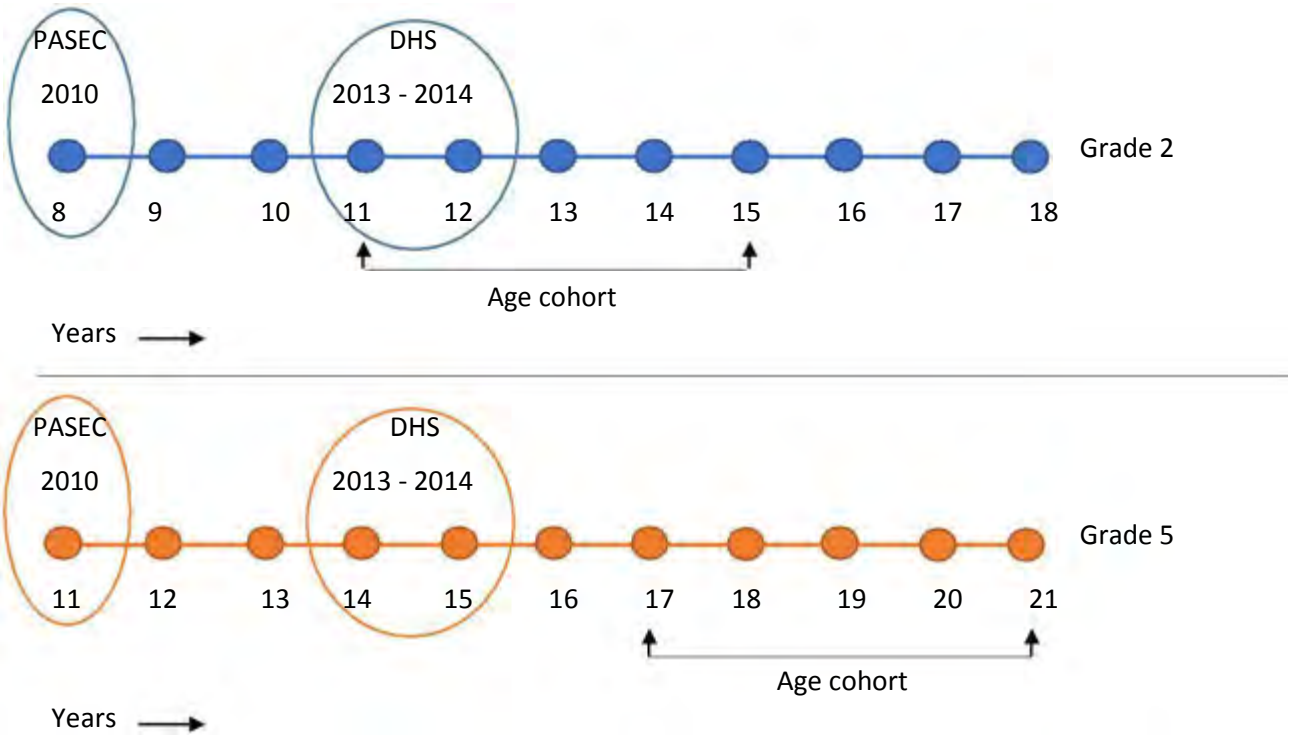


Figure 7. PASEC-DHS Match – Togo



For Burkina Faso and Senegal, the DHS datasets match to the PASEC data relatively well as the years overlap for both grade 2 and grade 5. For the DRC, Ivory Coast, and Togo the grade 2 data overlap and are therefore well matched. However, for grade 5 each county has a one year gap between the DHS dataset and the PASEC data. In each case the DHS data were collected earlier than the years which represent the age cohorts. This means that the students who took the PASEC test are probably not the same students who will be investigated in the DHS data for these countries in grade 5; for example in Togo the PASEC students are around ages 14 to 15 in the DHS data while the DHS students used are ages 17 to 21. What this means practically is that the cognitive outcomes investigated belong to a slightly more recent group of students than the completion rates do. Notwithstanding the above, there is an argument to be made that assuming that slightly older or younger cohorts approximate each other (and can therefore proxy for each other) is an assumption worth making if it means that creating access-to-quality statistics becomes possible.

Chapter 4 Methodology

4.1 Creating a Learning Benchmark

An initial point to note is that the research questions in *Section 1.5 Research Questions* ask about the proportions of students acquiring basic competencies, yet the data on education quality being used is in the format of a continuous variable; students answer a number of multiple choice questions and they get a grade according to the proportion of questions answered correctly. For SACMEQ[13], which is the student achievement data used by Spaull and Taylor (2015), there are clearly defined levels of achievement according to how many questions were correctly answered. These correspond to the achievement of general basic skills, rather than grade-specific skills and are psychometric in their formulation[14]. Unfortunately the same categorisation does not exist for PASEC, but PASEC does make use of a levels system which is also based on the number of correct answers given by students. Theirs is a more arbitrary way of defining achievement (to be explained below) but it still represents the best data on cognitive achievement available for these countries.

Learning benchmarks for PASEC consist of three levels: Level 1 is a score of between 0% and 24% correct answers (inclusive). At this level students are said to be failing scholastically. Level 2 is a score of between 25% and 40% (inclusive). At this level students are not failing but they also cannot be said to possess basic knowledge in reading, writing, and counting. Level 3 is a score of above 40% and at this level students are said to possess basic knowledge (Education Policy and Data Center, 2012b). The 40% threshold for level 3 was chosen by PASEC and CONFEMEN because,

[13] The Southern and Eastern Africa Consortium for Monitoring Educational Quality which is run by UNESCO and conducts cross-national student achievement tests in Anglophone African countries.

[14] This means that they were developed by professionals who ensured that the benchmarks developed actually correspond to learned skills. Conversely, PASEC levels were chosen in a more arbitrary manner.

due to the multiple choice format of the PASEC tests, a student could score 30% on the test just by guessing. This is a weak reason to use this benchmark, however it has been used before with earlier rounds of PASEC surveys (Michaelowa, 2001). One can imagine that this could be considered as giving an upper bound estimate of the proportions of children who meet basic competency standards, as it is a low threshold to pass.

Unfortunately, this means that comparing the achievement of PASEC countries and SACMEQ countries is not possible under the current methodology. The PASEC and SACMEQ tests were developed independently meaning that achievement on one does not necessarily equate to achievement on the other, and the fact that the learning benchmarks were chosen in different ways means that these do not equate to each other either. It is not too surprising that little effort was made to make the test scores comparable since the point of these regional assessments is to compare similar regions rather than comparing across dissimilar ones. However, it is unfortunate that under the current methodology this work cannot be compared to that of Spaull and Taylor (2015) who pioneered this approach in Sub-Saharan Africa using SACMEQ data. A methodology for comparing otherwise incomparable cross-regional assessments has been developed but this is beyond the scope of this research paper. The methodology will be discussed briefly under *Section 6.2 Limitations and Recommendations.*

Calculating the proportion of the age cohort who achieve a learning benchmark (access to learning) is given by the multiplication of the proportion of the cohort who complete the grade with the proportion of the in-school cohort who reach the basic competency standard outlined above. For example, if 60% of the age cohort have completed grade 5 and 40% of these acquired basic literacy skills at the grade 5 level then 24% of the age cohort completed grade 5 with basic literacy skills (0.6x0.4=0.24). The inverse of this proportion – 76% in this case – represents the proportion of the age cohort who did not acquire basic literacy skills.

Note that if we are assuming to know the proportions of the population meeting and not meeting basic learning standards, but only have data on the learning achievement of those in school, then we are making an assumption about the learning achievement of those who are out of school. The assumption made is that those who do not complete the relevant grade also do not achieve the grade-specific level of basic learning. This assumption follows that used by Spaull and Taylor (2015) who motivated it by pointing out that (1) it is unlikely that individuals who never enrol in school will learn to read, write, and do math, and (2) it is also unlikely that individuals who enrol but drop out would have acquired these skills before dropping out. This second motivation may seem weak at first but if we consider the fact that most individuals who drop out do so because they have failed previous grades or repeated multiple grades then the motivation becomes more clear. Consider as well that those who drop out because of income constraints or distance from school are also statistically less likely to be in the better performing part of the performance distribution before dropout. Finally, the fact that a large proportion of students who do complete the grade do not acquire basic skills makes it unlikely that those who drop out before completing the grade

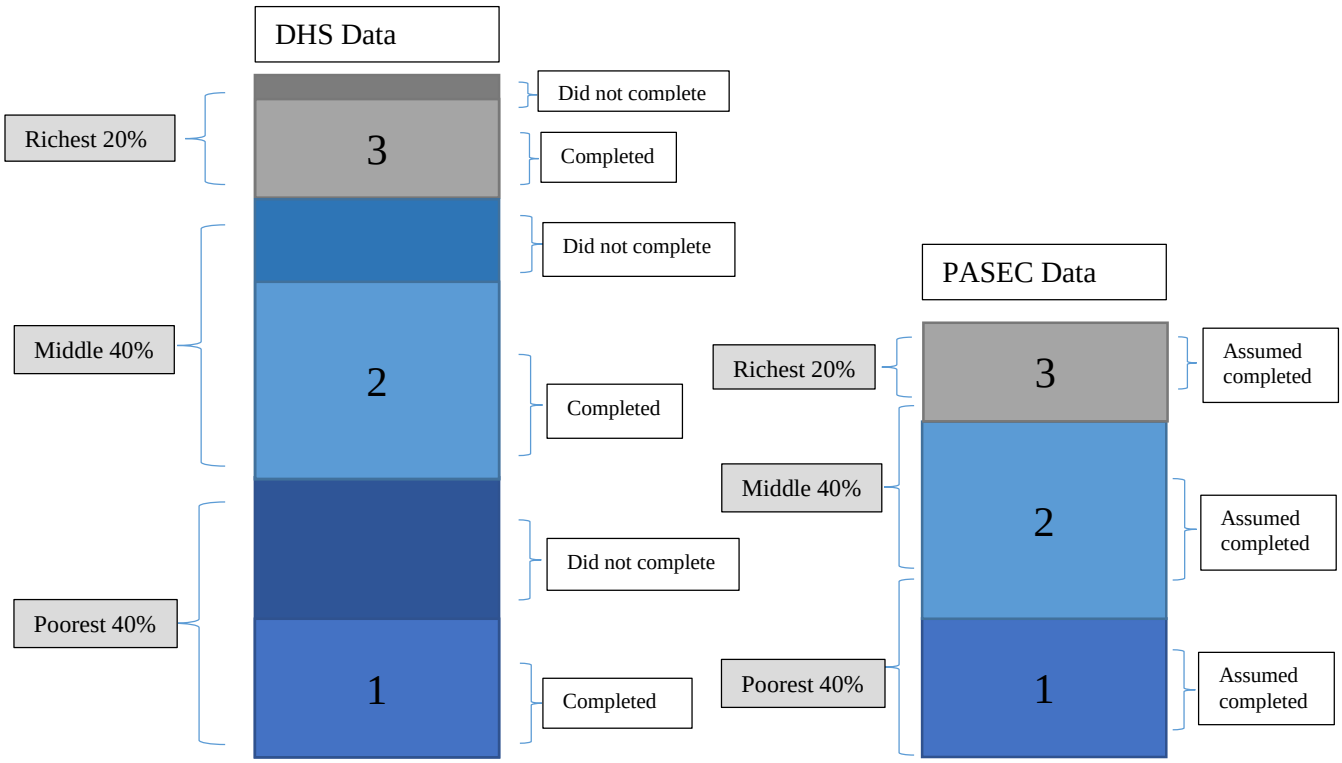
would acquire these skills (Spaull & Taylor, 2015). For these reasons Spaull and Taylor (2015) argue that these are reasonable assumptions to make.

4.2 Adjusting for the Underrepresentation of Poor Individuals in Schools

Before separating the PASEC data into wealth quintiles to estimate achievement rates, it is necessary to incorporate completion rates for different wealth categories into the PASEC data. This is because the completion rates differ for richer and poorer individuals so that they are not proportionately represented in the PASEC data. For example, assume that only half of the poorest 40% of individuals will ever complete grade 5 and that all of the rest of the population will do so. Then, in the PASEC data 20% of the school-going population is missing, as the PASEC data only contains school-going individuals. When separating the PASEC data by wealth we should account for the missing 20% by splitting the PASEC data into quintiles of the poorest 20%, the middle 40%, and the richest 20% of individuals (rather than the usual 40/40/20 split). As mentioned previously, the out-of-school portion (proxied by those that did not complete the relevant grade) will be assumed to have not acquired basic literacy and numeracy skills. Thus when calculating the proportion of individuals who did not acquire basic skills, the out-of-school 20% would be added to the proportion of students in the lowest wealth quintile who did not acquire skills from the PASEC data. Figure 8 below illustrates this concept.

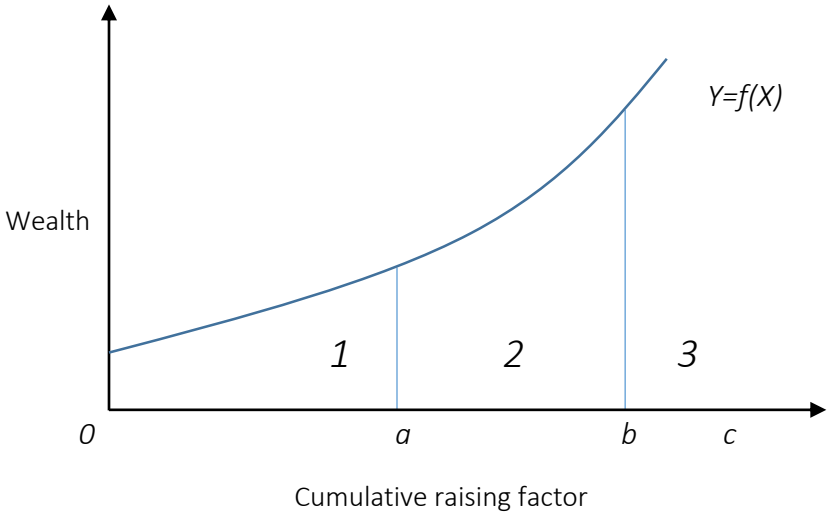
In the figure, blocks 1, 2, and 3 represent the proportion of the age cohort who complete grade 5 – the poorest 40%, the middle 40%, and the richest 20% respectively. If the PASEC data is split without first taking the shaded portions of the blocks into account (which represent the portion of the cohort which did not complete grade 5) then the split will be incorrect and consequently the relationship between wealth and learning will be misrepresented (see how, in the figure, the poorest 40% within the PASEC data contains block 1 as well as some of block 2). Due to the fact that the PASEC data being used was collected in an earlier year to the DHS data, the completion rates of the older cohort, by wealth, were used to estimate those enrolled at the time that PASEC was conducted. Since it will be the post-test PASEC scores being used completion rates of the different wealth quintiles are probably a good representation of what proportion of individuals from different quintiles took the test. That is, given that the PASEC test was conducted at the end of the school year, an assumption is again being made that those who took the PASEC test completed the year.

Figure 8. The Relationship between DHS and PASEC Data



Correcting the PASEC data was done in four steps: (1) the PASEC data was sorted by wealth, (2) a cumulative distribution of the sample raising factor was created, (3) this distribution was split according to the completion rates of the different wealth quintiles taken from the DHS data, and (4) wealth quintiles in the PASEC data were created according to this split. Figure 9 below illustrates these steps:

Figure 9. Creating Wealth Quintiles in PASEC Data: Graphical Representation



In the figure, the slope *Y=f(X)* is the distribution that is created by first sorting the PASEC data on wealth and then creating a cumulative distribution of the PASEC sample raising factor variable[15] which is derived from the PASEC sampling procedure (this information is taken from the PASEC reports[16]). The sections *1*, *2*, and *3* correspond to blocks 1, 2, and 3 in Figure 8. The lines *a* and *b* are chosen according to the DHS data (how they are chosen is illustrated in Equation 1 below). The point *c* is the maximum of the distribution. From *0* to *a* is the first wealth quintile (block 1) – the PASEC students which correspond to the poorest 40% of the DHS age cohort; from *a* to *b* is the second wealth quintile (block 2) – the PASEC students which correspond to the middle 40% of the DHS age cohort; from *b* to *c* is the third wealth quintile (block 3) – the PASEC students which correspond to the richest 20% of the DHS age cohort.

Mathematically, this process can be represented by the following equation, which is given in Spaull and Taylor (2015):

Equation 1. Creating Wealth Quintiles in PASEC Data: Mathematical Representation

$$P = \int_{0}^{\left(\frac{\mathrm{CR_{poor40}}}{0.4 \times \mathrm{CR_{total}}}\right) \times N} \mathrm{CN_{ses}} + \int_{\left(\frac{\mathrm{CR_{poor40}}}{0.4 \times \mathrm{CR_{total}}}\right) \times N}^{\left(\frac{\mathrm{CR_{mid40}}}{0.4 \times \mathrm{CR_{total}}}\right) \times N} \mathrm{CN_{ses}} + \int_{\left(\frac{\mathrm{CR_{mid40}}}{0.4 \times \mathrm{CR_{total}}}\right) \times N}^{\left(\frac{\mathrm{CR_{rich20}}}{0.2 \times \mathrm{CR_{total}}}\right) \times N} \mathrm{CN_{ses}},$$

[15] I.e. the sample weight. Named PROINCLU1 in the PASEC reports (which can be found here: http://www.confemen.org/le-pasec/rapports-et-documents-pasec/les-rapports-du-pasec/); Named IPROINCLU in most datasets but named poids_eleve in the DRC dataset, despite referring to the same variable.

[16] All reports can be found at http://www.confemen.org/le-pasec/rapports-et-documents-pasec/les-rapports-du-pasec/

Where *P* is the total PASEC sample, CR_{poor40}, CR_{mid40}, and CR_{rich20}, are the grade completion rates (either grade 2 or grade 5) for the poorest 40%, the middle 40%, and the richest 20% of the relevant age cohort in the respective country. CR_{total} is the national grade completion rate, and *N* is the total grade 2 or grade 5 population. *N* is obtained by inflating the PASEC sample to the population of grade 2 or grade 5 students using the PASEC raising factor variable mentioned above. CN_{ses} is the cumulative distribution of the grade 2 or grade 5 school-going population, sorted from poorest to wealthiest (*Y=f[X]* in Figure 9). The first integral corresponds to *block 1* in Figure 9 - the PASEC students which correspond to the poorest 40% of the DHS age cohort – just as the second integral corresponds to *block 2* and the third to *block 3*. Line *a* in Figure 9 is therefore chosen by using the equation which forms the upper limit of the first integral, and line *b* is chosen by using the equation which forms the upper limit of the second integral. As mentioned previously, point *c* is simply the maximum of the distribution *Y=f(X)*.

4.3 Creating Wealth Indices

Conducting the exercise above requires both the DHS and PASEC datasets to contain information on socioeconomic status (or simply wealth) for each country. Unfortunately, while the DHS data always contains wealth indices, within PASEC wealth indices were not already available for any of the countries except the DRC. Therefore, Multiple Correspondence Analysis (MCA) was used to create wealth indices from asset, housing quality, and other variables that were available in the data. (The list of variables used to create the wealth indices are displayed in Table 1C in Appendix C; the variables used depend on those that were available for each country, and hence Table 2C highlights which variables were and were not available for each country.) The method employed in creating the wealth indices follows that of Wittenberg and Leibbrandt (2015) and is discussed in more detail in Appendix C. Note that the decision to conduct an MCA and not a Principal Component Analysis (PCA) was arbitrary but non-consequential since the differences between the results of a PCA and an MCA are slight (this is evidenced in the paper by Wittenberg and Leibbrandt, 2015, but also shown in the analysis provided in Appendix C).

Besides discussing the method employed in creating the wealth indices, Appendix C also presents a comparison of the PASEC wealth index which was already available for the DRC with the one created using the MCA and following Wittenberg and Leibbrandt's (2015) method. The discussion in Appendix C highlights the fact that wealth quintiles created using the PASEC wealth index provided for the DRC discriminate poorly between wealth levels. For example, according to the PASEC index the poorest individuals in the DRC sample had the highest proportion of school children who have a flush toilet within their household. In contrast, wealth quintiles from the wealth index created by following Wittenberg and Leibbrandt's (2015) methodology discriminated well on all such categories (see Tables 3.1C and 3.2C in Appendix C). This is somewhat surprising given that both the wealth index in PASEC and that created here used similar variables and both were created using MCA (Le Nestour & Seydou, 2007). For an analysis of the wealth indices created for the remaining five countries, a discussion of the kernel density plots of these indices, and an analysis of the wealth indices provided in the DHS data, see Appendix C.

Chapter 5 Results

The statistics presented below are describing different time periods for different countries, due to PASEC being administered in different years. Tests in Benin were administered in 2005, in Burkina Faso and Senegal tests were administered in 2006, the Ivory Coast dataset is from 2009, and the DRC and Togo datasets are from 2010. While the education landscape may change relatively slowly, differences of three to four years may not be negligible in developing countries. Besides causing issues for comparability, the fact that the PASEC data are somewhat dated also means that the results here may no longer accurately reflect the state of education in these countries. However, they are the most recent publicly available data on these countries. It is impossible to say in exactly what ways the access to learning rates may have changed between when the data was collected and now, nor can we know in what ways they may have changed (whether enrolment rates, quality of schooling, or both have improved or worsened) at least until more recent data become available. Until that time this analysis is still crucial for understanding the state of education in Francophone Africa. Moreover, this analysis will also not become redundant once it can be replicated on more recent data – a comparison of the two analyses in order to understand how quickly, and in what ways, the education landscape in these areas can change is one of the broader goals of this research.

Appendix D, Tables 1D and 2D, give completion rates from DHS data for the different countries separated by gender, wealth, and a gender-wealth interaction. Appendix E gives information about achievement on PASEC tests for the different countries; percentile scores are listed in Tables 1D to 4D, a reminder of what the different PASEC learning benchmarks mean is given in Figure 1D, the proportions of students reaching different PASEC benchmarks (or levels) are listed in Tables 5D to 8D, and the proportion of students achieving level 3 (basic literacy or numeracy) is separated by gender, wealth, and a gender-wealth interaction and shown in Tables 9D to 12D. Finally, Appendix F provides access to literacy and access to numeracy rates separated by gender, wealth and a gender-wealth interaction. These tables were used to create the figures and graphs provided in this chapter.

5.1 Aggregate Levels of Access and Learning

Research question (1) in *Chapter 1 Introduction* asked,

(1) In each country what proportion of children
   a. never enrol,
   b. enrol initially but drop out before completing the relevant grade,
   c. enrol and complete the relevant grade but do so without having acquired grade-appropriate basic literacy and basic numeracy skills by this time, and

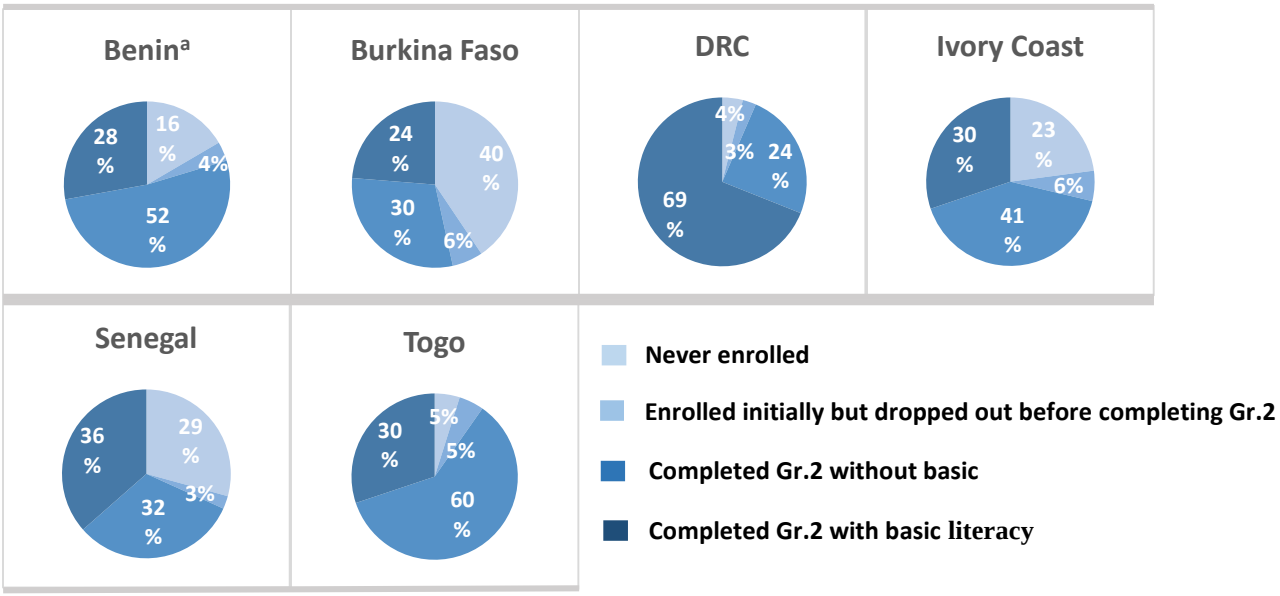
d. enrol and complete the relevant grade having acquired grade-appropriate basic literacy and numeracy skills?

The figures from this subsection are derived from Tables 1D and 2D in Appendix D as well as Tables 9E to 12E in Appendix E.

Grade 2

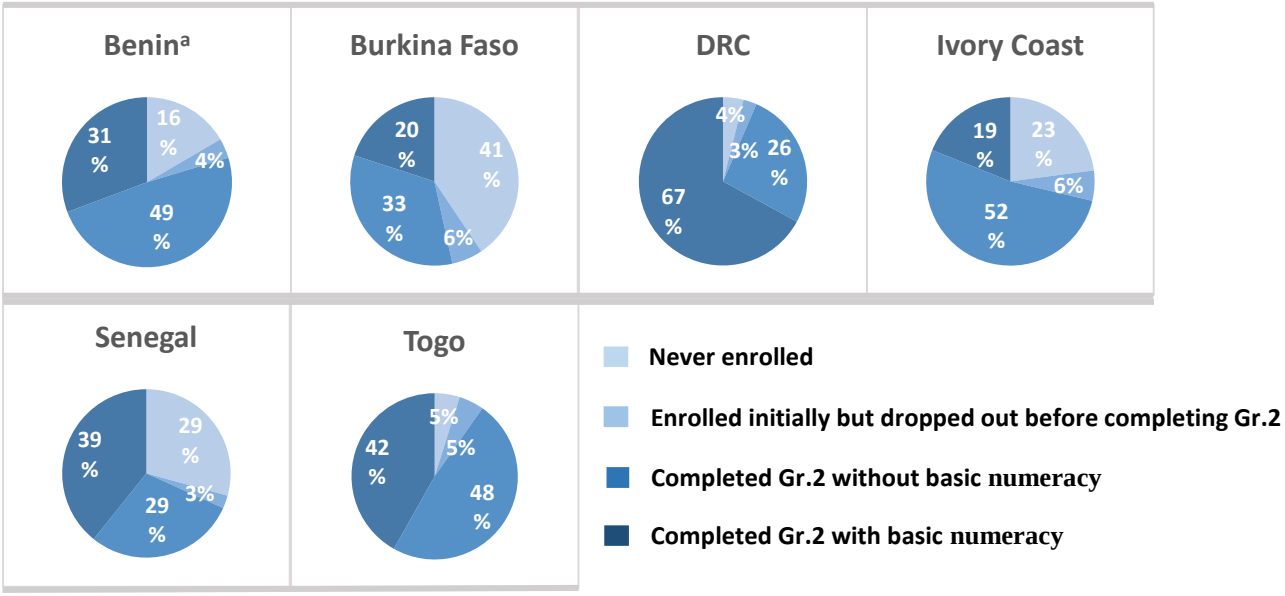
Figures 10 and 11 below display the proportion of children in each country who (a.) never enrolled in school, (b.) enrolled initially in grade 1 but dropped out before completing the relevant grade, (c.) completed the grade but did not acquire basic literacy (Figure 10) and numeracy (Figure 11) skills, and (d.) completed the grade and did acquire basic literacy and numeracy skills. These figures refer to grade 2 literacy and numeracy rates.

Figure 10. National Levels of Access and Quality of Education - Grade 2 Literacy



Note: [a]Estimates for literacy rates are run on the unweighted sample.

Figure 11. National Levels of Access and Quality of Education - Grade 2 Numeracy



Note: [a]Estimates for numeracy rates are run on the unweighted sample.

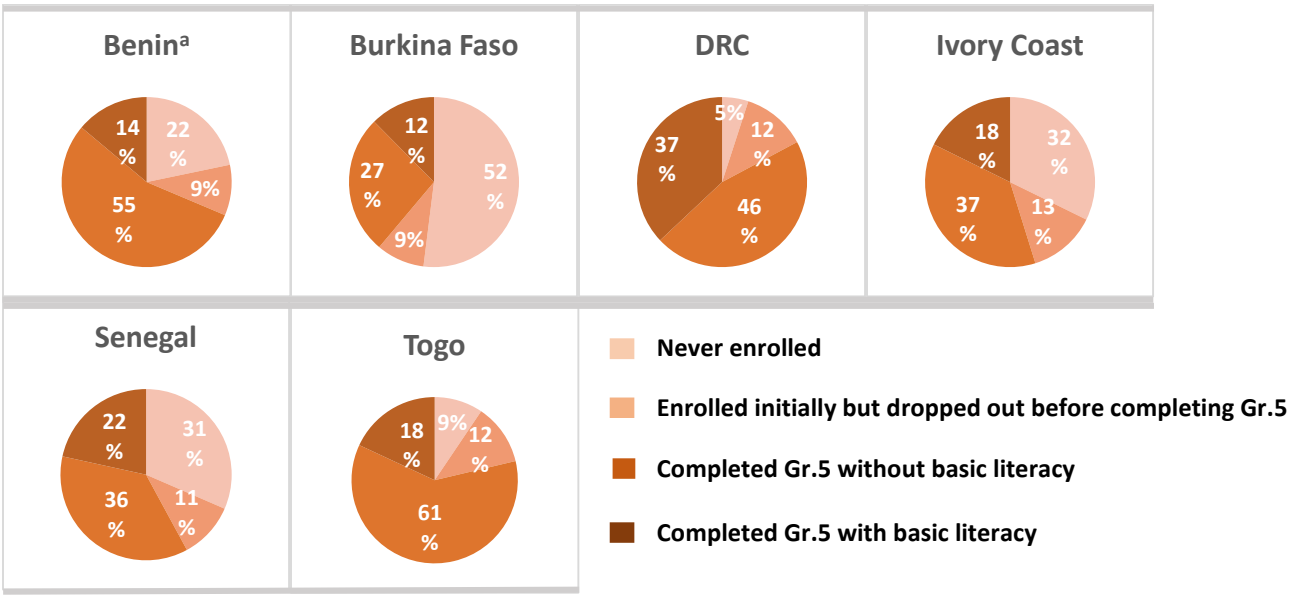
As one might expect all dropout rates are relatively low in Grade 2, with the DRC and Senegal having the lowest dropout rates (3%) and Burkina Faso and the Ivory Coast having the highest dropout rates (6%). Non-enrolment rates vary widely between countries; non-enrolment rates are the lowest in the DRC (4%) and Togo (5%) and the highest in Burkina Faso (41%). Once in school, all countries appear to suffer from a low level of educational quality; even the DRC and Togo, who have near universal completion rates, have a large proportion of students who do not acquire basic literacy (24% and 60% respectively) and basic numeracy (26% and 48% respectively). The DRC has the highest proportions of students who leave grade 2 with basic literacy (69%) and basic numeracy (67%), while the Benin has the lowest for literacy (28%) and the Ivory Coast has the lowest for numeracy (19%). Roughly half of all students in Benin, Ivory Coast, and Togo are completing grade 2 without possession of basic grade 2-level skills. Roughly a third of students in

Burkina Faso and Senegal, and a quarter of students in the DRC are doing the same. This is highly worrying, especially given that these are only the grade 2 results and that the benchmark used here for achievement is so low. Many of these children will be pushed through to higher grades and will continue to struggle there.

Grade 5

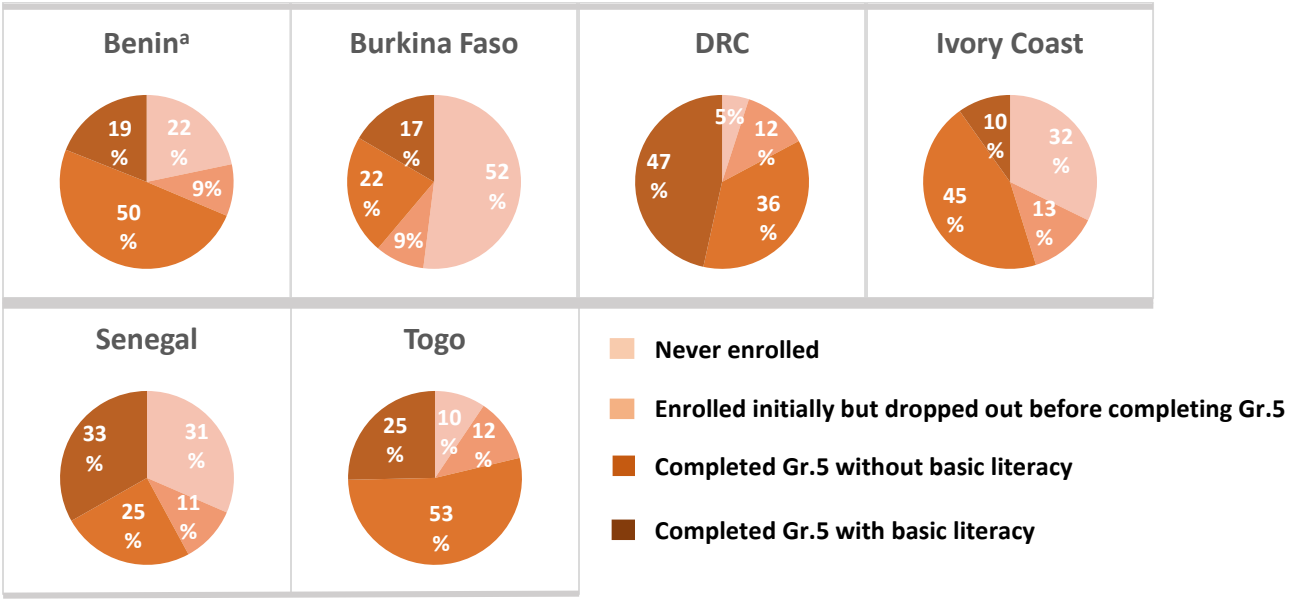
Figures 12 and 13 below display the proportion of children in each country who (a.) never enrolled in school, (b.) enrolled initially in grade 1 but dropped out before completing the relevant grade, (c.) completed the grade but did not acquire basic literacy (Figure 12) and numeracy (Figure 13) skills, and (d.) completed the grade and did acquire basic literacy and numeracy skills. These figures refer to grade 5 literacy and numeracy rates.

Figure 12. National Levels of Access and Quality of Education - Grade 5 Literacy



Note: [a]Estimates for literacy rates were run on the unweighted sample.

Figure 13. National Levels of Access and Quality of Education - Grade 5 Numeracy



Note: [a]Estimates of numeracy rates were run on the unweighted sample.

Unlike the results of Spaull and Taylor's (2015) study on Sub-Saharan Africa, literacy rates are not usually higher than numeracy rates for these countries. In fact, only the Ivory Coast does better

on tests of literacy (18% acquiring basic skills) than numeracy (10% acquiring basic skills). Proficiency in French is clearly not being achieved. Togo, which has some of the highest enrolment (91%) and completion rates (79%), has 61% of its student population not acquiring basic reading and writing skills in French. This equates to 77% of all of those who complete grade 5 not leaving with basic grade 5-level French proficiency. Although the other countries do better than Togo in terms of the proportions of students in school who acquire basic skills, all have extremely low literacy and numeracy rates. The DRC has the highest literacy (37%) and numeracy (47%) but even these are similar to the lowest scores seen for Sub-Saharan Africa's grade 6's (Spaull & Taylor, 2015; Taylor & Spaull, 2015), although, as discussed, the SACMEQ data for Sub-Saharan Africa is not directly comparable to the PASEC data used here. Benin and Burkina Faso have the lowest literacy rates (14% and 12% respectively) and the Ivory Coast has the lowest numeracy rate with only 10% of the student population completing grade 5 having acquired basic grade-appropriate numeracy skills.

As expected, the proportion of students who never enrolled is higher for grade 5 than for grade 2. This difference does not represent learners dropping out between grade 2 and grade 5 since "never enrolled" refers to those who had never enrolled in school, even in grade 1. Hence the higher enrolment rates for the grade 2 cohort refers to higher initial school enrolments for that age group, which is younger than the grade 5 age cohort. Therefore this represents an improvement in school enrolments between the years when the grade 5 cohort would have been expected to enrol and the years when the grade 2 cohort would have been expected to enrol. For Benin, Burkina Faso, the DRC, and the Ivory Coast there is a five year age difference between the two cohorts. For Senegal there is a four year age difference and for Togo there is a six year age difference. This means that in five years enrolment rates increased by 6% in Benin, 11% in Burkina Faso, 1% in the DRC, and 9% in the Ivory Coast. In Senegal enrolment rates increased by only 2% in four years and in Togo enrolment rates increased by 5% in six years. The improvements of the DRC and Togo should be seen in the light of their high initial enrolment levels, meaning that small improvements are good improvements. In contrast, the increase of only 2% in Senegal from an initial enrolment level of only 69% is far smaller than it should have been over the four years.

In summary, while the DRC and Togo have achieved near universal enrolment and completion for grade 2, the remaining countries have low completion rates which are driven by low initial enrolment rates. Yet even when a country has achieved universal enrolment and completion (for example, DRC), less than half of the cohort actually acquire basic numeracy and literacy skills. For grade 5, the DRC and Togo again display high initial enrolment, but dropout rates before reaching grade 5 mean that universal completion of grade 5 is not being achieved. The remaining countries all have a far larger problem with non-enrolment than with dropout – although both rates are disturbingly high. Burkina Faso in particular is very far from achieving universal enrolment, with 41% of the grade 2 age cohort having never enrolled in school. On the other hand, there have been improvements in educational access in all countries but particularly in Benin, Burkina Faso, and the Ivory Coast. Once in school, learning achievement is worryingly low for all countries and for both grades.

Thus neither educational access nor educational quality is being achieved for these countries. These figures, although not unexpected given what has already been discussed about these countries, point to an education crisis in West Africa and the DRC. Although improvements have been made in initial enrolment rates, initial enrolment remains worryingly low for all countries except for the DRC and Togo. Improvements in quality between grade 2 and grade 5 cannot be inferred from this data, but future research on the next round of PASEC could do so.

5.2 Aggregate Levels of Access to Learning

Research question (2) from *Chapter 1 Introduction* asked,

(2) Combining groups a., b., and c., from (1);
    a. what proportion of the population do not acquire grade-appropriate basic literacy and numeracy skills?

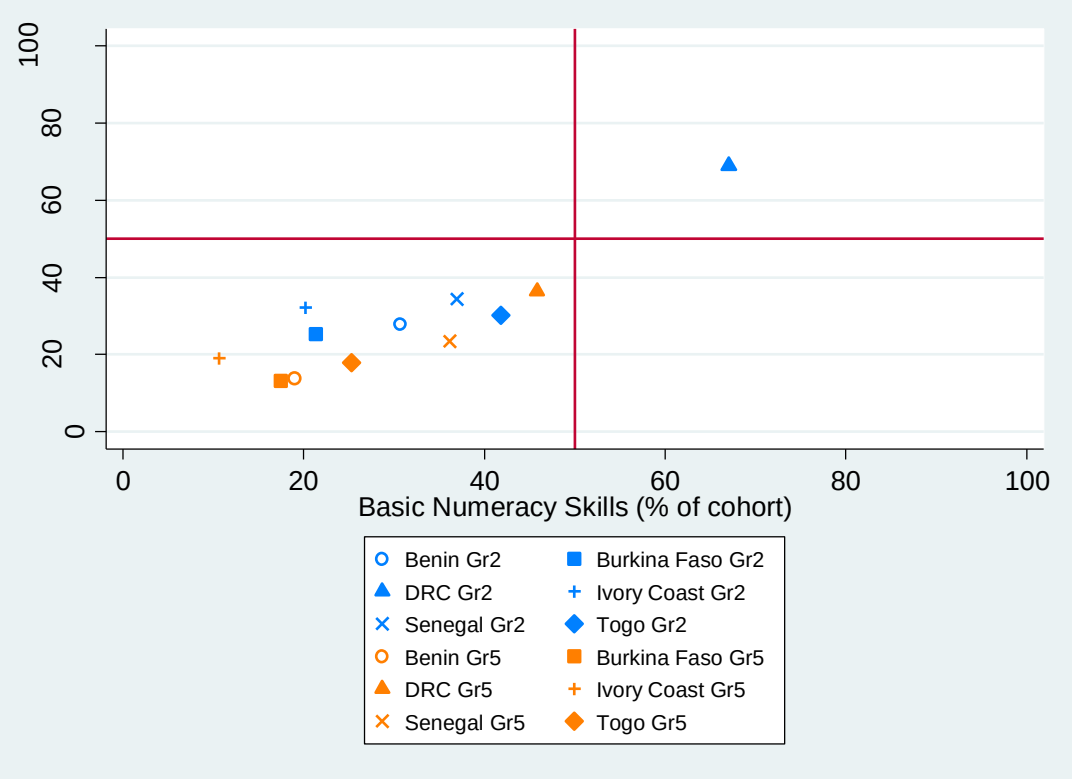
The figures in this subsection are derived from Tables 1F to 4F in Appendix F. Spaull and Taylor (2015) classify 11 Sub-Saharan African countries into three categories of basic skills acquisition: Countries with >80% acquisition are considered to have relatively high access to learning rates, countries with 60%-80% acquisition are considered to have relatively low access to learning rates, and countries with <60% acquisition are considered to have extremely low access to learning rates.

Due to the fact that all six of these countries, besides the DRC grade 2's, fall into the 'extremely low' category, it doesn't make sense to use that same classification system here.

Figure 14 below displays the percentage of each age cohort that *are* acquiring basic literacy and numeracy skills for each country and grade. Reference lines are given at 50% of the age cohort on both the Y axis (which displays acquirement of literacy skills) and the X axis (which displays acquirement of numeracy skills). For example, the data point for Benin in grade 2 is represented by a blue hollow circle, while the data point for Benin in grade 5 is represented by an orange hollow circle. From the graph it can be seen that roughly a third of the Benin grade 2 age cohort are acquiring basic literacy and numeracy skills at the grade 2 level and that less than 20% are acquiring these skills at a grade 5 level. All countries and all grades, except for the DRC in grade 2, fall below the 50% reference line for both literacy and numeracy.

For grade two, if one looks at Benin, Burkina Faso, the Ivory Coast, Senegal, and Togo together (all countries except the DRC), only one in three students will leave grade 2 having acquired basic grade-appropriate literacy and numeracy skills. These results reinforce the idea that there is an education crisis in Africa – especially since these are just the grade 2 results where one would expect far better outcomes. For grade 5, if one looks at all of these countries simultaneously approximately one in five individuals will complete grade 5 with basic grade-appropriate literacy skills and one in four will complete grade 5 with basic grade-appropriate numeracy skills.

Figure 14. Percent of Cohort Acquiring Basic Literacy and Numeracy Skills, By Country and Grade



Note: For Benin estimates of literacy and numeracy rates were run on the unweighted sample.

As expected, the grade 5 educational environment is worse than that for grade 2, which was already dire. All of the statistics presented so far have been the national averages (i.e., the national average enrolment and completion rates, and the national average literacy and numeracy rates taking completion into account). Given what was discussed in the introduction to this dissertation we can expect that males and the richer portions of the age cohorts will display higher access and achievement rates than those seen so far, and that females and the poorer portions of the age cohorts will display even lower rates than those seen so far.

5.3 Disaggregated Levels of Access and Learning

Research question (3) from *Chapter 1 Introduction* asked,

(3) In each country, how do completion rates and learning achievement (of those in school) differ by the subnational categories of
   a. gender (males and females),
   b. wealth (poorest 40%, middle 40%, and richest 20%), and

c. a gender-wealth interaction (poorest 40% of females compared to poorest 40% of males, middle 40% of females compared to middle 40% of males, and richest 20% of females compared to richest 20% of males)?

Answering this research question allows us to see whether inequalities in educational outcomes are driven more by access inequalities in education or quality inequalities in education. The figures in this subsection are derived from Tables 1D and 2D in Appendix D as well as Tables 9E to 12E in Appendix E.

5.3.1 Gender inequalities

Gender inequalities in access

Access inequalities by gender are shown in Figures 15 and 16 below, for grades 2 and 5 respectively. Specifically, these graphs display completion rates for males and females of each country. The difference in completion rates for males and females are considered to represent access inequalities for gender. For grade 2 the DRC displays the smallest gender inequalities in access and the Ivory Coast displays the largest; this is roughly a 3 percentage point difference in access for males and females in the DRC and a 10 percentage point difference for the Ivory Coast. What this means practically is that females in the DRC are 3 percentage points less likely to complete grade 2 than males in the DRC, and females in the Ivory Coast are 10 percentage points less likely to complete grade 2 than males in the Ivory Coast. For Burkina Faso, Senegal, and Togo in grade 2 the confidence intervals (at 95%) for male and female completion rates overlap, meaning that we cannot be sure that they are not the same. The confidence intervals do not overlap in Benin, the DRC, and the Ivory Coast meaning that it is likely that the differences we see here are real – although they may be smaller (or larger) than the mean estimates indicate.

For grade 5, Burkina Faso now displays the lowest level of gender inequality since the DRC's is much higher at this level than it was for grade 2. In fact, the DRC's gender disparity in access is now only one percentage point lower than that for the Ivory Coast – which again displays the highest gender disparities in access. For Burkina Faso there is only a 2 percentage point difference in the male and female completion rate while for the DRC and Ivory Coast there is a 15 and 16 percentage point difference, respectively. Note however that the confidence intervals for Benin, Burkina Faso, Senegal, and Togo all overlap meaning that we cannot be sure that the differences in male and female completion are not zero. The confidence intervals for male and female completion do not overlap in the Ivory Coast and the DRC, however they are very close to overlapping in the Ivory Coast. For the DRC the confidence intervals are small and very far apart, indicating that we can be sure that there is a large difference in access for males and females in the DRC. Note that confidence intervals are available for Benin here since these results are based on DHS data only, where weights and strata variables were available for all countries.

Figure 15. Access Inequalities – Gender, Grade 2

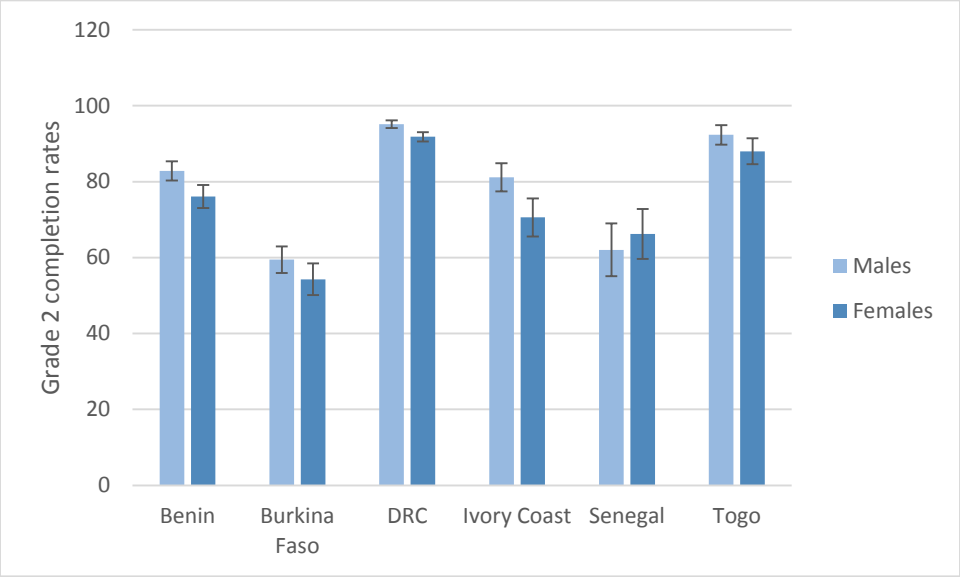
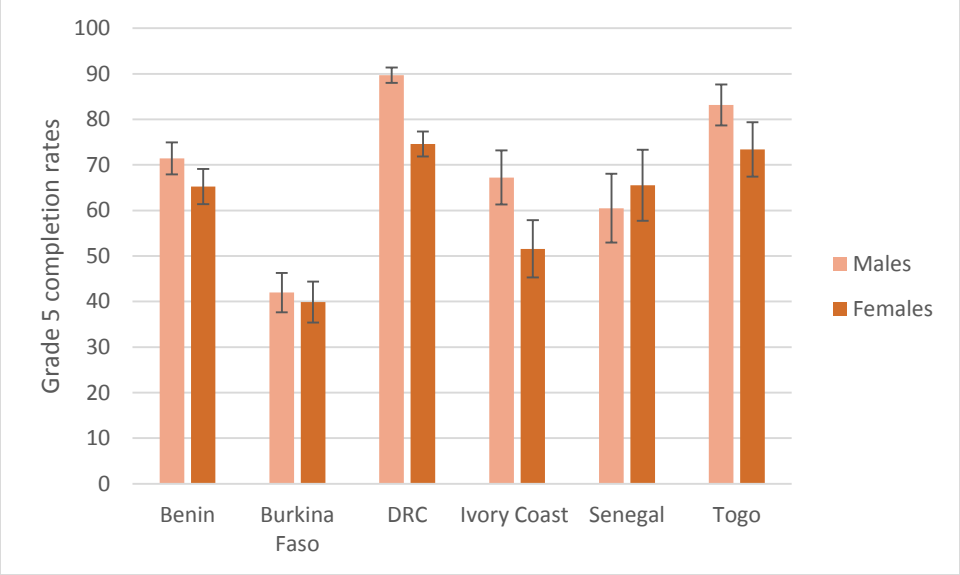


Figure 16. Access Inequalities – Gender, Grade 5

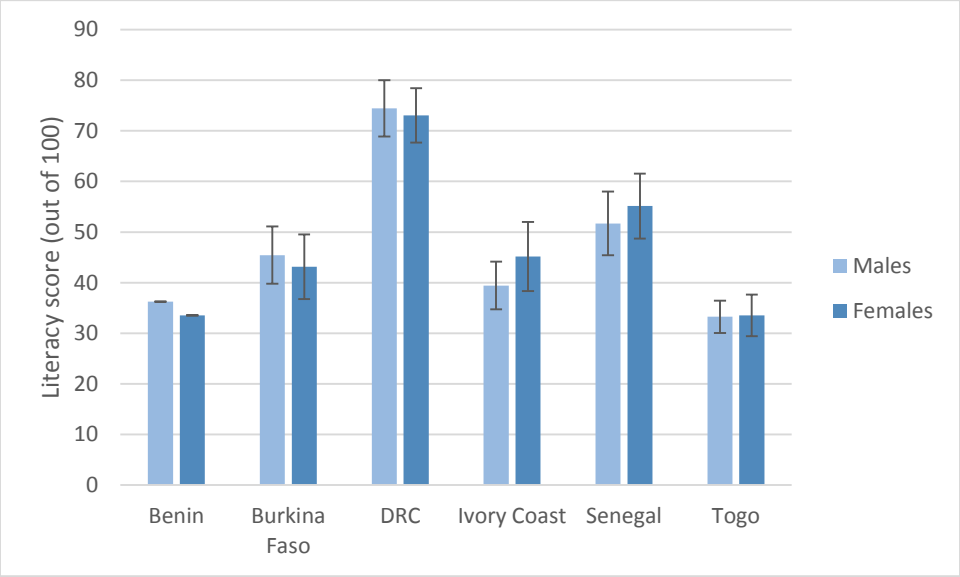


Gender inequalities in quality

Figures 17 to 20 below display the inequalities in the quality of education by gender. Specifically, the figures display learning achievement rates in basic literacy and numeracy skills (separately), for males and females in each country, unadjusted for completion rates. The differences between achievement rates for males and females are considered to represent quality inequalities for gender. Literacy and numeracy rates are similar for males and females in grade 2. Indeed, the

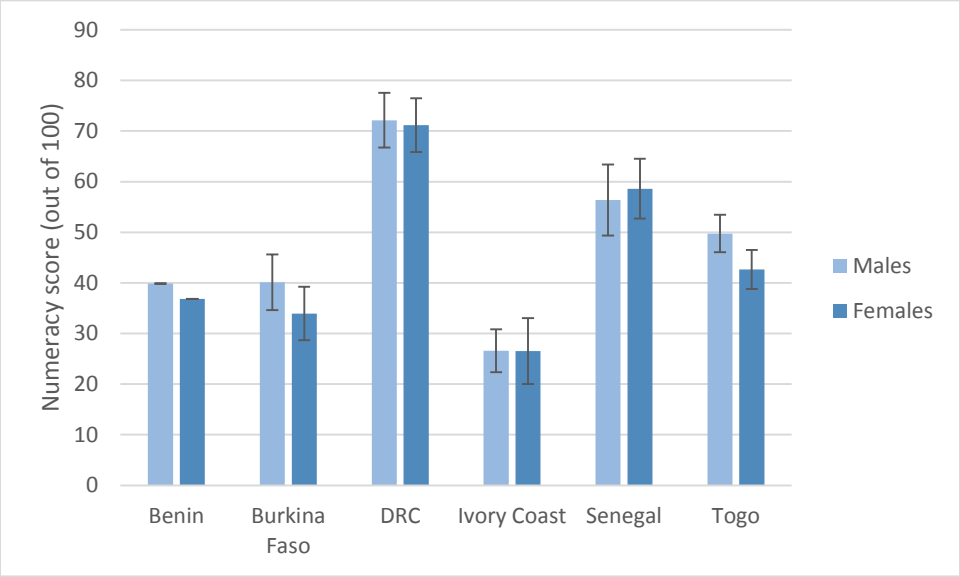
available confidence intervals are such that we cannot be sure that any of the differences are not zero. Some of the mean differences are even higher for females than for males. The smallest gender difference occurs in the Ivory Coast for numeracy scores: Here there is a gender difference of 0.06 percentage points favouring males. The largest differences for the grade 2 class occurs in Togo for numeracy scores: The gender difference is 7.1 percentage points, also favouring males. Note that even here, however, the confidence intervals overlap meaning that we cannot be sure that this difference is not zero. Practically the difference seen in Togo would mean that on average males are 7.1 percentage points more likely to acquire basic numeracy skills than females in Togo are, were the confidence intervals not overlapping.

Figure 17. Quality Inequalities – Gender, Grade 2 Literacy



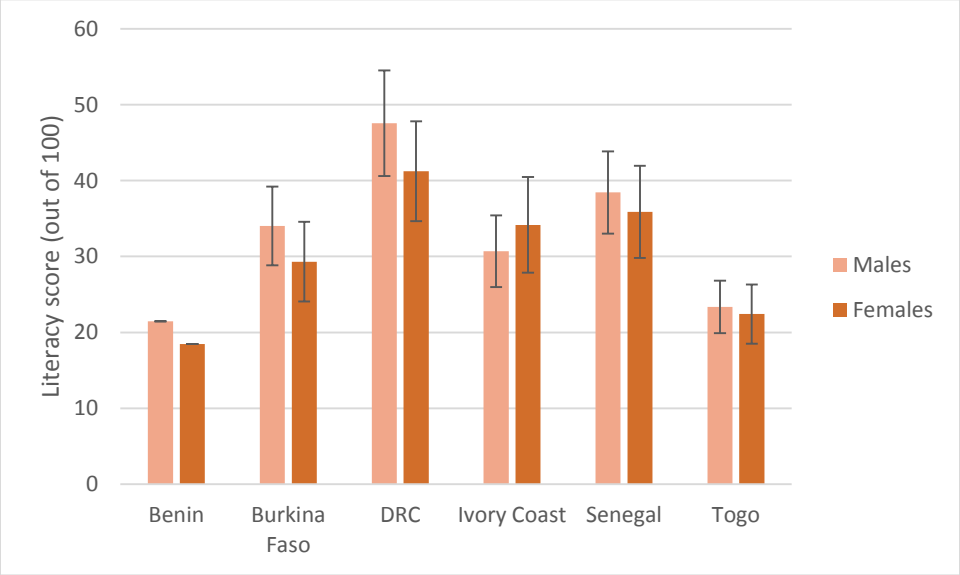
Note: For Benin estimates of literacy rates were run on the unweighted sample. Confidence intervals are unavailable for Benin.

Figure 18. Quality Inequalities – Gender, Grade 2 Numeracy



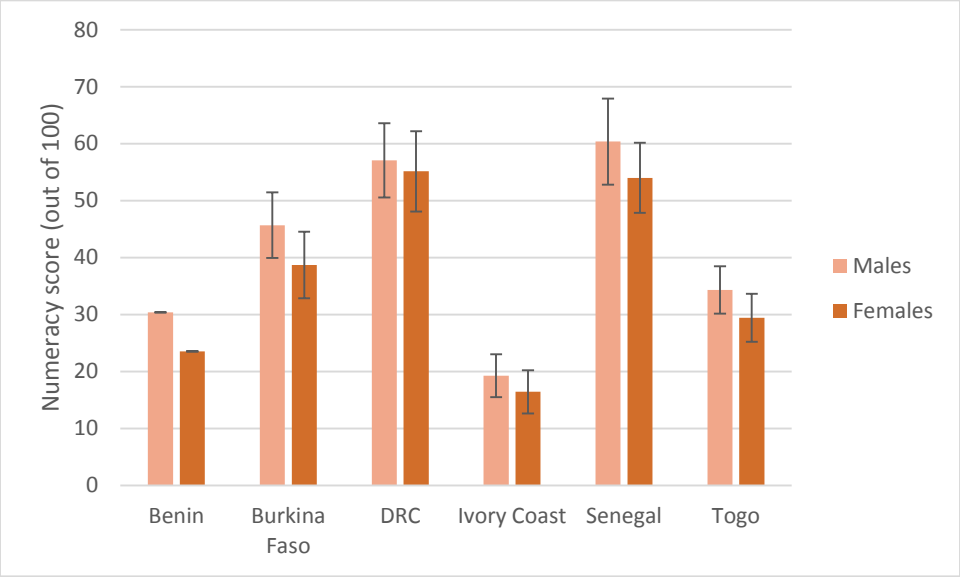
Note: For Benin estimates of numeracy rates were run on the unweighted sample. Confidence intervals are unavailable for Benin.

Figure 19. Quality Inequalities – Gender, Grade 5 Literacy



Note: For Benin estimates of literacy rates were run on the unweighted sample. Confidence intervals are unavailable for Benin.

Figure 20. Quality Inequalities – Gender, Grade 5 Numeracy



Note: For Benin estimates of numeracy rates were run on the unweighted sample. Confidence intervals are unavailable for Benin.

All available confidence intervals also overlap for literacy and numeracy gender differentials in grade 5. However, the mean differentials are larger in grade 5 than they were in grade 2, and there is now only one case where females do better on average than males – in the Ivory Coast females are 3.5 percentage points more likely to acquire basic literacy skills than are males. The smallest differential for grade 5 is seen in Togo for literacy – males are only 1 percentage point more likely to acquire basic literacy skills than females. The largest differential is seen in both Benin and Burkina Faso where males are 7 percentage points more likely to acquire basic numeracy skills than are females.

In summary for this subsection, while Benin, the DRC, and the Ivory Coast all display definite gender inequalities in access to education, we cannot be certain (using this data) that any of the other countries display these same inequalities due to the 95% confidence intervals overlapping on these statistics. Similarly, while the mean levels of literacy and numeracy achievement indicate gender inequalities, especially in grade 5, the 95% confidence intervals indicate that these differences could actually be zero.

5.3.2 Socioeconomic inequalities

Socioeconomic inequalities in access

Inequality in access to schooling by socioeconomic status is displayed in Figures 21 and 22 below, for grade 2 and grade 5 respectively. For grade 2 it appears that the DRC has very low levels of access inequality and Burkina Faso and Senegal have extremely high levels of access inequality. Benin and Togo have high inequality between the poorest 40% and the richest 60% of individuals,

Figure 21. Access Inequalities – Socioeconomic Status, Grade 2

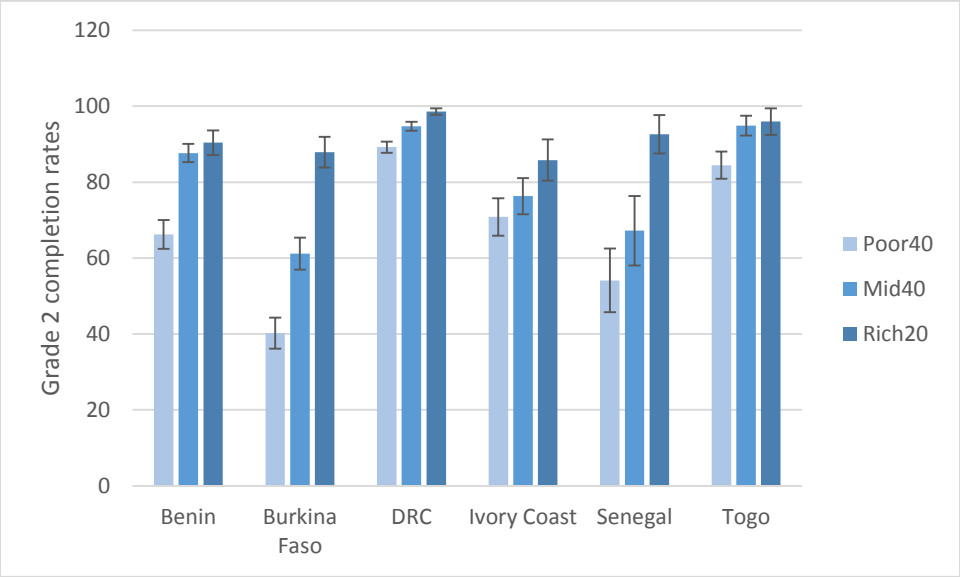
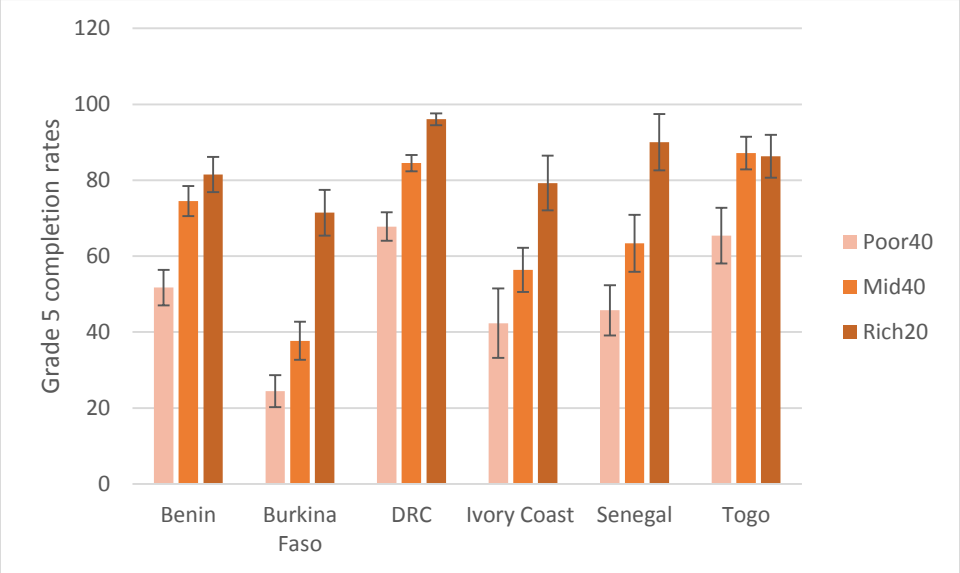


Figure 22. Access Inequalities – Socioeconomic Status, Grade 5



and relatively low levels of inequality between the middle 40% and richest 20% of the wealth distribution. The Ivory Coast has relatively moderate levels of inequality at all levels – although note how relatively moderate still amounts to a difference of 15 percentage points between the poorest and richest individuals. What that means practically is that someone from the poorest 40% of the wealth distribution is 15 percentage points less likely to complete grade 2 than someone from the richest 20% of the wealth distribution. Even in the DRC, which has relatively

low access inequality, there is a 9 percentage point difference between access for the poorest 40% of the age cohort and access for the richest 20%. This may be relatively small but it is practically large. The poorest individuals in Senegal and Togo are roughly half as likely to complete grade 2 as the wealthiest individuals.

As can be expected, inequality worsens in grade 5; even the DRC now displays relatively moderate levels of access inequality. Burkina Faso has much higher inequality between the poorest 80% of the age cohort and the richest 20% than within the poorest 80% of the age cohort. Togo on the other hand displays very similar levels of access for the middle and richest portions of the age cohort and far smaller levels for the poorest 40% of the population. The lowest levels of inequality are still seen in the DRC but in this case there is still a 28 percentage point difference between access for the poorest and access for the richest portions of the age cohort. Burkina Faso displays the most inequality and here the poorest 40% of the age cohort are less than half as likely to complete grade 5 as the richest 20%. Burkina Faso also has the lowest level of access for the poorest 40% of the age cohort in absolute terms: only 24.5% of these individuals complete grade 5. Note that although the confidence intervals overlap at times for both grade 2 and grade 5, there is never a case in which the confidence interval for the poorest 40% of the cohort overlaps with the confidence interval for the richest 20% of the cohort in either grade 2 or grade 5 and for any country.

Socioeconomic inequalities in quality

Figures 23 and 24 below display the socioeconomic status gradients (SES gradients) for literacy and numeracy scores on PASEC tests for grade 2 and grade 5. The slopes of these graphs relate to the level of socioeconomic inequality in the quality of schooling within schools – the greater the slope the more the inequality. In the interest of parsimony not all results are shown here. Where graphs are not displayed they can be found in Appendix G and the ways in which they differ from the graphs presented here are highlighted. The SES gradients are essentially scatter plots showing the relationship between test scores (on the y axis) and socioeconomic status, given by the wealth index (on the x axis). Simple regressions were also run to determine the extent to which socioeconomic status (and socioeconomic status squared) can explain the variance in test scores. The pertinent results from this exercise are given in Table 6.

The SES gradients for the DRC are displayed in Figure 23. In this case all slopes are flat, with the partial exception of the slope for numeracy in grade 2 which slopes slightly upwards. This indicates that the DRC does not have socioeconomic inequality in the quality of its schooling. In other words, once in school students of varying socioeconomic backgrounds generally have access to an equal standard of education (or at least, they perform roughly equally). Table 6 confirms this: The proportion of variance in test scores that can be explained by differences in socioeconomic status (or the R^2 of the regression) is close to zero for three out of four of the categories and less than 2% in the last category. The only country that is similar to the DRC in this respect is Benin, where the SES gradients are more steeply sloping than for the DRC but still relatively flat. Benin's R^2 ranges from 1% to 3%. All other countries show steeply sloping SES gradients.

Figure 24 displays the SES gradients for Togo which are the most steeply sloping of all six countries. This indicates that Togo has vast inequality for individuals of different socioeconomic backgrounds. Table 6 confirms this by displaying an R^2 for Togo ranging from 6% to 21%. Literacy inequalities are greater than numeracy inequalities in Togo, and also in general. This difficulty with French tests in particular may be related to students not being first-language French speakers (see the discussion in *Chapter 2 Background*) and the tendency in developing countries for wealthier individuals to be the ones who speak the national language as their first language. Burkina Faso, the Ivory Coast, and Senegal all have SES gradients between the extremes of the DRC and Togo but their R^2 values are generally closer to those for Togo than those for the DRC. All countries except the DRC can be said to exhibit socioeconomic inequalities in quality, usually large but much smaller in the case of Benin.

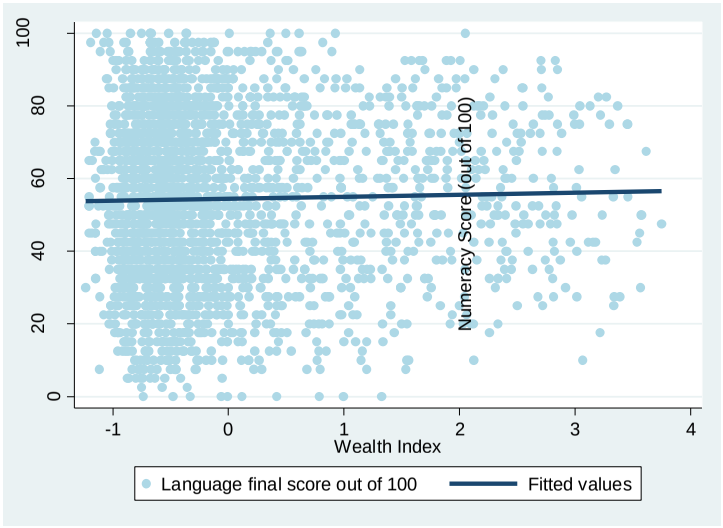
Table 6. Proportion of Variance in Test Scores that can be Explained by Differences in Socioeconomic Status

	Grade 2		Grade 5	
Country	Language	Math	Language	Math
Benin	3.09	2.22	3.27	0.92
Burkina Faso	9.19	7.12	10.30	3.75
DRC	0.00	1.11	0.06	0.00
Ivory Coast	9.12	7.53	13.98	5.57
Senegal	9.61	6.93	10.18	7.53
Togo	11.00	6.06	21.18	8.34

Note: Figures shown are adjusted R^2 values.

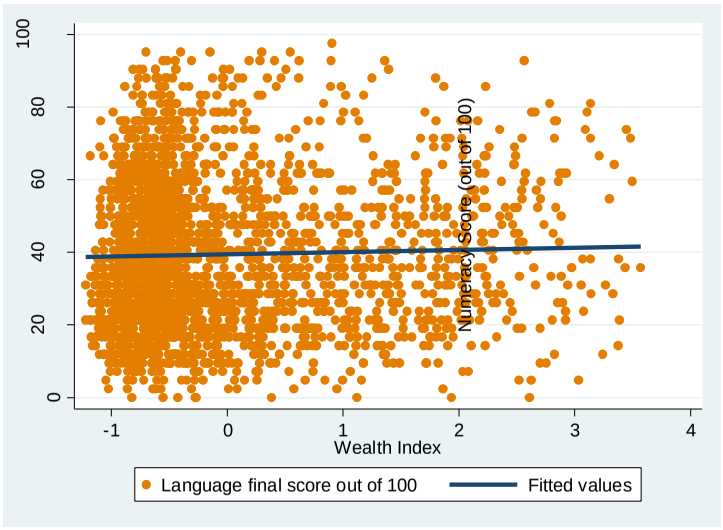
Figure 23. SES Gradients – DRC

Grade 2: Literacy



Grade 2: Numeracy

Grade 5: Literacy



Grade 5: Numeracy

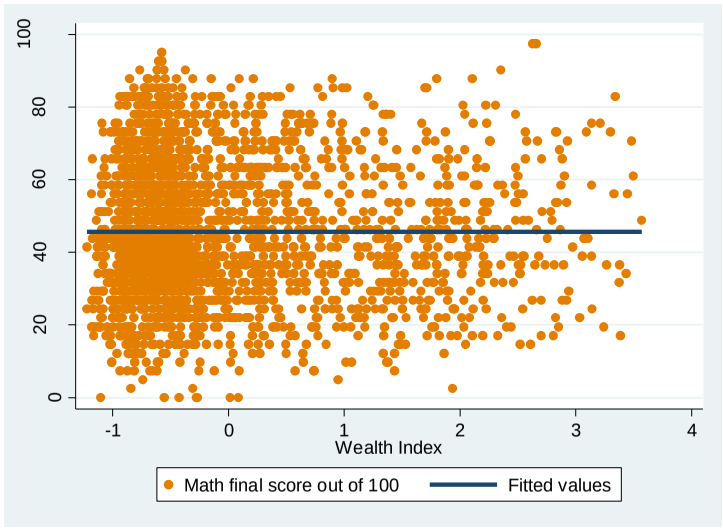
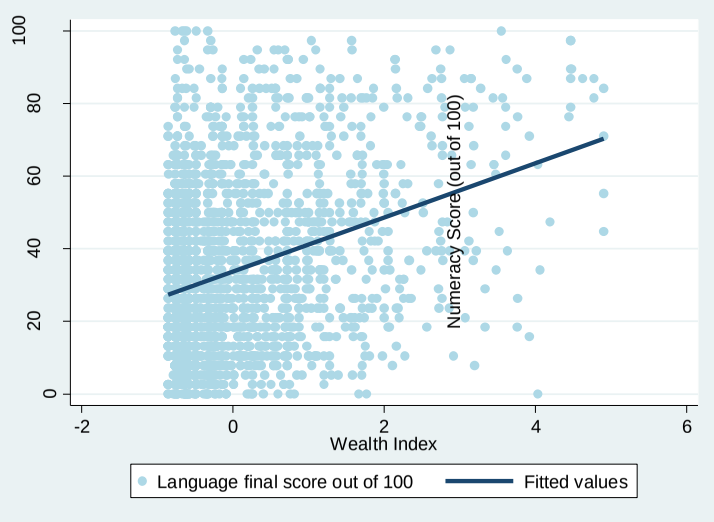


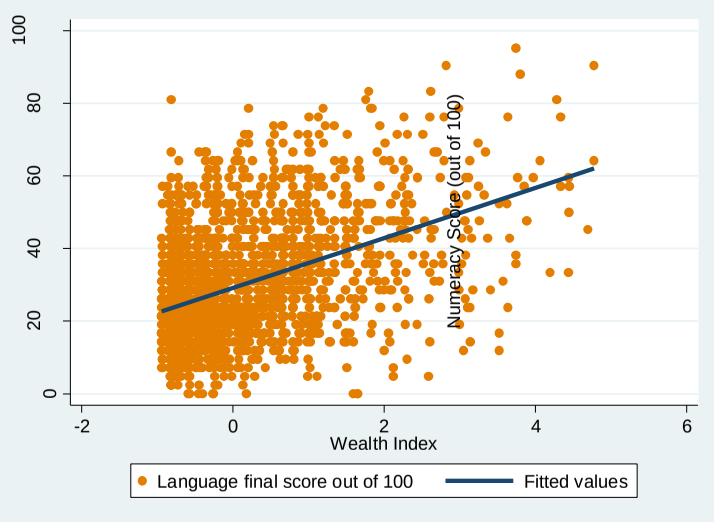
Figure 24. SES Gradients – Togo

Grade 2: Literacy



Grade 2: Numeracy

Grade 5: Literacy



Grade 2: Numeracy

In Summary of this subsection, all countries display socioeconomic inequalities in access and most display socioeconomic inequalities in quality. The DRC does not display quality inequalities and

Benin's quality inequalities are not large. Most countries display socioeconomic inequalities in access across the entire socioeconomic spectrum. In contrast, Benin's inequalities are mainly displayed between the poorest 40% and richest 60% of the distribution and Togo's inequalities are mainly displayed between the poorest 80% and richest 20% of the distribution.

5.3.3 Gender-wealth interactions in inequality

Although little evidence of gender inequality was observed in section *5.3.1 Gender inequalities*, this may be due to gender inequalities only being present at low socioeconomic levels. In Spaull and Taylor's (2015) paper they find evidence of a double disadvantage effect of discrimination whereby females are more likely to be at a disadvantage in comparison to males if they are of a low socioeconomic status (in both access and quality). Relatedly, those of a low socioeconomic status are likely to be at a greater disadvantage in comparison to those of a high socioeconomic status if they are also female.

Following this, two ways of looking at gender-wealth interactions are possible: Firstly, one can inspect the differences in access and achievement for the different wealth quintiles separately by gender, and secondly one can inspect the differences in male and female access and achievement rates for wealth quintiles separately. For example, in the first case one can look at the socioeconomic disparity between the poorest 40% of males, the middle 40% of males, and the richest 20% of males separately to the socioeconomic disparity between the poorest, middle, and richest females. In the second case one can look at the gender disparity between the poorest 40% of males and the poorest 40% of females separately to the gender disparity between the middle 40% of males and females, and separately to the same disparity between the richest 20% of males and females. One can also compare those differences that were looked at separately, for example comparing the socioeconomic disparities along the socioeconomic spectrum for males compared to females.

This first way of analysing the gender-wealth interaction will not be discussed in detail here as it mirrors the national differences in socioeconomic inequality seen in *Section 5.3.2 Socioeconomic inequalities*, both in terms of inequalities in access and quality, in every case except one. The only case in which socioeconomic inequalities were substantially different for males and females was in inequalities in quality for the Ivory Coast in grade 2: There is far more socioeconomic inequality in the quality of education for females than for males. Socioeconomic status can explain 16% and 13% of the variation in literacy and numeracy test scores respectively for females while it can only explain 4% and 3% of the variation in the same test scores for males. One can speculate that the mechanism by which this gender discrimination works is through males and females attending different schools. That is, it may be that poorer males are encouraged to attend, or are sent to, better schools than are poorer females. Or conversely, that wealthier females are sent to poorer quality schools than are wealthier males. However this effect disappears in grade 5 and is not seen for any other country. It is interesting in itself that socioeconomic inequalities are generally similar

for males and females, which is underlined by the fact that wealth discrimination leads to far more inequality than gender discrimination, as has already been seen.

The latter way of looking at the gender-wealth interactions bring up some interesting results, however most of these disappear in the presence of large confidence intervals. In the interest of parsimony the insignificant results will not be graphed. For completion rates, which speak to access inequalities, all gender disparities in mean completion rates within the different wealth quintiles favour males, except in the case of Senegal where females are generally favoured. For achievement rates, which speak to quality inequalities, in grade 2 poorer males generally do better than poorer females in all countries, and richer females generally do better than richer males in all countries. However in grade 5 males generally do better than females at all wealth levels. None of these differences are significant except access rates for Benin, Burkina Faso, and the DRC in grade 5. These differences are displayed in Figures 25 to 27 below.

Figure 25. Gender-Wealth Interaction in Access Inequality – Benin Grade 5

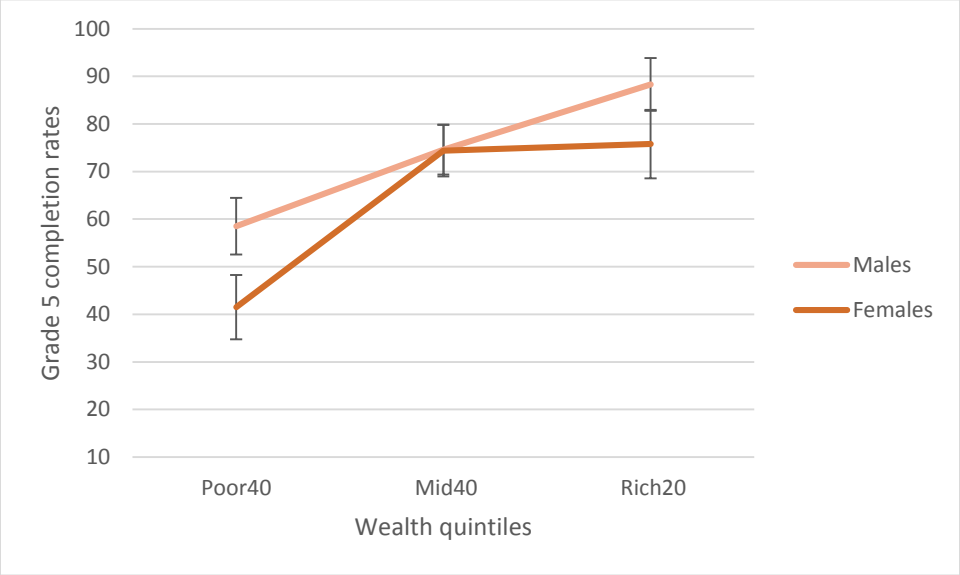


Figure 26. Gender-Wealth Interaction in Access Inequality – Burkina Faso Grade 5

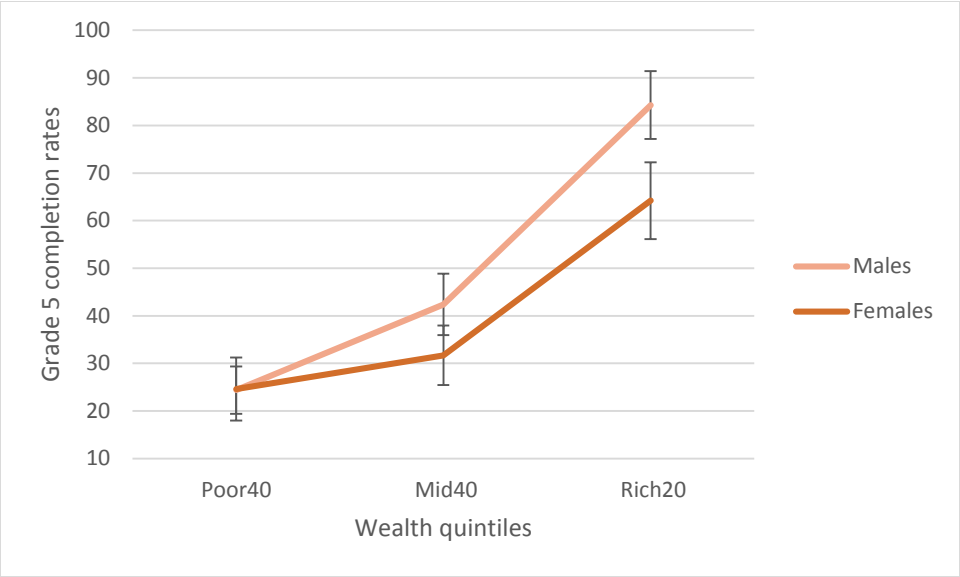
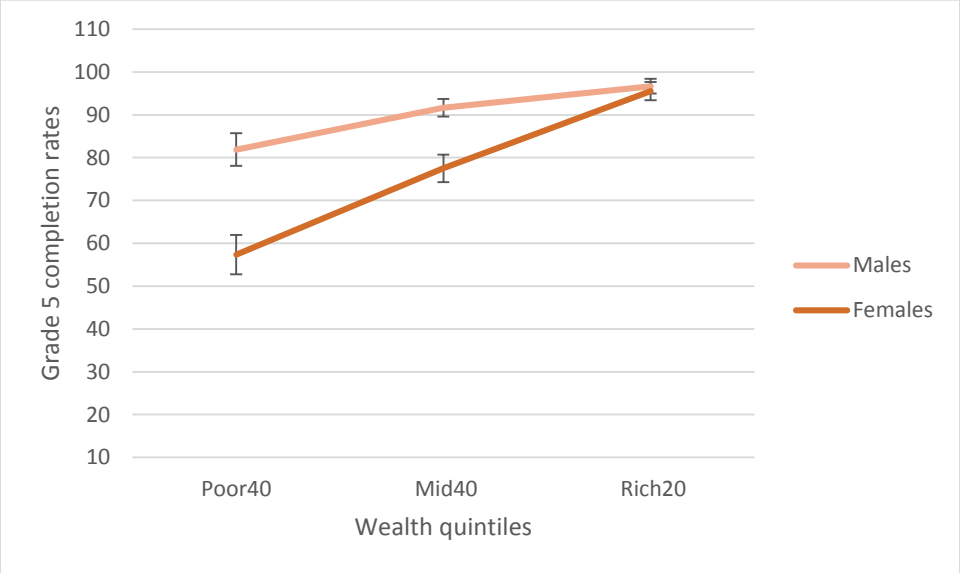


Figure 27. Gender-Wealth Interaction in Access Inequality – DRC Grade 5



For Benin, there is an almost 20 percentage point difference between the poorest 40% of males and the poorest 40% of females. Practically this means that a male who falls into the poorest 40% of the wealth distribution is 20 percentage points more likely to complete grade 5 than a female

who falls into the same wealth quintile. The remaining male and female disparities are not significant; however, there is a large disparity between the richest males and females (12.5 percentage points), despite the practically equal completion rates for the middle portion of the distribution. Burkina Faso is an interesting case; while most countries have a higher degree of gender discrimination at the lower ends of the wealth distribution (despite the differences not being significant), Burkina Faso has practically equal completion rates at the poorest end of the distribution while having significantly different rates for males and females at the richer end of the wealth distribution. The mean difference between the grade 5 completion rate for males and females is 20 percentage points – the largest of any male-female disparity at this end of the distribution. This speaks to the pervasiveness of gender discrimination among the rich in Burkina Faso. Finally, in the DRC the richest males and females have practically equal grade 5 completion rates while both poorer wealth quintiles display gender inequalities – the male completion rate is 25 percentage points higher than the female completion rate for the poorest males and females and the male completion rate is 14 percentage points higher than the female completion rate for the middle 40% of males and females.

From the above it is clear that there is a strong double disadvantage discrimination effect at work in the DRC for access to education in grade 5. Benin has high access discrimination at both ends of the wealth spectrum in grade 5, the gender component of which may have been partially hidden by the lack of discrimination in the middle portion of the distribution when gender discrimination was investigated at the aggregate level. Interestingly, gender discrimination in access is far more prevalent at the high end of the wealth spectrum in Burkina Faso in grade 5 which may be related to the fact that access for the lowest wealth quintile is extremely low regardless of gender (around 25%), thereby leaving little-to-no room for gender disparities to occur at this level. Unfortunately large standard errors make it impossible to detect significant differences in access rates for the other countries and in quality rates for all countries. However, mean estimates indicate that gender discrimination may be prevalent in both access and quality, especially in grade 5. Interestingly, for Senegal gender discrimination in access may actually favour females.

5.4 Disaggregated Levels of Access to Learning

Research question (4) from *Chapter 1 Introduction* asked,

(4) In each country how do the proportions of children identified in (2) above differ by the subnational categories identified in (3) above?

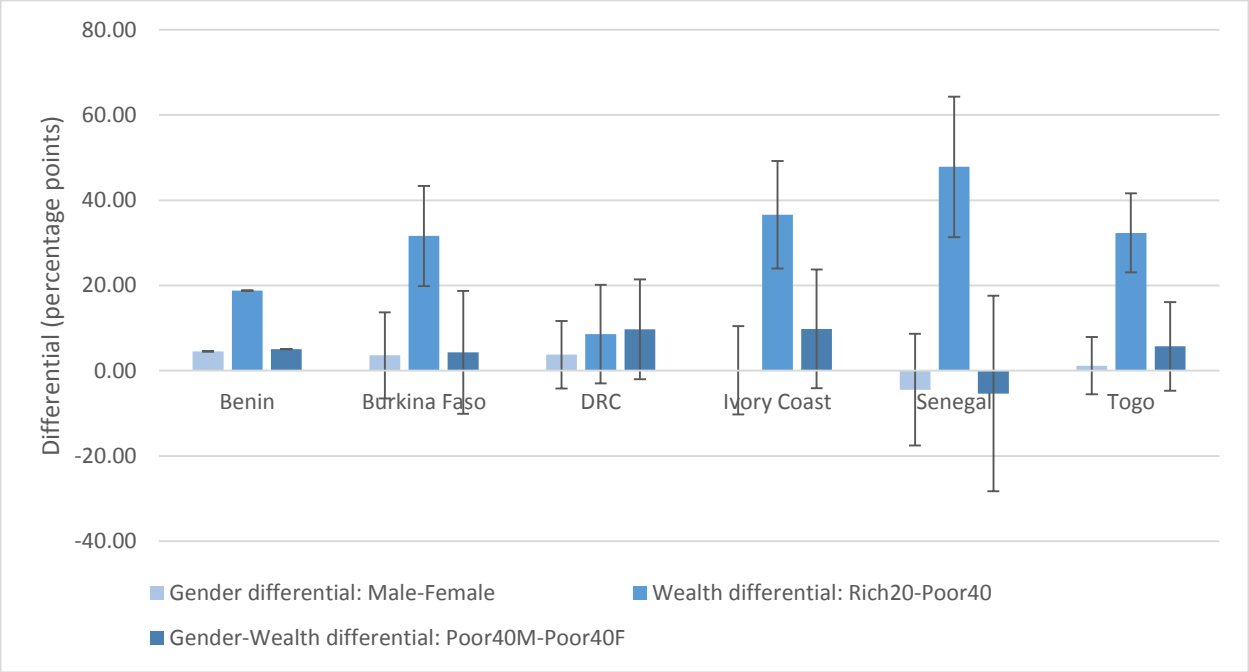
More directly, this question asks how access to literacy and access to numeracy (i.e. the access-adjusted literacy and numeracy rates) differ by gender, wealth, and a gender-wealth interaction. The figures in this subsection are derived from Tables 1F to 4F in Appendix F. Figures 28 to 31 display the access to literacy and access to numeracy differentials for gender, wealth, and the gender-wealth interaction. Important to note is the very large confidence intervals (at 95%) for each estimate. The large confidence intervals come from the fact that (1) the standard errors from the PASEC data are generally large, and (2) combining standard errors requires taking the square

root of the sum of the squared standard errors from each distribution, which results in larger standard errors for the combined estimate. Since the confidence intervals are so large we can't actually be sure that most gender differentials and gender-wealth differentials are not actually zero or negative. However, we are sure that all wealth differentials besides those for the DRC are in fact positive and generally very large.

There is only one case in which the gender differential favours females – in Senegal for grade 2 – otherwise the differential always favours males. Senegal also has the smallest gender differential in grade 5. The wealth differential is far larger than the gender differential in all countries and in both grades. Needless to say, the wealth differential always favours the rich. The wealth differential is always the largest in Senegal; Senegal clearly has a much larger problem addressing schooling for the economically disadvantaged than addressing gender equality. The wealth differential is consistently the smallest in the DRC, while their gender differentials are some of the largest. However, note that even in the DRC the wealth differential is greater than the gender differential. Results from the previous subsection showed that the large disadvantage of being poor in the DRC comes mainly from the lower completion rates of the poorest portions of the DRC age cohorts rather than differences in educational quality. All countries display clear issues when it comes to equality in education between socioeconomic groups. All countries besides Senegal and also display issues when it comes to gender equality in education although these are generally not statistically significant.

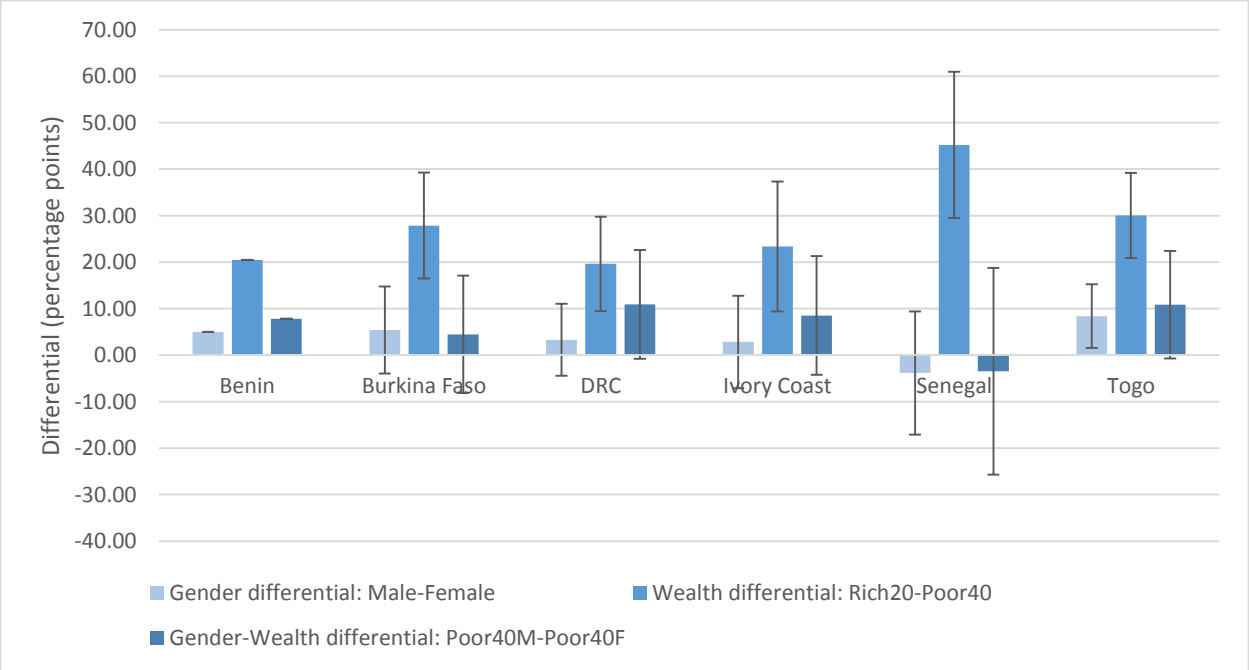
The last differential displayed is the gender-wealth interaction; this gives the difference in scores between the poorest males and the poorest females and is the effect of the double disadvantage of being both poor and female. For grade 2 the added disadvantage of being female does not make a difference in Benin for access to literacy and is actually an advantage in Senegal. However, all other cases display this double-disadvantage effect but not to a statistically significant degree. In grade 5 all countries, even Senegal, display a double-disadvantage effect but again the estimates are not statistically significant, except for the DRC in grade 5. The DRC shows the largest gender-wealth differentials in all cases except for grade 2 access to literacy – where the Ivory Coast displays the largest differential. For both the DRC and the Ivory Coast the added disadvantage of being female when one is already poor is around 10 percentage points for grade 2s (i.e. a poor female is 10 percentage points less likely to achieve basic literacy and numeracy at a grade 2 level than a poor male). In grade 5 this jumps to around 15 percentage points in the DRC and falls to around 5 percentage points in the Ivory Coast.

Figure 28. Grade 2 Literacy Differentials



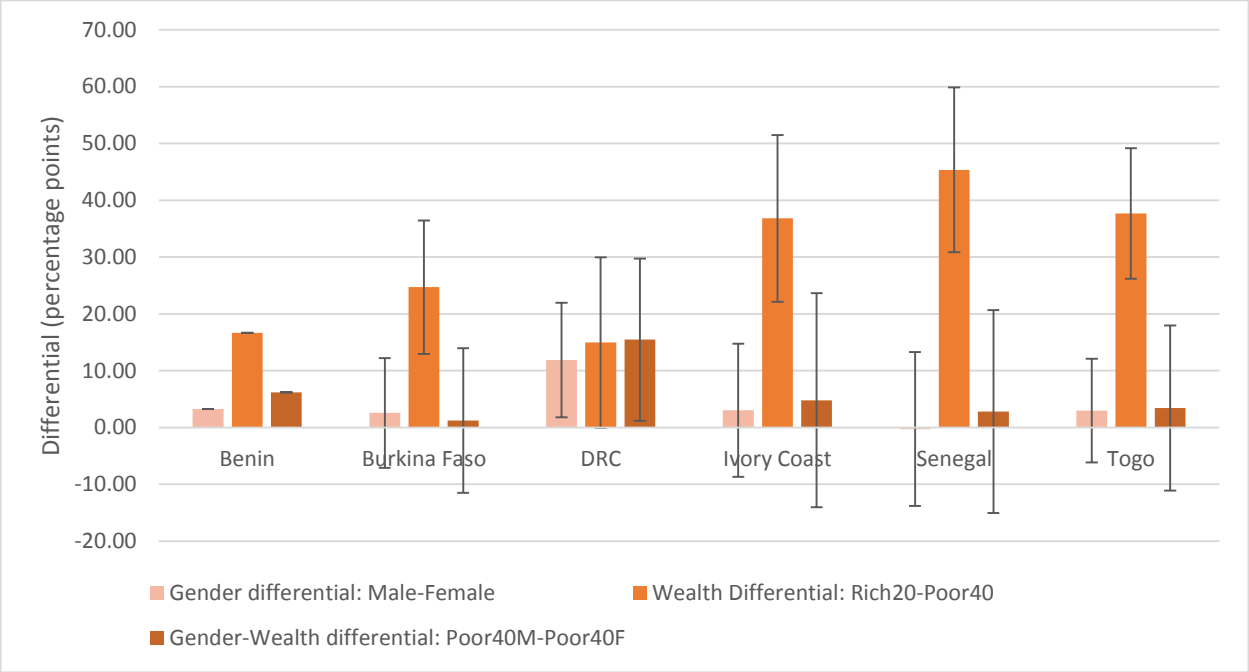
Note: For Benin estimates of literacy rates were run on the unweighted sample. Confidence intervals are unavailable for Benin.

Figure 29. Grade 2 Numeracy Differentials



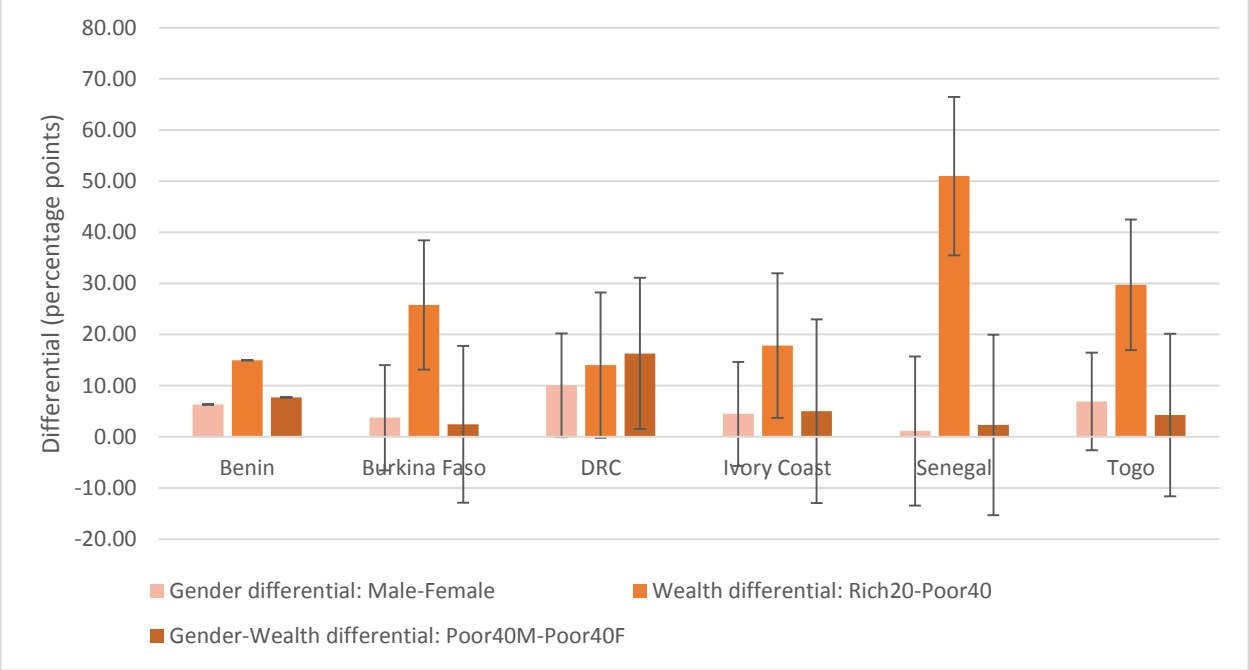
Note: For Benin estimates of numeracy rates were run on the unweighted sample. Confidence intervals are unavailable for Benin.

Figure 30. Grade 5 Literacy Differentials



Note: For Benin estimates of literacy rates were run on the unweighted sample. Confidence intervals are unavailable for Benin.

Figure 31. Grade 5 Numeracy Differentials



Note: For Benin estimates of numeracy rates were run on the unweighted sample. Confidence intervals are unavailable for Benin.

Throughout this section it has been clear that wealth differentials pose the biggest threat to educational equality in these countries – even for the DRC and Benin who showed low quality inequalities for wealth, since they still showed access inequalities in this regard. We discussed, too, how national access to literacy and access to numeracy rates were extremely low in most cases, and how they were likely to be lower in the case of inequalities. However, since this section has only discussed differentials and not actual access to literacy and access to numeracy rates, what we have not yet seen is how low the access to literacy and access to numeracy rates are for the most excluded groups. Tables 7 and 8 display access to literacy and access to numeracy rates for by gender for the poorest 40% of the age cohorts for grade 2 and grade 5 respectively.

There is one case in which the access to literacy rate is larger for the poorest males than it is nationally – this is for the DRC in grade 2. Here the male access to literacy rate is 70% while the national access to literacy rate is 69%. In all other cases the access to literacy and access to numeracy rates are smaller for both males and females in the poorest 40% of the wealth distribution than they are nationally. For all countries except the DRC, the poorest females always display extremely low access to literacy and access to numeracy rates, for both grade 2 and grade 5. However even the DRC has very low rates of access to learning for these females. In the Ivory Coast in grade 5, only 2% of females have access to numeracy and the standard error here is 6.5, meaning that we can't be sure that the rate here is not actually zero. Access to numeracy in the

Ivory Coast is not an exception, the access to literacy rate in grade 5 could be zero for females in Benin, the Ivory Coast, and Togo and very close to zero for Senegal and Burkina Faso.

Poor males have better access to literacy and access to numeracy than poor females in all cases but in absolute terms the rates here are still often extremely low: Less than 10% of males have access to literacy at a grade 5 level in all countries except the DRC (and even here the access to literacy rate is only 39%). Less than 20% of males have access to numeracy at a grade 5 level in all countries except the DRC (and here it is only 48% - less than half). This highlights the fact that there is barely any real formal education (i.e., formal education which results in learning) happening in West Africa – which excludes the DRC – at a grade 5 level for the poorest 40% of the population. Some basic education is taking place at a grade 2 level but most of the poorest 40% of the population will not even acquire basic grade 2 level skills.

Table 7. Access to Literacy and Access to Numeracy for the Poorest 40% of Individuals - Grade 2

	Literacy					
Countries	National	SE	Males	SE	Females	SE
Benin	27.85	-	14.45	-	9.39	-
Burkina Faso	25.35	3.2	17.28	4.9	12.99	5.5
DRC	68.97	2.6	70.01	4.2	60.32	4.2
Ivory Coast	32.23	3.0	24.84	4.2	15.01	5.7
Senegal	34.31	4.1	18.31	8.3	23.65	8.3
Togo	30.14	1.8	22.11	3.2	16.39	4.2
	Numeracy					
	National	SE	Males	SE	Females	SE
Benin	30.69	-	24.41	-	16.58	-
Burkina Faso	21.35	3.0	15.44	4.3	10.97	4.8
DRC	67.05	2.5	65.55	4.2	54.67	4.3
Ivory Coast	20.19	2.7	16.94	4.0	8.41	5.2
Senegal	36.91	4.2	22.32	8.4	25.79	7.6
Togo	41.84	1.9	36.58	3.6	25.74	4.6

Note: 'SE' is the standard error. Values shown are percentages. Estimates were run on the unweighted sample, standard errors are not available.

Table 8. Access to Literacy and Access to Numeracy for the Poorest 40% of Individuals - Grade 5

	Literacy					
Countries	National	SE	Males	SE	Females	SE
Benin	13.89	-	8.68	-	2.46	-
Burkina Faso	13.10	3.0	5.94	4.5	4.72	4.6
DRC	43.83	3.2	38.82	5.1	23.35	5.2
Ivory Coast	19.06	3.3	8.96	6.6	4.15	7.0
Senegal	23.44	4.1	9.89	6.5	7.07	6.3
Togo	18.06	2.6	6.65	4.0	3.23	6.2
	Numeracy					
	National	SE	Males	SE	Females	SE
Benin	18.98	-	14.04	-	6.37	-
Burkina Faso	17.47	3.2	10.44	5.1	8.01	5.9
DRC	55.13	3.2	48.18	5.1	31.89	5.5
Ivory Coast	10.60	2.8	7.01	6.4	2.01	6.5
Senegal	36.13	4.4	19.85	6.4	17.54	6.4
Togo	25.34	2.8	15.19	4.5	10.94	6.7

Note: 'SE' is the standard error. Values shown are percentages.
Estimates were run on the unweighted sample, standard errors are not available.

This chapter has presented a lot of information and hence Table 9 below displays a summary of the main conclusions. These points will be will summarised and discussed in the next chapter.

Table 9. Summary of Results

	Grade 2								
Country	Enrolment	Dropout	Completion	Access to lit	Access to num	Access ineq: G	Quality ineq: G	Access ineq: W	Quality ineq: W
Benin	moderate	low	Moderate	very low	Low	high	Indeterminate	very high	low
Burkina Faso	very low	low	very low	very low	very low	Indeterminate	Indeterminate	very high	very high
DRC	very high	low	very high	moderate	Moderate	moderate	Indeterminate	high	none
Ivory Coast	low	low	Low	low	very low	very high	Indeterminate	very high	very high
Senegal	low	low	Low	low	Low	Indeterminate	Indeterminate	very high	very high
Togo	very high	low	very high	low	Low	Indeterminate	Indeterminate	very high	very high
	Grade 5								
	Enrolment	Dropout	Completion	Access to lit	Access to num	Access ineq: G	Quality ineq: G	Access ineq: W	Quality ineq: W
Benin	low	Moderate	Low	very low	very low	high	Indeterminate	very high	low
Burkina Faso	very low	Moderate	very low	very low	very low	high	Indeterminate	very high	very high
DRC	high	Moderate	Moderate	low	Low	very high	Indeterminate	very high	none
Ivory Coast	low	Moderate	very low	very low	very low	very high	Indeterminate	very high	very high
Senegal	low	Moderate	very low	very low	Low	Indeterminate	Indeterminate	very high	very high
Togo	high	Moderate	Moderate	very low	very low	Indeterminate	Indeterminate	very high	very high

Note: 'Lit' refers to literacy, 'num' refers to numeracy, 'ineq' refers to inequality, 'G' refers to gender, 'W' refers to wealth.

Chapter 6 Discussion and Conclusion

The results presented above clearly indicate that there is an education crisis in Francophone Africa, at least for the six countries studied here. Although access to learning in the DRC was comparatively high, even here the learning levels are actually worryingly low. The other five countries investigated all had shockingly low levels of access to education, quality education, and access to quality education. This reality needs to be faced and taken into account by policymakers and those developing indicators for the 2030 SDGs if progress is to be made. Although all six countries have issues relating to access, quality, and access to quality, these issues do not manifest in the same way for all countries.

6.1 Action Areas

Overall, all countries had moderate dropout rates at a grade 5 level, an extremely low level of quality education in both grades, and very high socioeconomic disparities in access to education. Gender discrimination in the quality of education could not be detected for any country but mean estimates implied gender inequalities for all countries, with Senegal being the only country to favour females. For grade 2, mean estimates for learning outcomes generally implied that males were advantaged at the lower end of the wealth spectrum and that females were advantaged at the higher end of the wealth spectrum. In grade 5 mean estimates suggested that males were advantaged across the wealth spectrum. When both gender and socioeconomic discrimination was present the socioeconomic discrimination was always far larger than the gender discrimination. Issues of access, gender discrimination in access, and socioeconomic discrimination in quality varied between countries.

In terms of access Benin has low initial enrolment. Benin also has gender disparities in access to education. Socioeconomic disadvantages in quality education is surprisingly low in Benin indicating that the quality of schools may be relatively equal across the wealth spectrum. However, this indicates a very low quality across all income levels rather than a high quality at low income levels. Socioeconomic disadvantages in access were characterised by the poorest 40% of the distribution being disadvantaged compared to the richest 60%, while within the richest 60% the differences in access were smaller. These results indicate that Benin needs to increase enrolment and lower dropout, especially for the poorest 40% of the population and also, to a lesser extent, for females. Benin also needs to increase the quality of schooling, making sure to do so across all socioeconomic levels so as to keep the quality of schooling equal.

Burkina Faso has very low initial enrolment levels. Gender discrimination in access is prevalent in Burkina Faso at the high end of the wealth spectrum. Socioeconomic discrimination is present in education quality and large across the wealth spectrum. Benin therefore needs a multifaceted approach to improving the education system which focuses simultaneously on access (both

enrolment and completion) and quality while rectifying existing gender and socioeconomic disparities.

The DRC has high initial enrolment. Gender disparities in access are not prevalent in the high income portion of the grade 5 cohort but present and large in the poor and middle income portions of the grade 5 cohort. Interestingly, socioeconomic disparities in quality were not detected for the DRC. Given this profile of results the DRC needs to concentrate on improving dropout rates and, crucially, on improving the quality of education within schools. Access to education is the area of attention for rectifying gender and socioeconomic inequalities in the DRC. Access needs to become equal for low and middle income individuals as compared to high income individuals and access needs to become equal for females of low and middle income socioeconomic status as compared to males and richer females.

The Ivory Coast has low initial enrolment and notable gender discrimination in access to education across the socioeconomic spectrum. Socioeconomic disparities in the quality of education were also observed. The Ivory Coast therefore also needs to pursue a multifaceted approach to improving the education system which focuses on improving enrolment, decreasing dropout, and increasing the quality of education within schools. The approach also needs to improve access disparities which disadvantage females and those of low socioeconomic status. Quality needs to be improved overall but especially for the socioeconomically disadvantaged.

Senegal has low initial enrolment and has not improved this substantially over a time span of four years. Gender discrimination in access to education was not detected in Senegal. Socioeconomic inequalities in the quality of education were present and large. Again, Senegal has many areas in which improvement is necessary. A multi-faceted approach would include policies aimed at increasing enrolment and the quality of education while decreasing dropout and socioeconomic disparities in both access and quality. In the 1990s Senegal made a commitment to reduce gender inequality in education, which at the time favoured males (Tall Thiam & Direction de la

Planification et de la Réforme de l'Education, 2006). Senegal should monitor or continue to monitor gender disparities in both access and quality as their policies to reduce gender discrimination are clearly working but they should not do so to the detriment of male scholars. Note however that the female advantage for Senegal was generally only visible at the grade 2 level indicating either that this advantage disappears in higher grades or that policies favouring females only began to be effective for the younger cohort. In the latter case, policies would need to be adjusted if gender equality is the goal, rather than female education specifically. Further research is needed to determine which is the case.

Finally, Togo has high initial enrolment and gender discrimination in access to education was not detected here. Socioeconomic discrimination in education quality was detected and was extremely large. Socioeconomic discrimination in access was characterised by the poorest 80% of the distribution being disadvantaged compared to the richest 20% of the distribution, while discrimination within the poorest 80% was relatively less prevalent. Togo therefore needs to focus on access for the socioeconomically disadvantaged, especially for the poorest 80% of the

population, while also improving the quality of education across the board and especially for the socioeconomically disadvantaged.

Note how, for all countries, dropout may be related to the low level of quality schooling as those who see the benefits of schooling are more likely to remain in the schooling system. In the same vein, higher quality schooling may lead to higher enrolment by increasing the demand for education. Therefore increasing school quality could also decrease school dropout and increase school enrolment. Finally, the absence of discrimination against girls in grade 2 in Senegal may be due to the effectiveness of policies supported by donor funding in light of the MDGs for 2015. Other countries may benefit from modelling their own gender-oriented policies against those of Senegal's.

It is notable that governments need to continue their focus on enrolment and completion rates, even as the international community begin to look to results on tests of cognitive skills to guide development strategies. Although improving the quality of education can lead to higher enrolment and completion rates, this cannot be the only pathway through which access is achieved. However, a focus on access also cannot be the sole guiding factor in policy. The fact that 62% and 43% of students in Senegal can spend 5 years in formal full-time schooling and still not emerge with the most elementary literacy and numeracy skills (respectively) is testament to this fact.

Overall the suggestion here is that countries need to see access to education (grade completion) and quality of education (learning) as two sides of the same coin. Prior to the Sustainable Development Goals the international community prioritized the universalization of access while neglecting learning. As the SDGs begin to be implemented countries must not switch to prioritising learning while ignoring access, especially those with low access rates as seen here. Both are important and crucial elements of the schooling system.

6.2 Limitations and Recommendations

Since the PASEC data was collected between 2005 and 2010 some of these results may be outdated. Unfortunately, even when the newest PASEC data is released this methodology will not be able to be replicated with the same rigorous standard until some years have passed as the method requires using an older cohort to estimate completion rates, and hence using DHS data from later years. International cognitive assessments such as PISA[17] get past this issue by testing a sample of students of 15 years of age, rather than a sample of students in a specific grade. PASEC administrators should consider using this methodology instead to help research of this kind to be as relevant as possible.

PASEC data is also limiting in the fact that the surveys were administered in different years in different countries. The results are still interesting on their own but coordinating PASEC across member countries would allow for meaningful comparisons to be made. PASEC data is also not

[17] The Programme for International Student Assessment, run by the OECD (Organisation for Economic Co-operation and Development) in member and non-member countries.

always reliable (as seen in *Chapter 3 Data*) which indicates that greater attention to the data cleaning, data documentation, and data coordination across countries would be beneficial for ease of analysis, comparability, and enabling inclusion of countries in the analysis.

The PASEC questionnaire itself is problematic in that it is not developed with the same rigour as other cognitive assessments such as SACMEQ. It has already been discussed how the SACMEQ benchmarks correspond well to the achievement of skills due to the psychometric procedure undertaken in its formulation, and conversely how PASEC benchmarks are based on a far more arbitrary decision process. More specifically, SACMEQ achievement levels purport to ascertain whether a student has acquired functional literacy – the ability to read a short text and extract meaning from it – or functional numeracy – the ability to convert graphical information in to fractions or interpret common units of measurement – rather than simply a basic understanding of the concepts covered in one particular grade (Ross et al. 2005 as cited in Taylor & Spaull, 2015). SACMEQ also purports to be able to distinguish between this and higher order learning, which involves critical reading and abstract problem solving.

Structuring PASEC in a way that mirrors the same basic or higher order achievement levels in SACMEQ would allow a deeper analysis of the competency levels of those coming out of PASEC-covered educational institutions. Rigorous formulation procedures would benefit research not only by allowing researchers to know exactly what students do and do not know but also by allowing comparison to SACMEQ-participating countries. One way of overcoming this issue without relying on the restructuring of the PASEC questionnaire and/or its learning benchmarks would be to match SACMEQ learning levels to PASEC achievement scores. This procedure has been done before for other cognitive achievement tests (Gustafsson, 2012). Future research could replicate this for PASEC and SACMEQ and then use Spaull and Taylor's (2015) methodology to provide SACMEQ-comparable indicators.

Aside from issues inherent in the PASEC data, there are also limitations related to the availability of research on this topic. There is a lack of reliable baseline indicators of access to learning. Without such indicators it was not possible to identify if there have been improvements or deteriorations over time in the combined access and learning indicator. The work presented here aimed to provide one starting point for such comparisons that future work in the area can make use of. Baseline indicators are also not available for a number of other developing countries but the data to replicate this work in other countries does exist. For example, future research could apply Spaull and Taylor's (2015) methodology to data from other areas such as Latin America and the Caribbean using SERCE[18] data.

Finally, it is clear that competency in French is not being achieved on a large scale in these countries. It would be interesting to see future studies compare French competency levels with

[18] The Second Regional Comparative and Explanatory Study conducted by UNESCO and the LLECE (Latin American Laboratory for Assessment of the Quality of Education).

those of the indigenous languages, and perhaps for studies such as PASEC to begin testing competency in these languages as well.

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Appendix A Comparison of Weighted and Unweighted Results

Table 1A. PASEC Grade 2 Access to Literacy, Weighted and Unweighted Comparison

Country	National	SE	Males	SE	Females	SE	Poor40	SE	Mid40	SE	Rich20	SE
Burkina Faso	2.08	3.2	1.86	3.4	2.33	3.9	1.54	4.5	-0.02	4.9	7.25	4.0
DRC	-1.03	2.6	-0.59	2.9	-1.36	2.8	-1.11	3.9	-0.61	3.1	-1.74	4.4
Ivory Coast	-1.32	3.0	-0.26	3.0	-2.15	4.3	-0.75	3.6	-0.76	3.8	-6.80	5.3
Senegal	1.46	4.1	1.23	4.8	1.66	4.7	0.60	7.3	2.89	5.6	0.27	4.2
Togo	0.00	1.8	0.00	2.1	0.00	2.7	0.00	2.7	0.00	2.4	0.00	3.9
	Poor40M	SE	Poor40F	SE	Mid40M	SE	Mid40F	SE	Rich20M	SE	Rich20F	SE
Burkina Faso	0.84	4.9	2.01	5.5	-3.95	5.2	2.59	6.2	10.56	4.7	4.83	5.4
DRC	-6.69	4.2	2.87	4.2	-2.26	3.7	-0.42	3.7	3.92	4.2	-6.55	4.5
Ivory Coast	-7.35	4.2	2.56	5.7	6.11	4.2	-3.72	5.2	11.06	6.4	-11.76	6.9
Senegal	5.22	8.3	-1.11	8.3	5.75	7.1	1.04	6.9	-1.61	5.7	1.35	5.1
Togo	-3.96	3.2	1.92	4.2	2.28	2.8	-0.66	3.3	3.27	4.2	-1.92	5.2

Note: Statistics reported are the difference in means between the results from Section *5.2* and the same results estimated with unweighted data. Poor40 refers to the poorest 40% of individuals in the country, Mid40 the middle 40%, and Rich20 the richest 20%. 'SE' is the standard error of the weighted results. An 'M' or 'F' after the wealth bracket refers to 'Males' or 'Females', respectively. Values in red indicate that the mean differences are greater than the relevant standard errors.

Table 2A. PASEC grade 2 Access to Numeracy, Weighted and Unweighted Comparison

Country	National	SE	Males	SE	Females	SE	Poor40	SE	Mid40	SE	Rich20	SE
Burkina Faso	1.31	2.9	0.91	3.3	1.78	3.4	0.88	3.7	0.21	3.9	4.21	4.5
DRC	-2.16	2.5	-1.99	2.8	-2.12	2.8	-1.61	3.8	-2.75	3.1	-2.04	3.5
Ivory Coast	-1.19	2.7	-0.41	2.9	-1.85	4.2	-0.63	3.1	-1.08	3.4	-4.63	6.4
Senegal	0.61	4.2	0.65	5.0	0.54	4.5	-0.45	7.0	2.28	5.8	-0.82	4.0
Togo	0.00	1.9	0.00	2.3	0.00	2.6	0.00	3.1	0.00	2.4	0.00	3.5
	Poor40M	SE	Poor40F	SE	Mid40M	SE	Mid40F	SE	Rich20M	SE	Rich20F	SE
Burkina Faso	0.44	4.3	1.19	4.8	0.35	4.4	-9.54	5.0	2.86	5.7	5.78	5.4
DRC	-1.60	4.2	-1.67	4.3	-1.94	3.6	-2.74	3.8	-2.90	4.2	-1.76	3.4
Ivory Coast	-0.53	4.0	-0.11	5.2	-0.12	3.9	-12.95	8.5	-2.21	6.4	-6.40	8.8
Senegal	0.18	8.4	-1.30	7.6	2.62	7.3	-7.72	6.9	-2.57	5.4	-0.69	5.0
Togo	0.09	3.6	0.00	4.6	-0.11	3.0	-20.55	4.2	0.00	4.0	0.00	4.9

Note: Statistics reported are the difference in means between the results from Section *5.2* and the same results estimated with unweighted data. Poor40 refers to the poorest 40% of individuals in the country, Mid40 the middle 40%, and Rich20 the richest 20%. 'SE' is the standard error of the weighted results. An 'M' or 'F' after the wealth bracket refers to 'Males' or 'Females', respectively. Values in red indicate that the mean differences are greater than the relevant standard errors.

Table 3A. PASEC grade 5 Access to Literacy, Weighted and Unweighted Comparison

Country	National	SE	Males	SE	Females	SE	Poor40	SE	Mid40	SE	Rich20	SE
Burkina Faso	0.66	3.0	0.45	3.4	0.88	3.5	0.26	3.6	0.61	3.9	1.47	4.8
DRC	0.46	3.2	-0.59	3.7	1.37	3.6	-0.51	4.7	1.77	4.1	-0.64	6.0
Ivory Coast	-1.42	3.3	-0.92	3.9	-1.85	4.6	0.59	5.3	-1.84	4.0	-5.22	5.3
Senegal	0.75	4.1	0.05	4.7	1.59	5.0	2.42	5.4	0.86	4.8	-3.03	5.0
	Poor40M	SE	Poor40F	SE	Mid40M	SE	Mid40F	SE	Rich20M	SE	Rich20F	SE
Burkina Faso	0.42	4.5	0.84	4.6	-0.12	4.7	-0.09	5.0	1.77	5.4	2.36	5.7
DRC	-1.58	5.1	0.50	5.2	1.06	4.9	1.62	4.5	-1.81	6.5	2.44	6.5
Ivory Coast	0.62	6.6	0.08	7.0	-1.34	5.4	-1.70	5.7	-2.92	5.8	-5.13	7.2
Senegal	1.78	6.5	2.86	6.4	-1.08	6.0	2.37	6.5	-1.00	7.7	-3.51	6.1
Togo	-0.23	4.0	0.00	6.2	0.01	3.1	-0.12	4.5	0.00	5.4	0.00	5.9

Note: Statistics reported are the difference in means between the results from Section *5.2* and the same results estimated with unweighted data. Poor40 refers to the poorest 40% of individuals in the country, Mid40 the middle 40%, and Rich20 the richest 20%. 'SE' is the standard error of the weighted results. An 'M' or 'F' after the wealth bracket refers to 'Males' or 'Females', respectively. Values in red indicate that the mean differences are greater than the relevant standard errors.

Table 4A. PASEC grade 5 Access to Numeracy, Weighted and Unweighted Comparison

Country	National	SE	Males	SE	Females	SE	Poor40	SE	Mid40	SE	Rich20	SE
Burkina Faso	1.03	3.2	1.06	3.7	0.92	3.8	0.36	4.3	0.54	4.7	3.12	4.8
DRC	0.50	3.2	0.37	3.4	0.48	3.9	-1.30	4.7	1.80	4.1	1.07	5.5
Ivory Coast	-0.62	2.8	-0.59	3.6	-0.71	3.8	0.37	5.1	-0.98	3.5	-2.16	5.1
Senegal	-0.05	4.4	-0.37	5.4	0.40	5.1	1.28	4.8	1.34	5.0	-5.73	6.3
	Poor40M	SE	Poor40F	SE	Mid40M	SE	Mid40F	SE	Rich20M	SE	Rich20F	SE
Burkina Faso	0.62	5.1	0.67	5.9	0.36	5.4	-0.28	5.4	3.48	5.7	3.22	5.7
DRC	-2.04	5.1	-1.20	5.5	2.18	4.3	1.47	4.9	1.57	5.8	1.79	6.4
Ivory Coast	0.25	6.4	0.04	6.5	0.18	5.2	-1.32	4.9	-3.69	5.8	-0.68	6.7
Senegal	1.90	6.4	0.59	6.4	0.34	5.8	2.32	7.0	-6.27	8.9	20.89	5.6
Togo	-0.17	4.5	0.18	6.8	0.06	3.7	-0.33	4.6	0.00	5.5	0.00	6.4

Note: Statistics reported are the difference in means between the results from Section *5.2* and the same results estimated with unweighted data. Poor40 refers to the poorest 40% of individuals in the country, Mid40 the middle 40%, and Rich20 the richest 20%. 'SE' is the standard error of the weighted results. An 'M' or 'F' after the wealth bracket refers to 'Males' or 'Females', respectively. Values in red indicate that the mean differences are greater than the relevant standard errors.

Appendix B Male and Female Representation in DHS Data

Table 1B. Male and Female Representation in DHS Data

	Unweighted			
Country	Female	Male	Female-only households	Male-only households
Benin	50.51	49.49	3.2	2.5
Burkina Faso	51.51	48.49	1.16	1.7
DRC	51.27	48.73	2.57	1.84
Ivory Coast	50.36	49.64	2.48	4.48
Senegal	53.54	46.46	0.98	1.06
Togo	51.41	48.59	3.8	3.32
	Weighted			
Country	Female	Male	Female-only households	Male only households
Benin	50.58	49.42	3.28	2.67
Burkina Faso	51.42	48.58	1.05	1.62
DRC	51.43	48.57	2.54	1.71
Ivory Coast	50.11	49.89	2.35	4.84
Senegal	53.45	46.55	1.63	1.75
Togo	51.57	48.43	4.35	3.83

Note: Figures shown are percentages

Appendix C Construction of Wealth Indices from PASEC Data

1. Selecting Variables

The variables used to construct the wealth indices are displayed in Table 1C. Due to each country having slightly different variables available not all of the variables were used for each country. Table 2C displays which variables were available for each country.

Following the approach by Wittenberg and Leibbrandt (2015), the variables were specifically chosen to maximise the likelihood that the index would differentiate well between different wealth levels. The authors discuss the case of rural assets in the DHS data for South Africa – variables such as livestock are negatively correlated with the other assets and commodities used to create the DHS wealth index. This negative correlation means that the Principal Component Analysis (PCA) conducted by DHS sees the livestock variables as a 'bad' rather than a 'good' and hence those with such assets are ranked as poorer than those without them in the DHS wealth index. This is of course an incorrect ranking (and it violates the PCA assumption of monotonicity – that more goods mean more wealth). The authors suggest removing the negatively correlated 'goods' from the analysis for a more accurate index to be constructed.

Whenever possible, such variables were transformed so that they could be used instead of discarded; for example, the binary variable of whether the household owned a bicycle displayed similar issues as the variable relating to owning livestock as discussed above. This variable was combined with binary variables of whether the household owned a motorcycle or not, or owned a car or not – creating a single variable for vehicle ownership which ranges from a value of one (owns none of the vehicles) to a value of six (owns all three vehicles). Other than for this reason, binary variables were not combined since the purpose of an MCA is to assign different weights to different variables and combining them would not allow the MCA to do so – the combined variables would all be given the same weight as each other.

Contrary to the approach by Wittenberg and Leibbrandt (2015) who only used assets in their analysis, other commodities such as housing material and food intake were included in this MCA (for example, having a tile or dirt floor, or always/never eating breakfast). The reason for this is that when assets were excluded according to the criteria outlined above there was no longer a satisfactory amount of assets remaining to conduct the MCA.

Table 1C. Variables Used to Create Wealth Index for PASEC Countries

Variable name	Variable Description	Variable type
material	Material hh is made of	Hard/Semi-hard/Clay/Straw or Other
taps	Hh has taps	Yes/No
electricity	Hh has electricity	Yes/No
torch	Hh owns a torch	Yes/No
radio	Hh owns a radio	Yes/No
phone	Hh owns has access to a phone	Yes/No
sewing machine	Hh owns a sewing machine	Yes/No
internet	Hh has access to the internet	Yes/No
stove	Hh owns a stove	Yes/No
tv	Hh owns a TV	Yes/No
fridge	Hh owns a fridge	Yes/No
dvd/vcr m.	Hh owns a dvd/vcr player	Yes/No
camera	Hh owns a camera	Yes/No
stereo	Hh owns a stereo system	Yes/No
computer	Hh owns a computer	Yes/No
books	Hh owns books	Yes/No
breakfast	Student regularly has breakfast	Yes/No
lunch	Student regularly has lunch	Yes/No
supper	Student regularly has supper	Yes/No
rice	Student eats rice	Often/Rarely/Never OR Yes/No[b]
milk/eggs	Student eats milk/eggs	Often/Rarely/Never OR Yes/No[b]
corn	Student eats corn	Often/Rarely/Never OR Yes/No[b]
yoghurt	Student eats yoghurt	Often/Rarely/Never OR Yes/No[b]
cheese	Student eats cheese	Often/Rarely/Never OR Yes/No[b]
meat	Student eats meat	Often/Rarely/Never OR Yes/No[b]
fish	Student eats fish	Often/Rarely/Never OR Yes/No[b]
fruit/veg	Student eats fruit/veg	Often/Rarely/Never OR Yes/No[b]
work	Work prevents student going to school	Yes/No
parental literacy	Parents of the student are literate	Both/One/None
vehicle[a]	Hh owns vehicles	Car and (bicycle and/or motorcycle)/ Car only/ Bicycle and Motorcycle only/ Motorcycle only/Bicycle only/None
toilet[a]	Hh toilet facility	Flush/Pit/None OR Shared/Private OR Both[b]

Note: Original PASEC variable names are not given as the names vary between datasets, despite them representing the same asset/commodity. B. Faso refers to Burkina Faso and Iv. Coast refers to the Ivory Coast. Hh refers to the student's household.

[a] These variables were created from the PASEC data but are not generally available in the PASEC data in this form. [b] Response types vary depending on the country.

Table 2C. Variables Available to Create Wealth Index for PASEC Countries

	Countries that variable is available in					
Variable name	Benin	B. Faso	DRC	I. Coast	Senegal	Togo
material	Y	Y	Y	Y	Y	Y
taps	N	Y	Y	Y	Y	Y
electricity	N	Y	Y	Y	Y	Y
torch	N	Y	Y	Y	Y	N
radio	N	Y	Y	Y	Y	Y
phone	N	Y	Y	N	Y	Y
sewing machine	N	Y	Y	Y	Y	Y
internet	N	N	N	N	N	N
stove	N	Y	Y	Y	Y	N
tv	N	Y	Y	Y	Y	Y
fridge	N	Y	Y	Y	Y	Y
dvd/vcr m.	N	Y	Y	Y	N	N
camera	N	N	N	Y	Y	N
stereo	N	N	N	Y	N	N
computer	N	Y	Y	Y	Y	Y
books	N	N	Y	Y	N	Y
breakfast	Y	Y	Y	Y	Y	N
lunch	Y	Y	Y	Y	Y	N
supper	Y	Y	Y	Y	Y	N
rice	N	Y	N	N	Y	N
milk/eggs	Y	Y	Y	Y	Y	N
corn	N	N	Y	N	Y	N
yoghurt	N	Y	Y	Y	Y	N
cheese	N	Y	N	Y	Y	N
meat	Y	Y	Y	Y	Y	N
fish	Y	Y	Y	Y	Y	N
fruit/veg	Y	Y	Y	Y	Y	N
work	Y	N	Y	Y	N	N
parental literacy	Y	Y	Y	Y	Y	N
vehicle	Y	Y	Y	Y	Y	Y
toilet	Y	Y	Y	Y	Y	Y

Note: Original PASEC variable names are not given as the names vary between datasets, despite them representing the same asset/commodity. B. Faso refers to Burkina Faso and I. Coast refers to the Ivory Coast. a These variables were created from the PASEC data but are not generally available in the PASEC data in this form.

2. Testing the wealth index

In order to test whether the resulting wealth index was appropriate the data were separated into wealth quintiles of the poorest 40%, the middle 40%, and the richest 20%. These were then investigated to determine what proportions of each quintile owned different assets or other commodities. Two other wealth indices were also created for this purpose: An asset index using MCA and all available assets in the PASEC data, as well as the same index as has been under discussion but created using PCA rather than MCA. Finally, the PASEC index was also included to see whether the new indices resulted in an improvement or not. The analysis was conducted on data from the DRC (for grade 5) since this was the only country with a PASEC wealth index available.

Tables 3.1C and 3.2C compare the four wealth indices to see how they perform on PASEC data from the DRC. In the table they are named as follows: (1) PASEC: The wealth index given by PASEC,

(2) Assets: the asset index, (3) MCA: the wealth index eventually used, and (4) PCA: the same wealth index as in (3) but created using PCA rather than MCA. The tables display the proportion of households that have access to certain key commodities. While all indicators perform similarly on the car category, the PASEC index performs poorly on all other categories. For example, when looking at the variable relating to the presence of electricity infrastructure and taps in the household, the PASEC index shows very little variation between the different wealth categories, and where the proportions do vary the middle group actually has more households with access to electricity and running water than the wealthier group. According to the PASEC index the poorest individuals also have the highest proportion of school kids who regularly have breakfast and have a flush toilet within the household.

The other three wealth indicators have a higher degree of discrimination and are therefore arguably better indicators than the PASEC wealth index. The MCA and PCA indicators, that is those indicators which have the carefully selected variables, do slightly better on all categories than the asset index with the exception of the car category on which the asset index understandably does a bit better. The differences between the PCA and the MCA are slight and therefore the decision of which to use was arbitrary but non-consequential.

Table 3.1C. Comparison of Different Multiple Correspondence Analyses – Data from PASEC, DRC Grade 5

	Car				Electricity				Taps			
Wealth quintile	PASEC	Assets	Final	PCA	PASEC	Assets	Final	PCA	PASEC	Assets	Final	PCA
Poorest 40%	1.19	0	0.17	0.36	22.42	3	0.27	0.18	17.29	3.31	0.96	1
Middle 40%	7.96	2.51	3.5	3.39	28.81	14.3	13.5	12.75	24.88	14.75	12.82	12.88
Richest 20%	16.53	25.04	22.67	20.88	23.69	78.74	83.31	85.32	20.8	58.97	65.3	66.12

NOTE: PASEC refers to the wealth index available in the PASEC data. Assets refers to an asset index created using Multiple Correspondence Analysis (MCA). Final refers to the final wealth index used, which was created using MCA. PCA refers to a wealth index created using Principle Component Analysis (PCA). Values shown are percentages of individuals that have certain commodities.

Table 3.2C. Comparison of Different Multiple Correspondence Analyses – Data from PASEC, DRC Grade 5

	Breakfast				Flush toilet				No toilet			
Wealth quintile	PASEC	Assets	Final	PCA	PASEC	Assets	Final	PCA	PASEC	Assets	Final	PCA
Poorest 40%	60.44	55.94	47.11	47.21	16.62	3.36	2.59	2.63	43.28	68.08	75.69	74.4
Middle 40%	58.71	53.04	59.67	59.89	7.34	8.95	8.63	8.29	51.13	47.19	42.95	44.35
Richest 20%	54.69	73.05	74.34	76.64	9.46	29.38	30.83	29.14	48.93	16	12.29	12.4

NOTE: PASEC refers to the wealth index available in the PASEC data. Assets refers to an asset index created using Multiple Correspondence Analysis (MCA). Final refers to the final wealth index used, which was created using MCA. PCA refers to a wealth index created using Principle Component Analysis (PCA). Values shown are percentages of individuals that have certain commodities.

3. Adjusting for Benin and Togo

Benin and Togo have substantially fewer variables than the other countries. Specifically, Benin is missing the majority of the asset variables and Togo is missing the variables relating to food consumption. To test whether MCAs using the remaining variable could be used, the DRC MCA was rerun twice, first using only those variables available in the Benin data and secondly using only those variables available in the Togo data. The results of this exercise are given in Tables 4.1C and 4.2C below. From the tables it is clear that the Benin and Togo MCAs do not perform as well as the DRC MCA. However, they still manage to discriminate well on all categories, with no strange patterns being observable.

Table 4.1C. Testing of Benin and Togo Wealth Indices - Data from PASEC, DRC Grade 5

	Car			Electricity			Taps		
Wealth quintile	Final	Benin	Togo	Final	Benin	Togo	Final	Benin	Togo
Poorest 40%	0.17	1.95	0.2	0.27	8.17	0.29	0.96	7.68	0.48
Middle 40%	3.5	7.17	2.91	13.5	25.35	14.99	12.82	20.72	12.42
Richest 20%	22.67	14.52	24.16	83.31	54.3	82.25	65.3	44.28	68.05

Note: All wealth indices (Final, Benin, Togo) were created using Multiple Correspondence Analysis. All indices were run on data from the DRC - the names 'Benin' and 'Togo' refer to the variables that were included in the MCA. The name 'Final' refers to the MCA that is being used for the DRC. Values shown are percentages of individuals that have certain commodities.

Table 4.2C. Testing of Benin and Togo Wealth Indices - Data from PASEC, DRC Grade 5

	Breakfast			Flush toilet			No toilet		
Wealth quintile	Final	Benin	Togo	Final	Benin	Togo	Final	Benin	Togo
Poorest 40%	47.11	34.82	55.99	2.59	6.86	1.43	75.69	65.32	68.28
Middle 40%	59.67	63.3	53.48	8.63	10.52	9.62	42.95	43.18	46.18
Richest 20%	74.34	90.96	72.24	30.83	22.46	31.36	12.29	24.51	17.04

Note: All wealth indices (Final, Benin, Togo) were created using Multiple Correspondence Analysis. All indices were run on data from the DRC - the names 'Benin' and 'Togo' refer to the variables that were included in the MCA. The name 'Final' refers to the MCA that is being used for the DRC. Values shown are percentages of individuals that have certain commodities.

Since the evidence from these analyses on DRC data shows that the MCAs conducted are appropriate the same MCAs were run for each country. Tables 5C and 6C display the same tables as above but for each country besides the DRC.

Table 5C. Proportion of Individuals from Different Wealth Quintiles that have Certain Commodities - Benin

Wealth quintile	Concrete/Brick house	No literate parents	Both parents literate	Eats meat	Eats breakfast
Poorest 40%	14.82	68.81	6.43	3.18	62.39
Middle 40%	46.16	26.41	30.54	25.99	98.96
Richest 20%	66.00	8.93	48.14	87.15	100.00

Note: Values shown are percentages.

Table 6.1C. Proportion of Individuals from Different Wealth Quintiles that have Certain Commodities

	Car				Electricity				Taps			
Wealth quintile	B. Faso	I. Coast	Senegal	Togo	B. Faso	Ivory C.	Senegal	Togo	B. Faso	Ivory C.	Senegal	Togo
Poorest 40%	1.41	2.30	6.16	0.00	0.00	25.80	18.49	0.00	1.60	5.60	19.26	0.00
Middle 40%	3.84	9.87	27.69	2.43	2.83	95.95	95.08	31.48	6.50	47.44	77.75	8.01
Richest 20%	23.79	45.92	61.08	21.5	58.71	99.84	99.70	90.79	46.25	90.10	98.11	29.52

Note: B.Faso refers to Burkina Faso and I. Coast refers to the Ivory Coast. Values shown are percentages.

Table 6.2C. Proportion of Individuals from Different Wealth Quintiles that have Certain Commodities

	Breakfast				Flush toilet				No toilet			
Wealth quintile	B. Faso	I. Coast	Senegal	Togo	B. Faso	Ivory C.	Senegal	Togo	B. Faso	Ivory C.	Senegal	Togo
Poorest 40%	84.58	80.19	79.26	-	0.00	3.32	16.58	0.00	100.00	96.68	83.42	100.00
Middle 40%	89.76	86.15	95.62	-	1.17	21.09	45.67	4.68	98.83	78.91	54.33	95.32
Richest 20%	92.22	91.02	97.74	-	15.12	69.28	78.63	29.94	84.88	30.72	21.37	70.06

Note: B.Faso refers to Burkina Faso and I. Coast refers to the Ivory Coast. Values shown are percentages.

4. Kernel Densities

The kernel density plots of the wealth indices created are shown in Figures 1C to 12C. Benin and Senegal have distributions that are skewed to the right, meaning that there are fewer individuals that lie on the poorest portion of the distribution. Senegal's distribution is far more evenly spread however, with Benin having a high peak on the right side. Burkina Faso, the DRC, and Togo all have left-skewed distributions with Togo's being the most heavily skewed in any direction of all the countries. The left skew indicates that there are many people in the poorest part of the distribution for these countries. The Ivory Coast has the most evenly spread distribution, with the kernel density plot shaped like an inverted U. This means that the Ivory Coast has a (mostly) even amount of people along (most of) the wealth distribution. Note that the shape of these distributions can indicate the relative spread of wealth within countries but they are not appropriate for a comparison of wealth levels between countries – the fact that Benin has a right skew and Togo has a left skew does not mean that Benin has richer people than Togo.

Figure 1C. Kernel Density Estimate for Benin – Grade 2

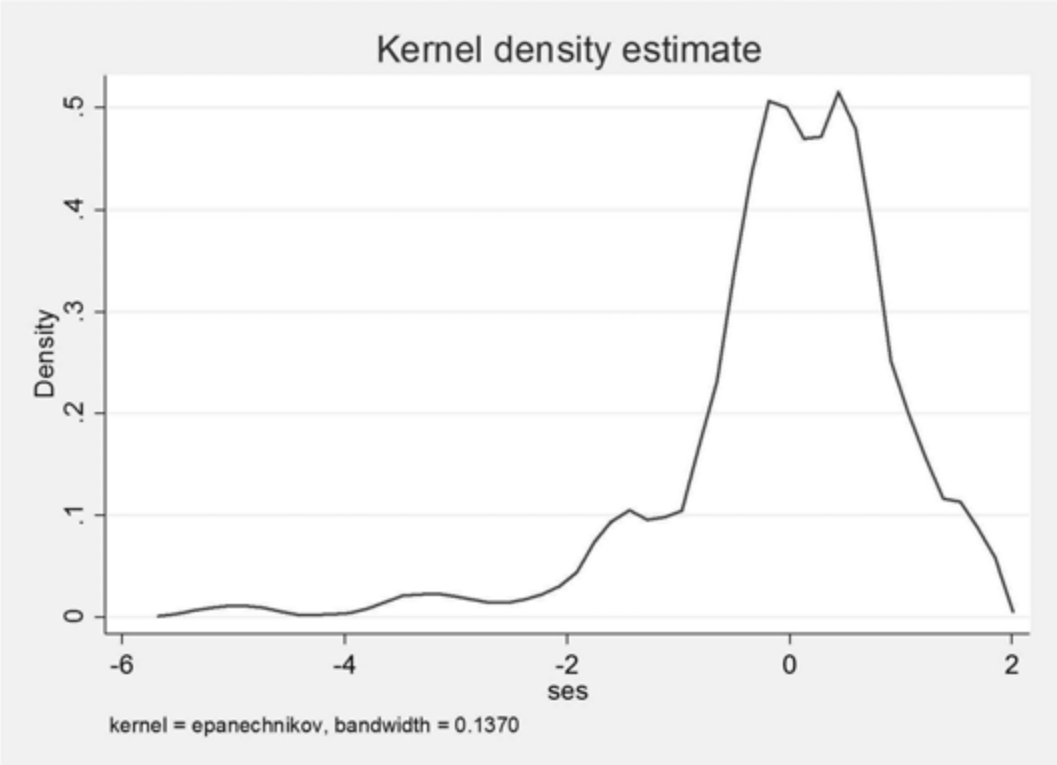


Figure 2C. Kernel Density Estimate for Benin – Grade 5

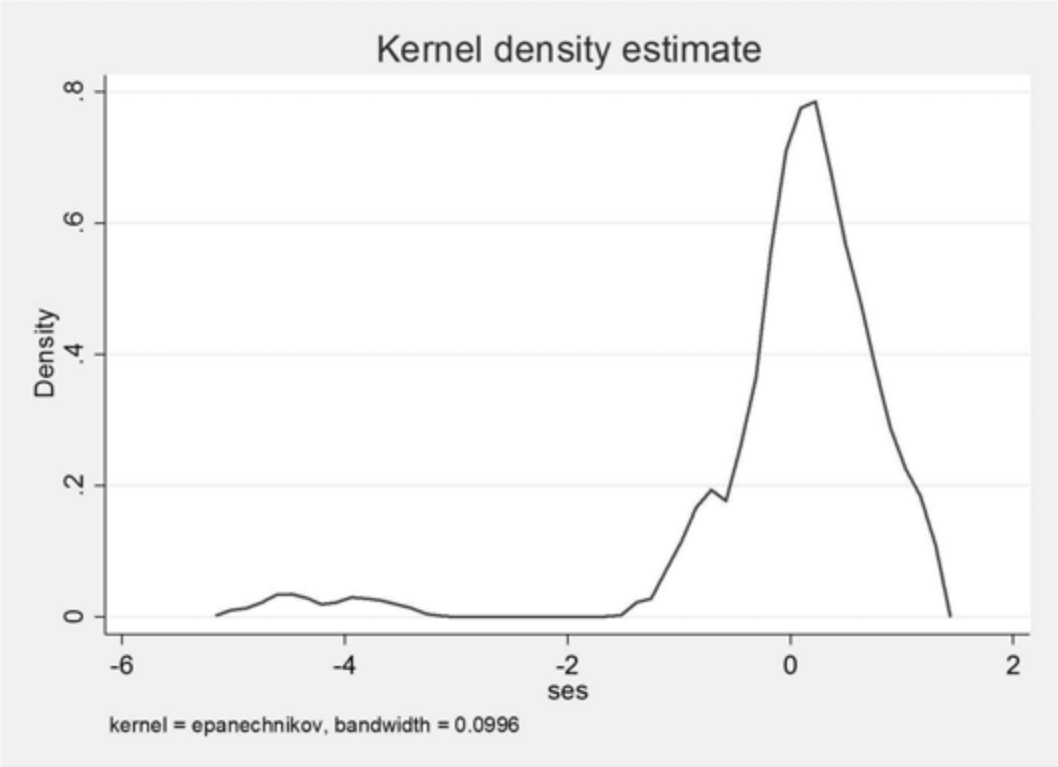


Figure 3C. Kernel Density Estimate for Burkina Faso – Grade2

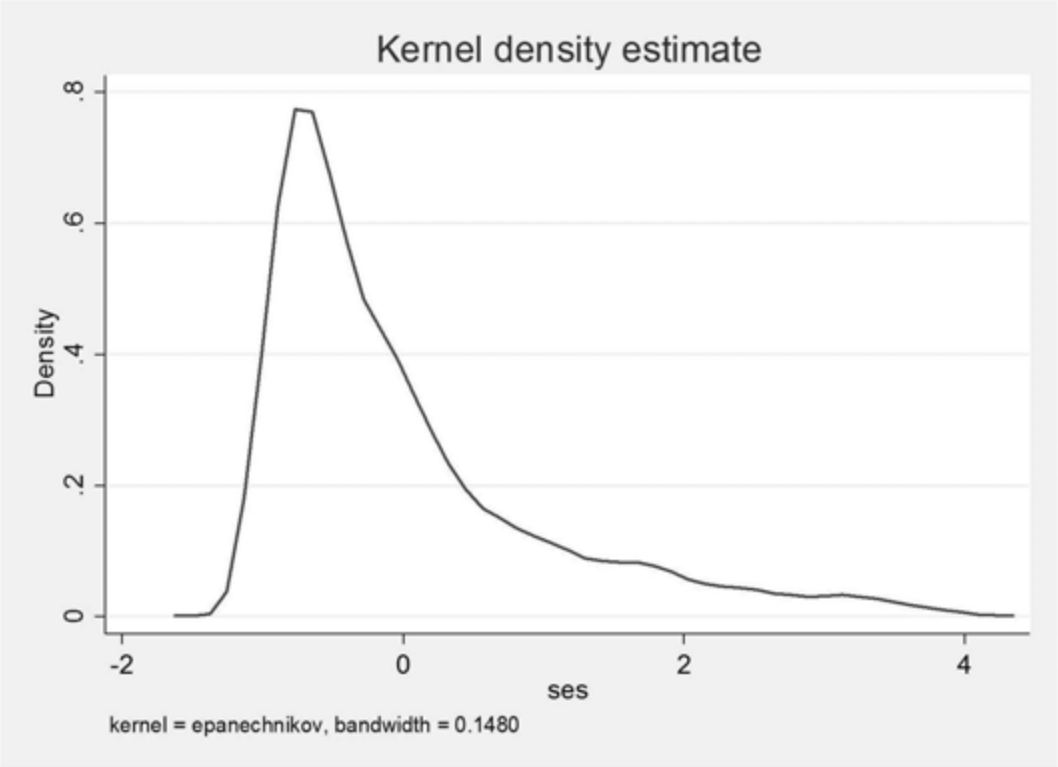


Figure 4C. Kernel Density Estimate for Burkina Faso – Grade5

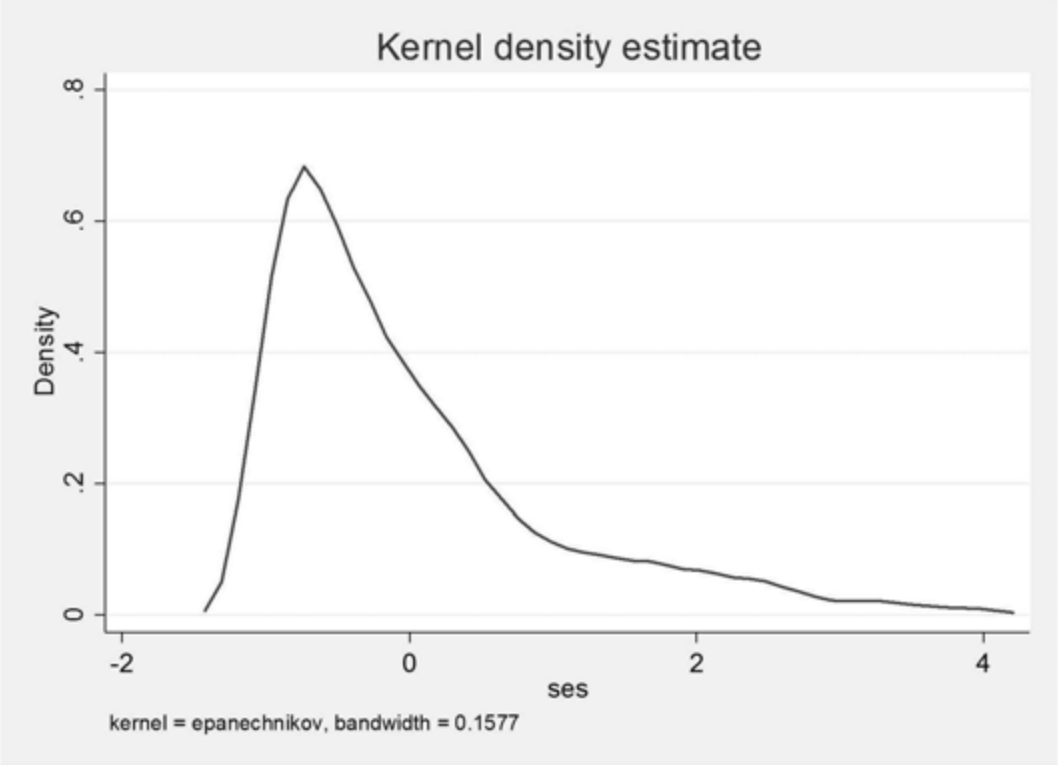


Figure 5C. Kernel Density Estimate for the DRC – Grade 2

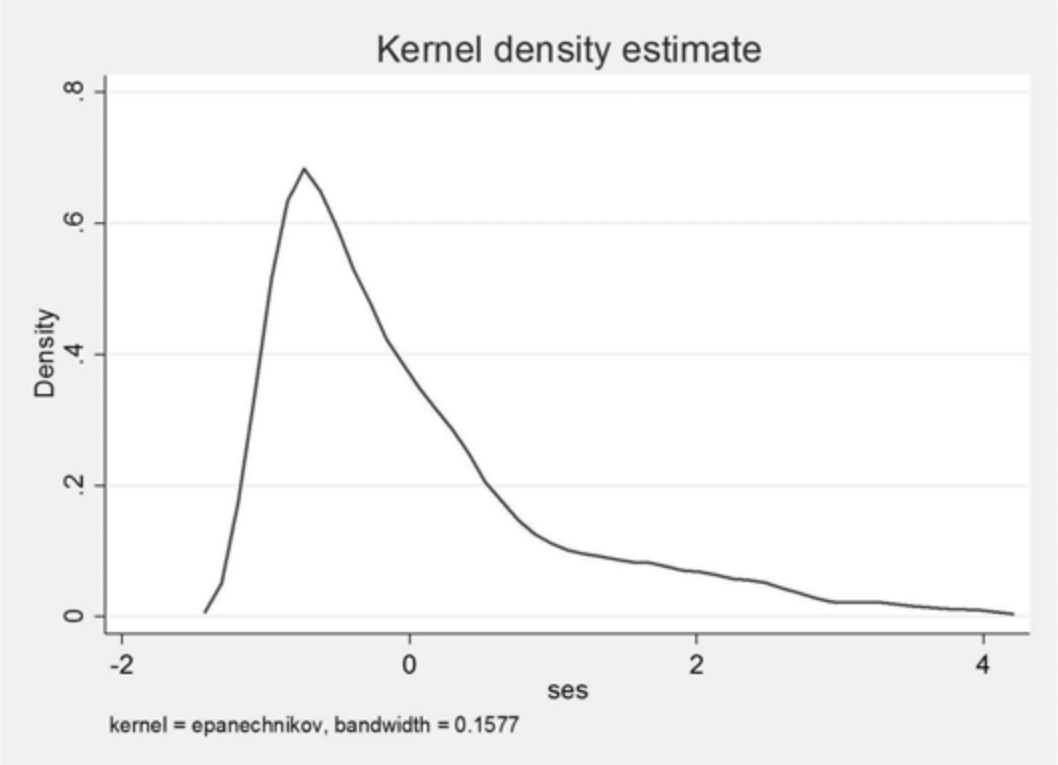


Figure 6C. Kernel Density Estimate for the DRC – Grade 5

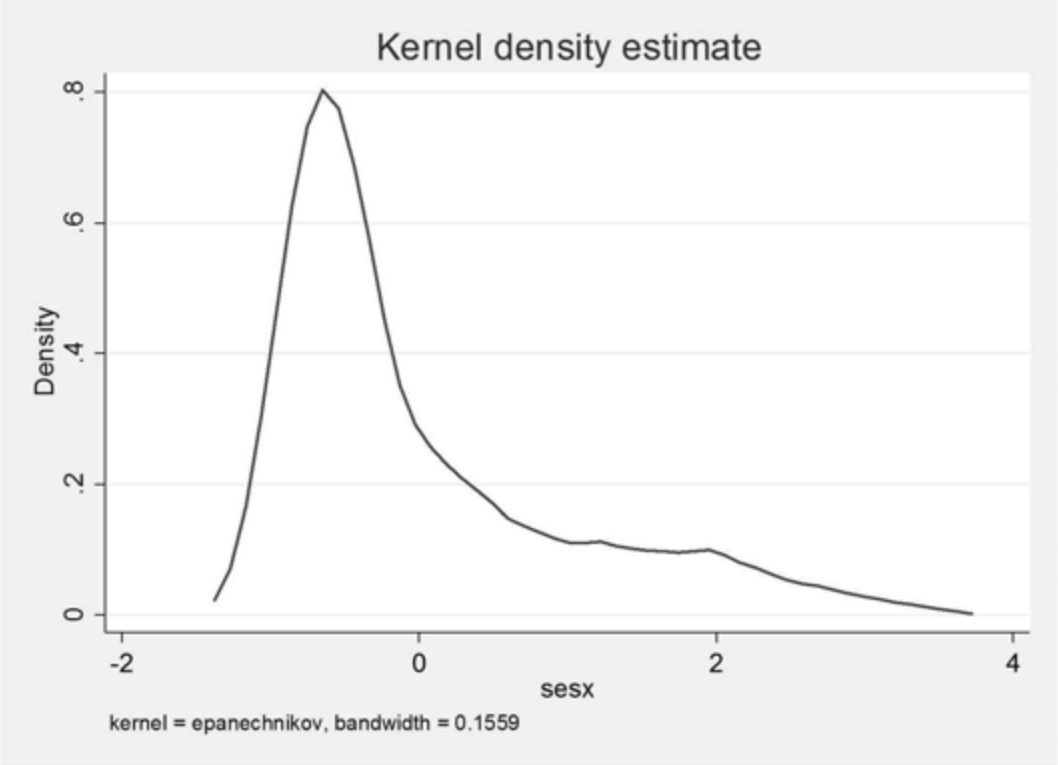


Figure 7C. Kernel Density Estimate for the Ivory Coast – Grade2

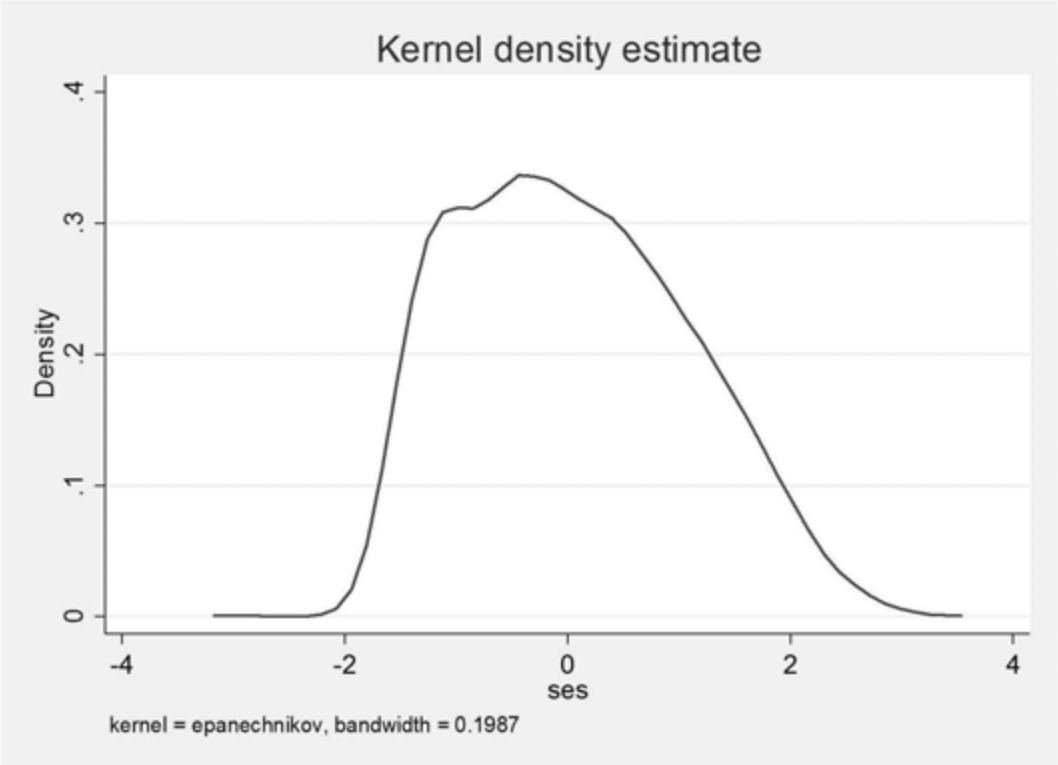


Figure 8C. Kernel Density Estimate for the Ivory Coast – Grade5

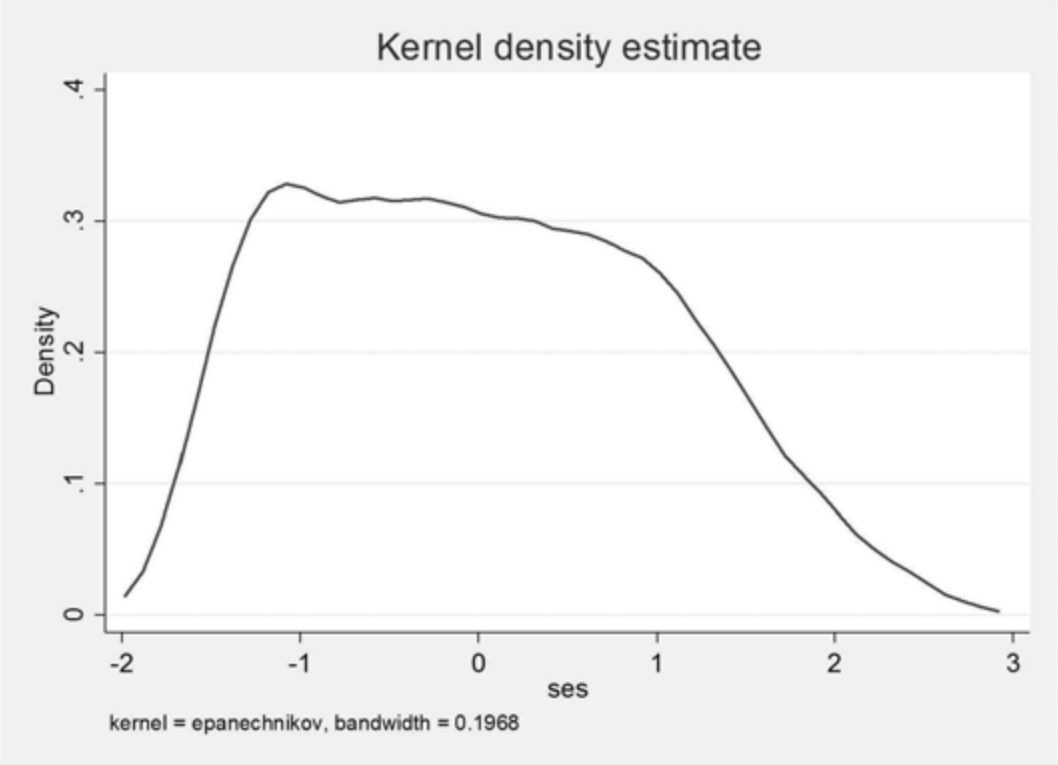


Figure 9C. Kernel Density Estimate for Senegal – Grade 2

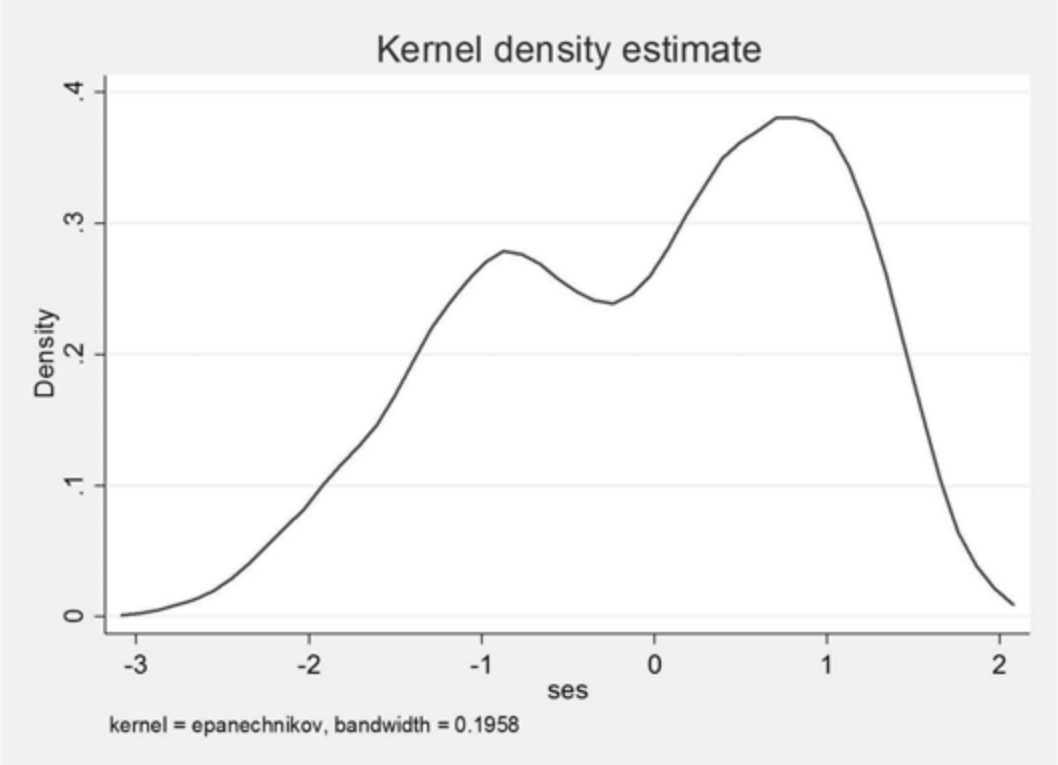


Figure 10C. Kernel Density Estimate for Senegal – Grade5

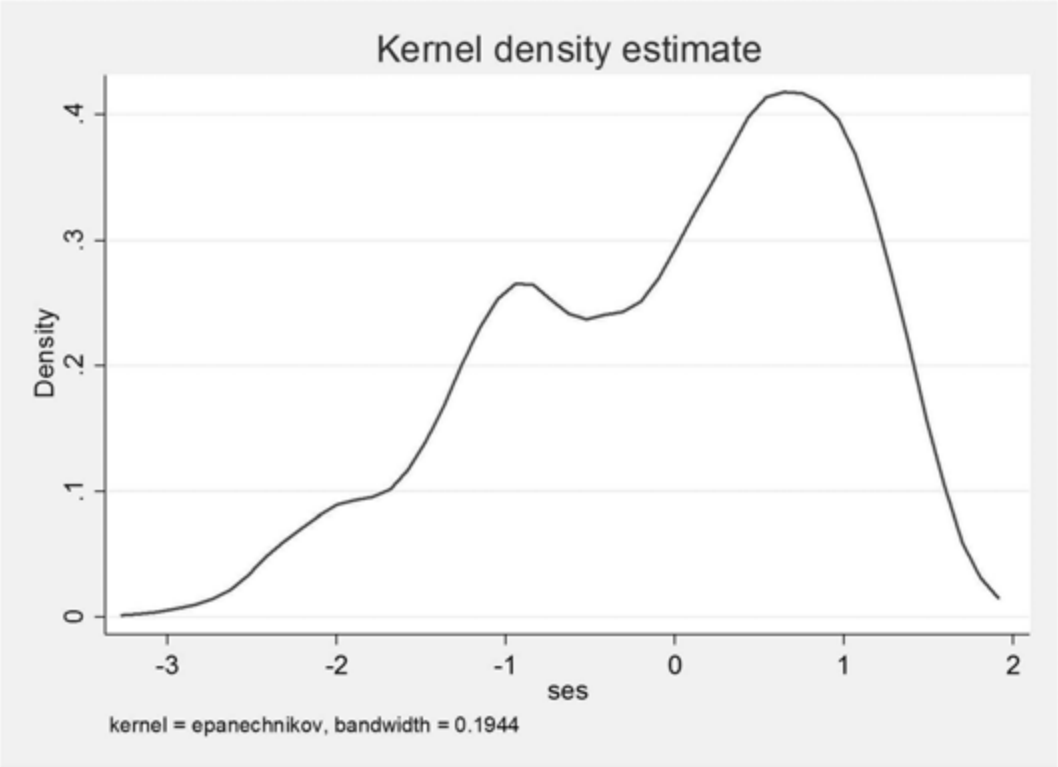


Figure 11C. Kernel Density Estimate for Togo – Grade 2

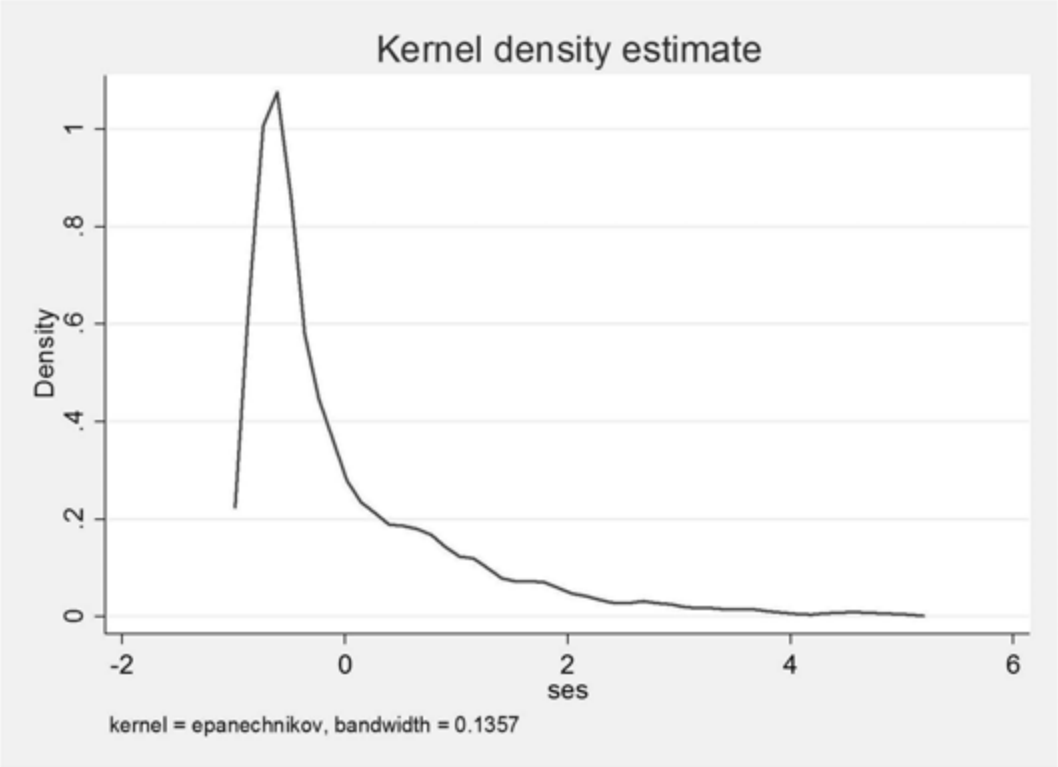
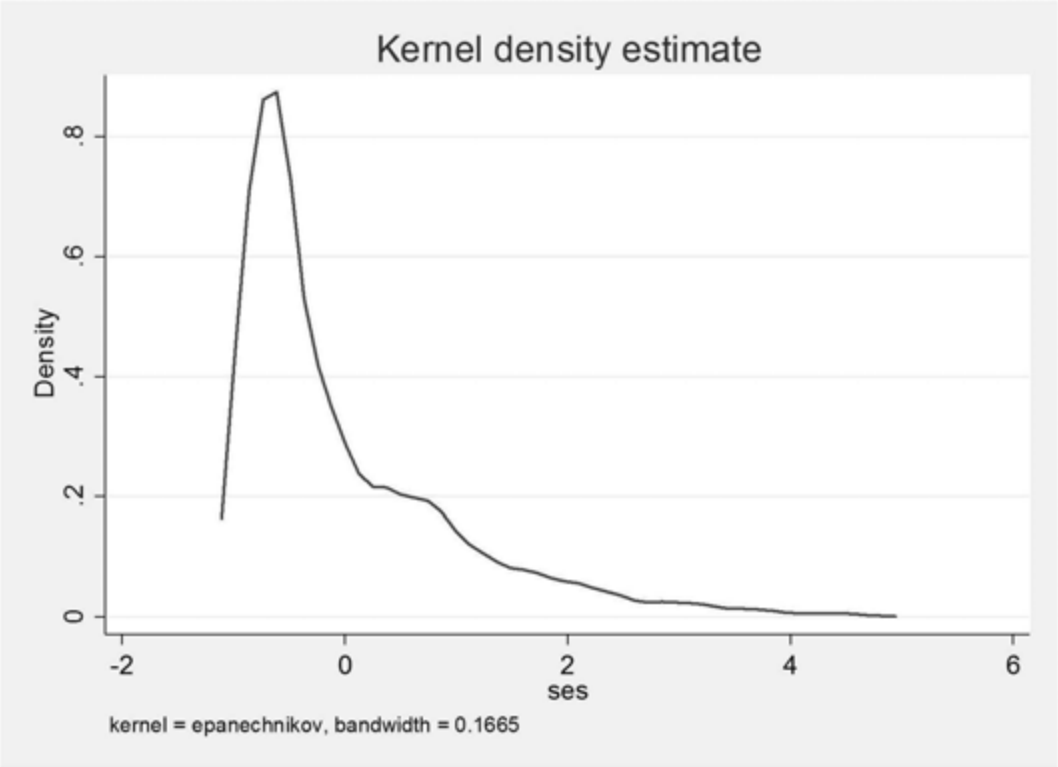


Figure 12C. Kernel Density Estimate for Togo – Grade 5



5. Checking the DHS Wealth Indices

Given the clear problems with the PASEC wealth index, in combination with the recent critique of the DHS wealth index by Wittenberg and Liebbrandt (2015), a similar exercise was conducted on the DHS wealth index (also on data from the DRC) to see whether it exhibited the same issues. Tables 7.1C and 7.2C display these results. The differences between the indicators are slight this time, and therefore the DHS wealth index (variable name: hv271) was used. This is an interesting result given what we already know about the DHS index from Wittenberg and Leibbrandt (2015). The reason for the strangely similar results may lie in the fact that incorrectly ranked individuals can still be grouped into the correct category. That is to say, although the DHS index ranks some individuals incorrectly, the ranking may not be wrong enough to meaningfully affect which wealth quintile individuals fall into.

Table 7.1C. Testing of DHS Wealth Index - Data from DHS, DRC

	Car		Electricity		Taps		Toilet	
Wealth quintile	DHS	New index	DHS	New index	DHS	New index	DHS	New index
Poorest 40%	0.00	0.00	0.06	0.00	0.00	0.00	77.57	71.50
Middle 40%	0.10	0.04	2.42	1.29	0.08	0.01	90.73	94.22
Richest 20%	9.64	8.14	70.81	61.05	5.44	4.66	98.61	98.35

Note: DHS refers to the wealth index available in the DHS data. New index refers to the index that was created for comparison to the DHS index. Values shown are percentages of individuals that have certain commodities.

Table 7.2C. of individuals that have certain commodities - Data from DHS, DRC

	Cart		Livestock		Bed	
Wealth quintile	DHS	New index	DHS	New index	DHS	New index
Poorest 40%	0.00	0.02	53.48	51.23	66.34	60.97
Middle 40%	0.13	0.11	61.23	60.59	87.32	88.67
Richest 20%	0.28	0.23	24.76	33.94	92.67	94.02

Note: DHS refers to the wealth index available in the DHS data. New index refers to the index that was created for comparison to the DHS index. Values shown are percentages of individuals that have certain commodities.

Appendix D Completion Rates from DHS Data

Table 1D. Demographic and Health Survey Grade 2 Completion Rate, with Standard Errors (%)

Country	National	SE	Males	SE	Females	SE	Poor40	SE	Mid40	SE	Rich20	SE
Benin	79.66	1.1	82.82	1.3	76.09	1.6	66.22	2.0	87.67	1.2	90.38	1.7
Burkina Faso	57.07	1.5	59.44	1.8	54.27	2.1	40.25	2.1	61.16	2.2	87.89	2.1
DRC	93.49	0.4	95.13	0.5	91.81	0.6	89.22	0.8	94.72	0.6	98.59	0.4
Ivory Coast	76.05	1.6	81.13	1.9	70.58	2.6	70.84	2.5	76.3	2.4	85.82	2.8
Senegal	64.21	2.9	62.03	3.6	66.25	3.4	54.12	4.3	67.2	4.7	92.61	2.6
Togo	90.27	1.1	92.32	1.3	88.01	1.8	84.46	1.8	94.91	1.3	95.97	1.8
	Poor40M	SE	Poor40F	SE	Mid40M	SE	Mid40F	SE	Rich20M	SE	Rich20F	SE
Benin	70.36	2.3	61.12	2.8	90.21	1.5	84.85	1.9	94.75	2.0	86.05	2.7
Burkina Faso	44.03	2.5	35.61	3.0	62.77	2.7	59.34	3.0	88.91	2.7	86.64	3.5
DRC	91.71	0.9	86.61	1.2	96.26	0.7	93.08	0.9	99.18	0.5	98.05	0.6
Ivory Coast	76.3	3.2	64.37	4.8	81.7	2.8	70.43	3.6	90.97	4.3	81.31	4.2
Senegal	52.68	4.6	55.61	5.2	65.09	5.7	69.07	5.7	92.25	4.3	92.9	3.2
Togo	88.22	2.1	79.7	3.2	95.48	1.8	94.38	2.0	97.98	2.0	93.76	3.1

Note: Poor40 refers to the poorest 40% of individuals in the country, Mid40 the middle 40%, and Rich20 the richest 20%. 'SE' is the standard error. An 'M' or 'F' after the wealth bracket refers to 'Males' or 'Females', respectively. Values shown are percentages.

Table 2D. Demographic and Health Survey Grade 5 Completion Rate, with Standard Errors (%)

Country	National	SE	Males	SE	Females	SE	Poor40	SE	Mid40	SE	Rich20	SE
Benin	68.64	1.4	71.43	1.8	65.24	2.0	51.73	2.4	74.53	2.0	81.52	2.4
Burkina Faso	40.97	1.8	41.97	2.2	39.9	2.3	24.48	2.2	37.68	2.6	71.44	3.1
DRC	98.08	0.6	89.69	0.9	74.6	1.4	67.78	1.9	84.52	1.1	96.06	0.8
Ivory Coast	59.04	2.2	67.24	3.0	51.57	3.2	42.34	4.7	56.38	3.0	79.27	3.7
Senegal	62.97	3.1	60.49	3.9	65.53	4.0	45.75	3.4	63.39	3.8	90.03	3.8
Togo	78.7	2.1	83.16	2.3	73.39	3.1	65.42	3.7	87.17	2.2	86.35	2.9
	Poor40M	SE	Poor40F	SE	Mid40M	SE	Mid40F	SE	Rich20M	SE	Rich20F	SE
Benin	58.54	3.0	41.48	3.5	74.62	2.7	74.4	2.8	88.3	2.8	75.8	3.7
Burkina Faso	24.39	2.5	24.61	3.4	42.38	3.3	31.68	3.2	84.27	3.6	64.19	4.1
DRC	81.9	1.9	57.35	2.3	91.66	1.1	77.51	1.6	96.68	0.9	95.57	1.1
Ivory Coast	53.54	5.9	30.43	6.2	63.51	4.6	50.82	4.3	86.11	4.2	72.63	5.5
Senegal	47.01	4.9	44.08	4.0	60.64	5.1	65.87	5.4	86.91	6.3	92.74	3.4
Togo	70.25	3.6	57.39	6.0	93	2.3	80.31	3.7	93.91	3.6	81.36	4.4

Note: Poor40 refers to the poorest 40% of individuals in the country, Mid40 the middle 40%, and Rich20 the richest 20%. 'SE' is the standard error. An 'M' or 'F' after the wealth bracket refers to 'Males' or 'Females', respectively. Values shown are percentages.

Appendix E Achievement on PASEC Tests

Table 1E. Percentile Scores of PASEC Tests - Language, Grade 2

Country	5	10	25	50	75	90	95
Benin[a b]	2.5	7.5	17.5	27.5	50.0	75.0	85.0
Burkina Faso[a]	7.5	12.5	20.0	37.5	60.0	75.0	85.0
DRC[a]	15.0	22.5	37.5	55.0	72.5	85.0	90.0
Ivory Coast[a]	5.0	10.0	17.5	32.5	52.5	75.0	82.5
Senegal[a]	7.5	12.5	25.0	42.5	67.5	82.5	90.0
Togo	5.3	7.9	15.8	28.9	47.4	68.4	78.9

Note: [a]Test scores have been rounded to the nearest five in the microdata from PASEC. [b]Estimates were run on the unweighted sample. Scores displayed refer to the percent correctly answered.

Table 2E. Percentile Scores of PASEC Tests - Mathematics, Grade 2

Country	5	10	25	50	75	90	95
Benin[a]	0.0	5.1	12.8	28.2	53.9	74.4	84.6
Burkina Faso	5.1	7.7	18.0	33.3	51.3	66.7	71.8
DRC	10.3	18.0	35.9	53.9	71.8	84.6	92.3
Ivory Coast	2.6	5.1	10.3	23.1	38.5	56.4	66.7
Senegal	7.7	15.4	23.1	46.2	69.2	82.1	89.7
Togo	2.6	7.7	18.0	35.9	59.0	74.4	82.1

Note: Scores displayed refer to the percent correctly answered. [a]Estimates were run on the unweighted sample.

Table 3E. Percentile Scores of PASEC Tests - Language, Grade 5

Country	5	10	25	50	75	90	95
Benin[a]	7.1	9.5	16.7	26.2	35.7	50.0	64.3
Burkina Faso	11.9	16.7	21.4	31.0	45.2	57.1	66.7
DRC	9.5	14.3	23.8	35.7	54.8	69.0	76.2
Ivory Coast	9.5	14.3	19.1	28.6	42.9	54.8	64.3
Senegal	3.2	18.4	23.7	36.8	50.0	65.8	73.7
Togo	9.5	11.9	19.0	26.2	38.1	52.4	59.5

Note: Scores displayed refer to the percent correctly answered. [a]Estimates were run on the unweighted sample.

Table 4E. Percentile Scores of PASEC Tests - Mathematics, Grade 5

Country	5	10	25	50	75	90	95
Benin[b]	7.3	12.2	22.0	31.7	41.5	53.7	63.4
Burkina Faso	11.4	17.1	25.7	37.1	48.6	62.9	71.4
DRC	17.0	22.0	31.7	43.9	58.5	73.2	78.0
Ivory Coast[a]	7.5	12.5	20.0	27.5	35.0	42.5	47.5
Senegal	16.2	21.6	29.7	43.2	56.8	67.6	73.0
Togo	9.8	14.6	24.4	34.1	43.9	53.7	58.5

Note: [a]Test scores have been rounded to the nearest five in the microdata from PASEC. [b]Estimates were run on the unweighted sample. Scores displayed refer to the percent correctly answered.

Figure 1E. Description of PASEC Learning Benchmarks

EPDC learning level corresponding to benchmark	Benchmark name (score range)	Description of ability level associated with benchmark
Students performing below the lowest learning benchmark	Level 1 (0-24% of responses correct)	A score in this range could be obtained by random answers on the assessment. Students at this level are considered to be failing scholastically.
Students performing at or above the lowest learning benchmark	Level 2 (25-40% of responses correct)	Students at this level are not considered to be failing scholastically, but also did not reach the minimum performance threshold of 40% seen by PASEC as defining the possession of knowledge (reading, writing and counting).
Students performing at or above the lowest learning benchmark	Level 3 (more than 40% of responses correct)	Students at this level are considered to have exceeded the minimum performance threshold of 40% seen by PASEC as defining the possession of basic knowledge (reading, writing and counting).
Students performing at the highest learning benchmark		

Note: Figure reproduced from Education Policy and Data Center (2012b).

Table 5E. Proportions of Students Reaching Different PASEC Levels - Language, Grade 2

Country	Level 1	Level 2	Level 3	Total
Benin[a]	40.65	26.92	32.43	100
Burkina Faso	33.55	24.67	41.78	100
DRC	10.16	19.23	70.62	100
Ivory Coast	34.73	25.61	39.66	100
Senegal	26.74	23.41	49.85	100
Togo	43.34	22.93	33.73	100

Note: Figures shown are percentages of students reaching each performance level. For a description of what each level means see Figure 1C. [a]Estimates were run on the unweighted sample.

Table 6E. Proportions of Students Reaching Different PASEC Levels - Mathematics, Grade 2

Country	Level 1	Level 2	Level 3	Total
Benin[a]	44.11	17.36	38.53	100
Burkina Faso	38.79	23.80	37.41	100
DRC	12.93	15.36	71.72	100
Ivory Coast	52.30	21.15	26.55	100
Senegal	23.36	19.15	57.49	100
Togo	35.91	17.80	46.29	100

Note: Figures shown are percentages of students reaching each performance level. For a description of what each level means see Figure 1C. [a]Estimates were run on the unweighted sample.

Table 7E. Proportions of Students Reaching Different PASEC Levels - Language, Grade 5

Country	Level 1	Level 2	Level 3	Total
Benin[a]	49.20	30.55	20.24	100
Burkina Faso	34.61	33.42	31.97	100
DRC	28.44	26.87	44.69	100
Ivory Coast	37.09	30.63	32.28	100
Senegal	27.10	35.67	37.23	100
Togo	46.93	31.28	21.80	100

Note: Figures shown are percentages of students reaching each performance level. For a description of what each level means see Figure 1C.
[a]Estimates were run on the unweighted sample.

Table 8E. Proportions of Students Reaching Different PASEC Levels - Mathematics, Grade 5

Country	Level 1	Level 2	Level 3	Total
Benin[a]	37.85	34.50	27.65	100
Burkina Faso	25.79	36.67	37.54	100
DRC	15.13	28.67	56.21	100
Ivory Coast	38.69	47.18	14.13	100
Senegal	17.07	25.56	57.37	100
Togo	29.56	38.84	31.59	100

Note: Figures shown are percentages of students reaching each performance level. For a description of what each level means see Figure 1C.

[a]Estimates were run on the unweighted sample.

Table 9E. PASEC Grade 2 Literacy Rate, with Standard Errors (%) – Uncorrected For Those Who Do Not Complete Grade 2

Country	National	SE	Males	SE	Females	SE	Poor40	SE	Mid40	SE	Rich20	SE
Benin[a]	34.96	-	36.22	-	33.51	-	30.9	-	33.78	-	43.42	-
Burkina Faso	44.42	2.8	45.43	2.9	43.12	3.3	38.28	3.9	42.11	4.4	53.49	3.4
DRC	73.77	2.6	74.43	2.8	73.04	2.8	74.19	3.8	72.32	3.0	75.83	4.4
Ivory Coast	42.38	2.5	39.44	2.4	45.19	3.5	28.35	2.6	43.7	3.0	66.05	4.6
Senegal	53.44	2.9	51.71	3.2	55.14	3.3	39.44	5.9	50.14	3.0	74.71	3.3
Togo	33.39	1.5	33.25	1.6	33.55	2.1	22.98	2.0	31.84	2.1	53.92	3.4
	Poor40M	SE	Poor40F	SE	Mid40M	SE	Mid40F	SE	Rich20M	SE	Rich20F	SE
Benin[a]	26.36	-	30.9	-	32.28	-	33.78	-	46.78	-	43.42	-
Burkina Faso	39.25	4.2	36.47	4.7	45.03	4.4	37.72	5.5	52.41	3.9	56.16	4.0
DRC	76.34	4.1	69.64	4.1	72.48	3.7	72.13	3.6	74.71	4.1	80.75	4.5
Ivory Coast	32.55	2.8	23.32	3.1	38.3	3.2	47.99	3.7	52.52	4.8	72.59	5.5
Senegal	34.75	6.9	42.53	6.5	48.16	4.1	52.93	3.8	75.84	3.7	73.55	4.0
Togo	25.06	2.4	20.57	2.8	30.15	2.2	32.54	2.7	52.63	3.8	55.97	4.2

Note: Poor40 refers to the poorest 40% of individuals in the country, Mid40 the middle 40%, and Rich20 the richest 20%. 'SE' is the standard error. An 'M' or 'F' after the wealth bracket refers to 'Males' or 'Females', respectively. Values shown are percentages. [a]Estimates were run on the unweighted sample.

Table 10E. PASEC Grade 2 Numeracy Rate, with Standard Errors (%) – Uncorrected For Those Who Do Not Complete Grade 2

Country	National	SE	Males	SE	Females	SE	Poor40	SE	Mid40	SE	Rich20	SE
Benin[a]	38.53	-	39.89	-	36.86	-	32.29	-	39.39	-	46.32	-
Burkina Faso	37.41	2.5	40.11	2.8	33.95	2.7	33.38	3.0	33.3	3.2	47	4.0
DRC	71.72	2.4	72.14	2.8	71.17	2.7	67.75	3.7	70.51	3.0	81.21	3.5
Ivory Coast	26.55	2.2	26.58	2.2	26.52	3.3	18.33	1.8	26.38	2.4	42.37	5.8
Senegal	57.49	3.0	56.38	3.6	58.59	3.0	44.43	5.5	56.12	3.4	74.79	3.0
Togo	46.35	1.6	49.75	1.9	42.65	2.0	37.14	2.6	45.26	1.9	63.98	3.0
	Poor40M	SE	Poor40F	SE	Mid40M	SE	Mid40F	SE	Rich20M	SE	Rich20F	SE
Benin[a]	34.7	-	27.13	-	42.14	-	37.18	-	43.48	-	50.88	-
Burkina Faso	35.06	3.5	30.81	3.7	37.44	3.5	44.69	4.0	49.07	5.0	44.69	4.0
DRC	71.47	4.1	63.12	4.1	70.01	3.6	71.75	3.7	77.55	4.2	84.22	3.3
Ivory Coast	22.2	2.4	13.06	2.0	23.77	2.8	44.47	7.7	38.57	4.8	44.47	7.7
Senegal	42.37	7.0	46.38	5.6	52.87	4.5	73.73	3.8	77.14	3.2	73.73	3.8
Togo	41.46	2.9	32.29	3.4	48.2	2.5	62.55	3.8	66.54	3.5	62.55	3.8

Note: Poor40 refers to the poorest 40% of individuals in the country, Mid40 the middle 40%, and Rich20 the richest 20%. 'SE' is the standard error. An 'M' or 'F' after the wealth bracket refers to 'Males' or 'Females', respectively. Values shown are percentages. [a]Estimates were run on the unweighted sample.

Table 11E. PASEC Grade 5 Literacy Rate, with Standard Errors (%)– Uncorrected For Those Who Do Not Complete Grade 5

Country	National	SE	Males	SE	Females	SE	Poor40	SE	Mid40	SE	Rich20	SE
Benin[a]	20.24	-	21.44	-	18.46	-	11.57	-	22.41	-	27.78	-
Burkina Faso	31.97	2.4	34.02	2.7	29.31	2.7	23.48	2.9	27.12	2.9	42.63	3.7
DRC	44.69	3.2	47.54	3.6	41.22	3.4	44.45	4.3	43.6	3.9	46.93	6.0
Ivory Coast	32.28	2.4	30.69	2.4	34.16	3.2	15.17	2.5	30.5	2.7	54.55	3.9
Senegal	37.23	2.6	38.43	2.8	35.88	3.1	18.81	4.2	34.27	2.9	59.92	3.3
Togo	22.95	1.6	23.35	1.8	22.41	2.0	8.65	1.4	19.76	2.0	50.19	3.2
	Poor40M	SE	Poor40F	SE	Mid40M	SE	Mid40F	SE	Rich20M	SE	Rich20F	SE
Benin[a]	14.82	-	5.94	-	22.83	-	22.61	-	28.3	-	24.58	-
Burkina Faso	24.35	3.8	19.19	3.2	29.22	3.4	25.87	3.8	44.21	4.0	40.26	4.0
DRC	47.4	4.7	40.72	4.7	45.34	4.8	42.15	4.2	51.87	6.4	40.31	6.4
Ivory Coast	16.74	2.9	13.65	3.2	28.97	2.8	30.82	3.8	50.83	4.0	55.6	4.7
Senegal	21.04	4.4	16.05	5.0	37.07	3.2	32.67	3.5	58.29	4.6	59.91	5.1
Togo	9.46	1.8	5.63	1.5	18.33	2.1	20.96	2.6	53.33	4.0	47.88	3.9

Note: Poor40 refers to the poorest 40% of individuals in the country, Mid40 the middle 40%, and Rich20 the richest 20%. 'SE' is the standard error. An 'M' or 'F' after the wealth bracket refers to 'Males' or 'Females', respectively. Values shown are percentages. [a]Estimates were run on the unweighted sample.

Table 12E. PASEC Grade 5 Numeracy Rate, with Standard Errors (%)– Uncorrected For Those Who Do Not Complete Grade 5

Country	National	SE	Males	SE	Females	SE	Poor40	SE	Mid40	SE	Rich20	SE
Benin[a]	27.65	-	30.38	-	23.55	-	20.73	-	30.54	-	31.48	-
Burkina Faso	42.65	2.7	45.69	2.9	38.7	3.0	39.2	3.7	38.28	3.9	49.48	3.7
DRC	56.21	3.1	57.08	3.3	55.16	3.6	57.11	4.3	56.23	3.9	54.89	5.4
Ivory Coast	17.96	1.7	19.25	1.9	16.43	1.9	10.21	2.0	17.21	1.9	27.94	3.6
Senegal	57.37	3.1	60.37	3.9	54.01	3.1	41	3.5	54.8	3.2	77.47	5.0
Togo	57.37	3.1	60.37	3.9	54.01	3.1	41	3.5	54.8	3.2	77.47	5.0
	Poor40M	SE	Poor40F	SE	Mid40M	SE	Mid40F	SE	Rich20M	SE	Rich20F	SE
Benin[a]	23.99	-	15.35	-	33.48	-	26.38	-	33.96	-	27.37	-
Burkina Faso	42.81	4.5	32.54	4.9	41.47	4.3	34.92	4.4	51.56	4.4	47	3.9
DRC	58.83	4.7	55.61	5.0	56.33	4.2	56.11	4.6	55.52	5.8	53.08	6.3
Ivory Coast	13.09	2.5	6.59	1.9	16.88	2.3	16.47	2.4	30.57	4.0	24.46	3.9
Senegal	42.22	4.1	39.78	5.0	59.73	2.8	49.63	4.4	80.04	6.4	47	4.5
Togo	21.62	2.6	19.06	3.0	33.1	2.9	26.2	2.7	55.33	4.1	49.58	4.6

Note: Poor40 refers to the poorest 40% of individuals in the country, Mid40 the middle 40%, and Rich20 the richest 20%. 'SE' is the standard error. An 'M' or 'F' after the wealth bracket refers to 'Males' or 'Females', respectively. Values shown are percentages. [a]Estimates were run on the unweighted sample.

Appendix F Access to Literacy and Access to Numeracy Rates

Table 1F. PASEC Grade 2 Access to Literacy, with Standard Errors (%)

Country	National	SE	Males	SE	Females	SE	Poor40	SE	Mid40	SE	Rich20	SE
Benin[a]	27.85	-	30.00	-	25.50	-	20.46	-	29.61	-	39.24	-
Burkina Faso	25.35	3.2	27.00	3.4	23.40	3.9	15.41	4.5	25.75	4.9	47.01	4.0
DRC	68.97	2.6	70.81	2.9	67.06	2.8	66.19	3.9	68.50	3.1	74.76	4.4
Ivory Coast	32.23	3.0	32.00	3.0	31.90	4.3	20.08	3.6	33.34	3.8	56.68	5.3
Senegal	34.31	4.1	32.08	4.8	36.53	4.7	21.34	7.3	33.69	5.6	69.19	4.2
Togo	30.14	1.8	30.70	2.1	29.53	2.7	19.41	2.7	30.22	2.4	51.75	3.9
	Poor40M	SE	Poor40F	SE	Mid40M	SE	Mid40F	SE	Rich20M	SE	Rich20F	SE
Benin[a]	11.61	-	11.00	-	20.26	-	20.05	-	41.59	-	37.62	-
Burkina Faso	17.28	4.9	12.99	5.5	28.27	5.2	22.38	6.2	46.60	4.7	48.66	5.4
DRC	70.01	4.2	60.32	4.2	69.77	3.7	67.14	3.7	74.10	4.2	79.18	4.5
Ivory Coast	24.84	4.2	15.01	5.7	31.29	4.2	33.80	5.2	47.78	6.4	59.02	6.9
Senegal	18.31	8.3	23.65	8.3	31.35	7.1	36.56	6.9	69.96	5.7	68.33	5.1
Togo	22.11	3.2	16.39	4.2	28.79	2.8	30.71	3.3	51.57	4.2	52.48	5.2

Note: Poor40 refers to the poorest 40% of individuals in the country, Mid40 the middle 40%, and Rich20 the richest 20%. 'SE' is the standard error. An 'M' or 'F' after the wealth bracket refers to 'Males' or 'Females', respectively. Values shown are percentages. [a]Estimates of literacy rates were run on the unweighted sample.

Table 2F. PASEC Grade 2 Access to Numeracy, with Standard Errors (%)

Country	National	SE	Males	SE	Females	SE	Poor40	SE	Mid40	SE	Rich20	SE
Benin[a]	30.69	-	33.04	-	28.05	-	21.38	-	34.53	-	41.86	-
Burkina Faso	21.35	2.9	23.84	3.3	18.42	3.4	13.44	3.7	20.37	3.9	41.31	4.5
DRC	67.05	2.5	68.63	2.8	65.34	2.8	60.45	3.8	66.79	3.1	80.06	3.5
Ivory Coast	20.19	2.7	21.56	2.9	18.72	4.2	12.98	3.1	20.13	3.4	36.36	6.4
Senegal	36.91	4.2	34.97	5.0	38.82	4.5	24.05	7.0	37.71	5.8	69.26	4.0
Togo	41.84	1.9	45.93	2.3	37.54	2.6	31.37	3.1	42.96	2.3	61.40	3.5
	Poor40M	SE	Poor40F	SE	Mid40M	SE	Mid40F	SE	Rich20M	SE	Rich20F	SE
Benin[a]	24.41	-	16.58	-	38.01	-	31.55	-	41.20	-	43.78	-
Burkina Faso	15.44	4.3	10.97	4.8	23.50	4.4	26.52	5.0	43.63	5.7	38.72	5.4
DRC	65.55	4.2	54.67	4.3	67.39	3.6	66.78	3.8	76.91	4.2	82.58	3.4
Ivory Coast	16.94	4.0	8.41	5.2	19.42	3.9	31.32	8.5	35.09	6.4	36.16	8.8
Senegal	22.32	8.4	25.79	7.6	34.41	7.3	50.93	6.9	71.16	5.4	68.50	5.0
Togo	36.58	3.6	25.74	4.6	46.02	3.0	59.03	4.2	65.20	4.0	58.65	4.9

Note: Poor40 refers to the poorest 40% of individuals in the country, Mid40 the middle 40%, and Rich20 the richest 20%. 'SE' is the standard error. An 'M' or 'F' after the wealth bracket refers to 'Males' or 'Females', respectively. Values shown are percentages. [a]Estimates of numeracy rates were run on the unweighted sample.

Table 3F. PASEC Grade 5 Access to Literacy, with Standard Errors (%)

Country	National	SE	Males	SE	Females	SE	Poor40	SE	Mid40	SE	Rich20	SE
Benin[a]	13.89	-	15.31	-	12.04	-	5.99	-	16.70	-	22.65	-
Burkina Faso	13.10	3.0	14.28	3.4	11.69	3.5	5.75	3.6	10.22	3.9	30.45	4.8
DRC	43.83	3.2	42.64	3.7	30.75	3.6	30.13	4.7	36.85	4.1	45.08	6.0
Ivory Coast	19.06	3.3	20.64	3.9	17.62	4.6	6.42	5.3	17.20	4.0	43.24	5.3
Senegal	23.44	4.1	23.25	4.7	23.51	5.0	8.61	5.4	21.72	4.8	53.95	5.0
Togo	18.06	2.7	19.42	2.9	16.45	3.6	5.66	4.0	17.22	2.9	43.34	4.3
	Poor40M	SE	Poor40F	SE	Mid40M	SE	Mid40F	SE	Rich20M	SE	Rich20F	SE
Benin[a]	8.68	-	2.46	-	17.04	-	16.82	-	24.99	-	18.63	-
Burkina Faso	5.94	4.5	4.72	4.6	12.38	4.7	8.20	5.0	37.26	5.4	25.84	5.7
DRC	38.82	5.1	23.35	5.2	41.56	4.9	32.67	4.5	50.15	6.5	38.52	6.5
Ivory Coast	8.96	6.6	4.15	7.0	18.40	5.4	15.66	5.7	43.77	5.8	40.38	7.2
Senegal	9.89	6.5	7.07	6.4	22.48	6.0	21.52	6.5	50.66	7.7	55.56	6.1
Togo	6.65	4.0	3.23	6.2	17.05	3.1	16.83	4.5	50.08	5.4	38.96	5.9

Note: Poor40 refers to the poorest 40% of individuals in the country, Mid40 the middle 40%, and Rich20 the richest 20%. 'SE' is the standard error. An 'M' or 'F' after the wealth bracket refers to 'Males' or 'Females', respectively. Values shown are percentages. [a]Estimates of literacy rates were run on the unweighted sample.

Table 4F. PASEC Grade 5 Access to Numeracy, with Standard Errors (%)

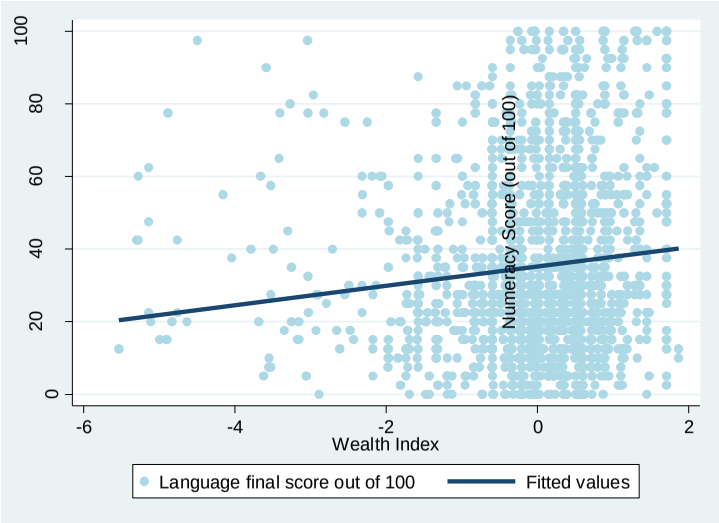
Country	National	SE	Males	SE	Females	SE	Poor40	SE	Mid40	SE	Rich20	SE
Benin[a]	18.98	-	21.70	-	15.36	-	10.72	-	22.76	-	25.66	-
Burkina Faso	17.47	3.2	19.18	3.7	15.44	3.8	9.60	4.3	14.42	4.7	35.35	4.8
DRC	55.13	3.2	51.20	3.4	41.15	3.9	38.71	4.7	47.53	4.1	52.73	5.5
Ivory Coast	10.60	2.8	12.94	3.6	8.47	3.8	4.32	5.1	9.70	3.5	22.15	5.1
Senegal	36.13	4.4	36.52	5.4	35.39	5.1	18.76	4.8	34.74	5.0	69.75	6.3
Togo	45.15	3.8	50.20	4.5	39.64	4.4	26.82	5.1	47.77	3.9	66.90	5.7
	Poor40M	SE	Poor40F	SE	Mid40M	SE	Mid40F	SE	Rich20M	SE	Rich20F	SE
Benin[a]	14.04	-	6.37	-	24.98	-	19.63	-	29.99	-	20.75	-
Burkina Faso	10.44	5.1	8.01	5.9	17.57	5.4	11.06	5.4	43.45	5.7	30.17	5.7
DRC	48.18	5.1	31.89	5.5	51.63	4.3	43.49	4.9	53.68	5.8	50.73	6.4
Ivory Coast	7.01	6.4	2.01	6.5	10.72	5.2	8.37	4.9	26.32	5.8	17.77	6.7
Senegal	19.85	6.4	17.54	6.4	36.22	5.8	32.69	7.0	69.56	8.9	43.59	5.6
Togo	15.19	4.5	10.94	6.8	30.78	3.7	21.04	4.6	51.96	5.5	40.34	6.4

Note: Poor40 refers to the poorest 40% of individuals in the country, Mid40 the middle 40%, and Rich20 the richest 20%. 'SE' is the standard error. An 'M' or 'F' after the wealth bracket refers to 'Males' or 'Females', respectively. Values shown are percentages. [a]Estimates of numeracy rates were run on the unweighted sample.

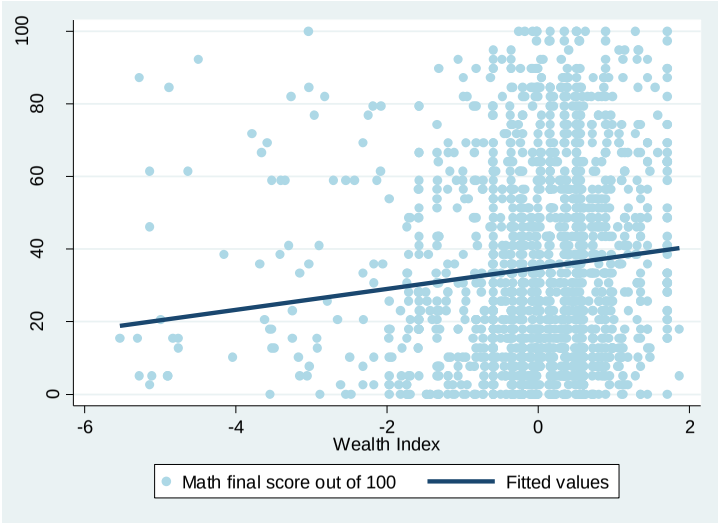
Appendix G SES Gradients Showing Socioeconomic Inequalities in Education Quality

Figure 1G. SES Gradients – Benin

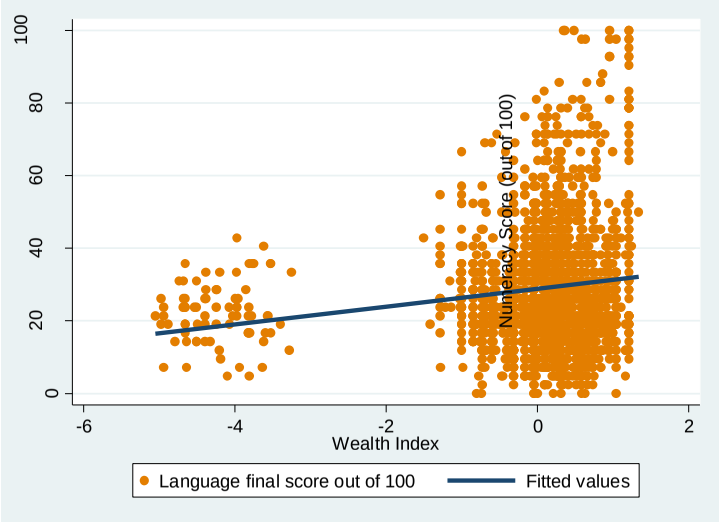
Grade 2 – Literacy



Grade 2 – Numeracy



Grade 2 – Literacy



Grade 2 – Numeracy

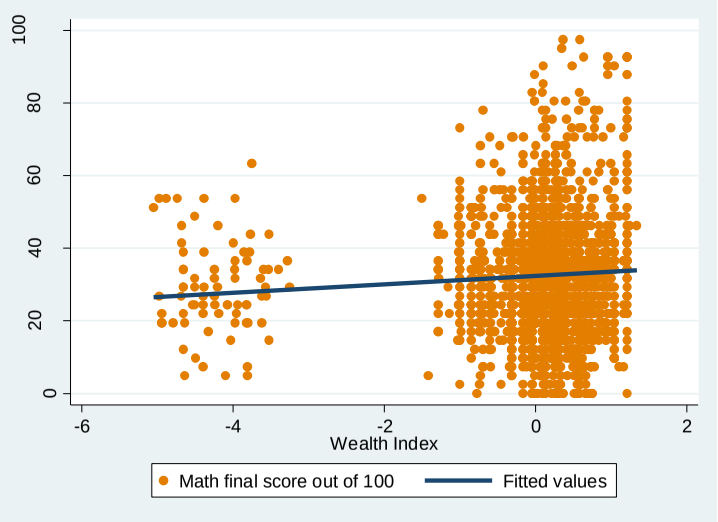
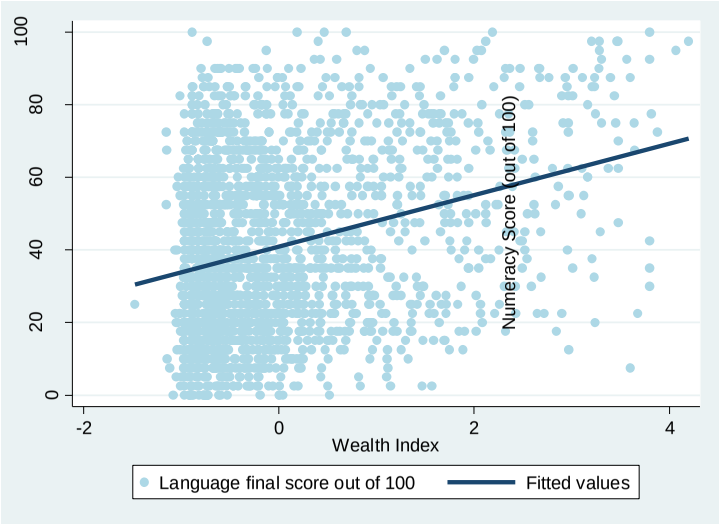


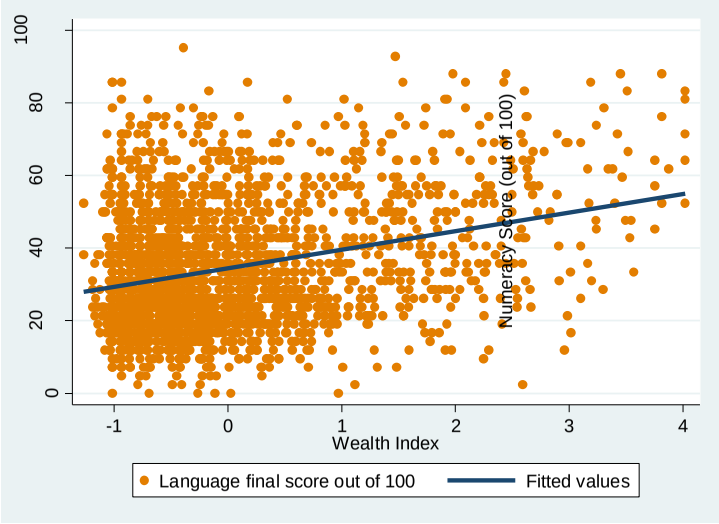
Figure 2G. SES Gradients – Burkina Faso

Grade 2 – Literacy



Grade 2 – Numeracy

Grade 2 – Literacy



Grade 2 – Numeracy

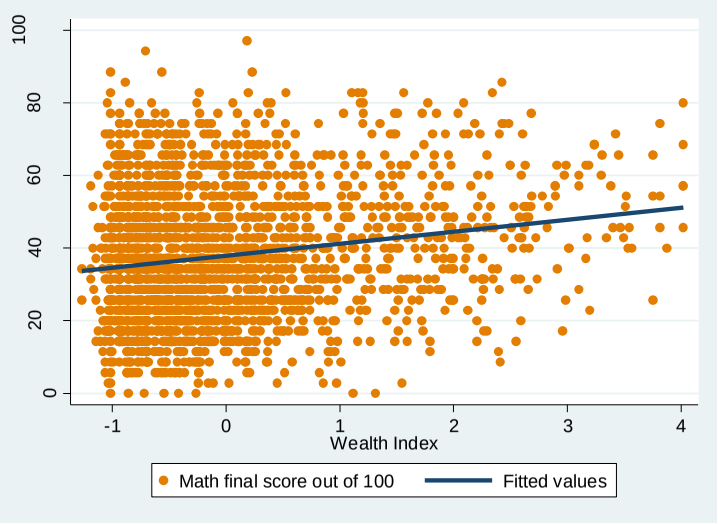
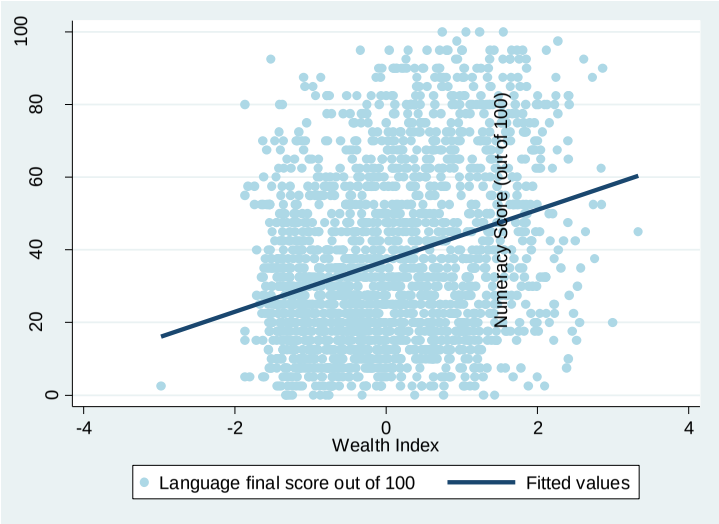


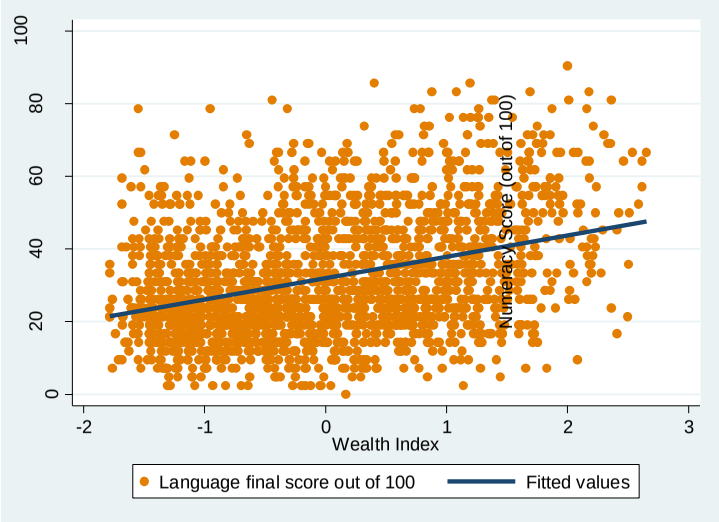
Figure 3G. SES Gradients – Ivory Coast

Grade 2 – Literacy



Grade 2 – Numeracy

Grade 2 – Literacy



Grade 2 – Numeracy

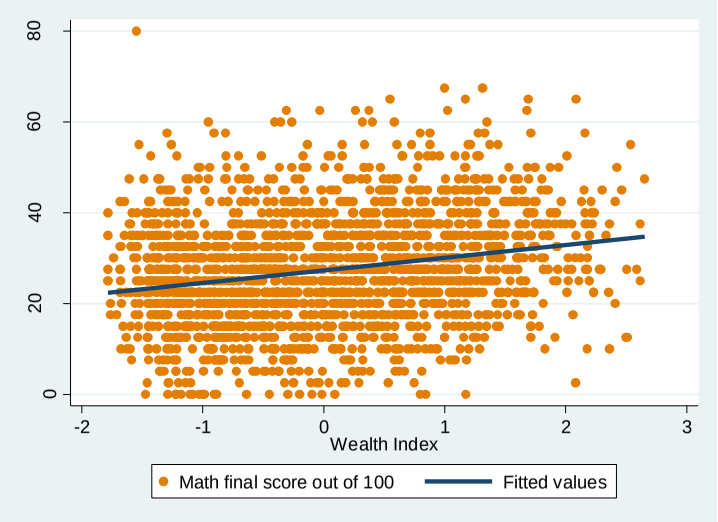
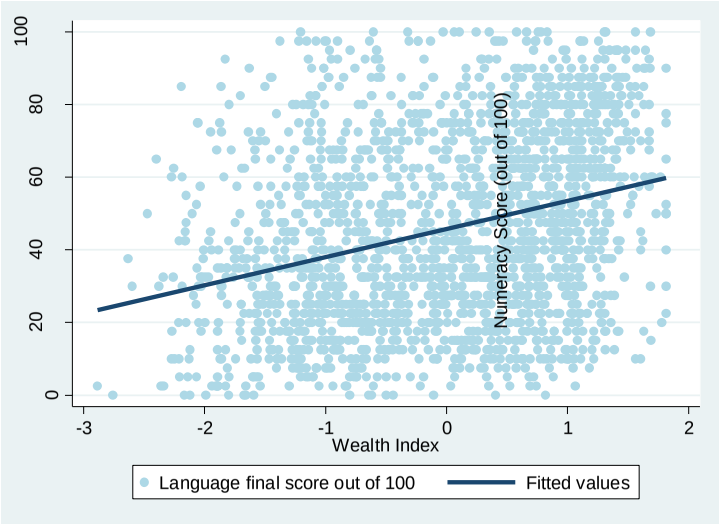
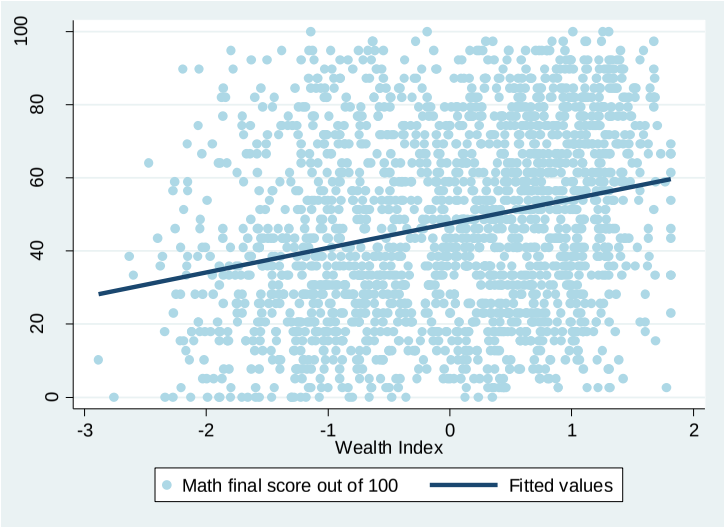


Figure 4G. SES Gradients – Senegal

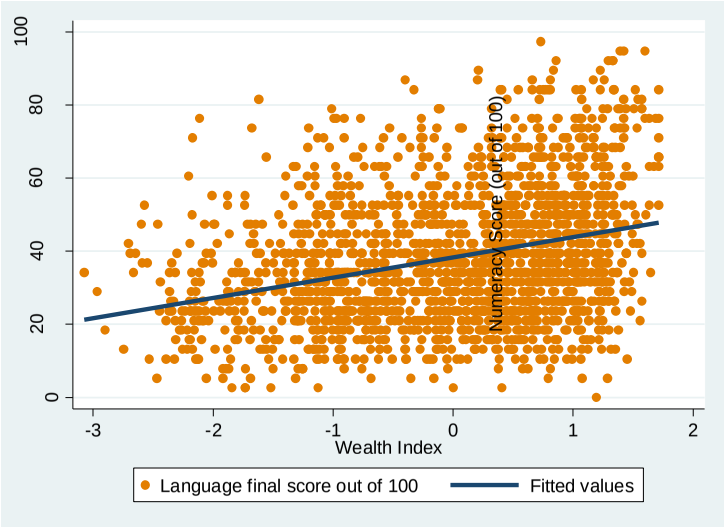
Grade 2 – Literacy



Grade 2 – Numeracy



Grade 2 – Literacy



Grade 2 – Numeracy