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**Parental Education and Children's Educational Access Over Time: Evidence  
from Six African Countries**

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# Parental education and children's educational access over time: Evidence from six African countries

Ricardo Sabates\* and Jimena Hernandez Fernandez

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## Abstract

This paper analyses the gap in educational access according to parental education over 10 year period using evidence from the Demographic Health Surveys (DHS) in six African countries (Kenya, Malawi, Nigeria, Tanzania, Uganda, and Zambia). Each country contains two DHS datasets, separated by at least a decade. The study uses the model of "zones of exclusion" developed by the Consortium for Research on Educational Access, Transitions and Equity to operationalised educational access for children. Parental education is defined according to years of schooling.

To investigate narrowing or widening in the gap in educational access according to parental education a probit model is used to estimate the likelihood that 15 to 19 years old children move out of the zones of exclusion and reach meaningful access. Three cohorts of parents and two cohorts of children are identified from our datasets. We estimated the slope of the relationship between parental education and children's educational access for all combinations of parent-children cohorts. Our results show a widening of the gap in Kenya, narrowing of the gap in Malawi and Uganda, and to a lesser extent in Nigeria and Zambia. In Tanzania there have been no changes in the gradient. Our methodology enables us to identify whether these changes are the result of the institutional educational system experienced by mothers, their children or a combination of these.

**Keywords:** zones of exclusion, educational access, intergenerational transmission of education.

## I. Introduction

Since the 1990 World Conference on Education for All in Jomtien, many countries have made significant progress towards achieving Universal Primary Education. In many countries access to education has improved dramatically, nevertheless a significant number of children are dropping out of primary schooling without even acquiring the most basic skills. Their brief schooling experience consists frequently of limited learning opportunities in overcrowded classrooms with insufficient learning materials and under-qualified teachers (Alexander, 2008). Children of different ages and abilities are mixed together in single classrooms without proper recognition of teaching methods to improve learning and to induce school engagement (Little, 2008). Such schooling circumstances, together with personal and family level factors such as ill-health, malnutrition and poverty, jeopardise meaningful access to education for many children. As a result, many children are registered in schools but fail to attend, they participate but fail to learn, they are enrolled for several years but fail to progress or they simply drop-out from school.

Studies on how intergenerational mobility is related to education have shown that more educated parents provide "better" educational environment for their children even though the degree of relation varies across countries in a wide way (UNICEF, 2002; Chevalier et al., 2005). The relation between family social class and children's academic development has been well studied and there is evidence that there is a direct positive relation between children's level of education and cognitive development and their parents' education (Wolfe & Haveman, 2002). Also studies have shown that the age at which parents left school affects the probability that the child stays more at school (Bynner & Joshi, 2002; Feinstein et al., 1999; Gregg & Machin, 2000). For example, Bynner & Joshi (2002) investigated the effects on academic achievement and attainment according to social disadvantage finding a negative relation with parental drop out. Their estimations suggest that if parents left school before the age of 15 it impacts both the probability that the child stays at school beyond compulsory age and also their academic achievement. These relations are stronger if it is the mother who left schooling as opposed to the father (Smith et al., 1997; Hanson et al., 1997; Joshi & Verropoulou, 2000; Hill et al., 2001; Gayle et al., 2002).

Chevalier et al., (2005) suggests that there are four types of studies to analyse the intergenerational transmission of

education. The first kind is related with the relationship between genetics and children education performance. This "nature" hypothesis studies have provided evidence on that inherited genes affect the intergenerational transmission of ability (Dearden, et al., 1997; Sacerdote 2002, 2007; Plug 2004; Björklund, et al. 2004, 2006; Plug and Vijverberg; 2003; Bowles and Gintis, 2002; Plomin et al. 2001). Plug and Vijverberg (2003) designed a study to identify the impact of genetics on educational attainment analysing the differences between adopted children and children who are their parents' offspring. Their results show that parental ability (IQ) directly affect children's school success: the more schooling years and the higher the parents' IQ, the greater the probability that children attend college. The effect is statistically significant for both groups, but substantially higher for offspring children. Therefore, they conclude that the biological children enjoy the effect of both genetic and cultural transfers, while adopted children only cultural transfers. The studies conducted by Dearden et al., (1997) and Sacerdote (2002) analysed the impact of adoptive father years of schooling on children education, and report positive and significant effects that are almost identical to the effects found for fathers and their own-birth sons. All these results confirm the argument that beyond the nature aspects the environment and context play a substantial and relevant role in educational transmission (Collins et al. 2000; Rutter, 1997) and that in a completely equal education system and society is expected to find variation according to parent-child genetic transmission (Bowles and Gintis, 2002).

The second kind of approach has to do with the direct effect of parental education on children's attainment (net of genetics and other social factors). Oreopoulos et al. (2003) find that one year increase in parental education decrease the probability of repeating a schooling year (or grade) among children age 7 and 15 and that parental compulsory schooling significantly lowers the likelihood of dropping out from school between 15 to 16 year old children. Chevalier et al., (2004) estimate the effect parental education on the probability that children continue studying post-compulsory education. Their research shows that one year more of parental education increases by 4% the probability to stay at school; with a considerable larger effect for sons than for daughters. In addition, a year of maternal education is associated with an increase in the probability of post-secondary participation of 4% for boys and 3% for girls. This suggests that the impact of maternal education on boys is larger than on girls (Chevalier et al., 2005).

The third approach explains how financial returns are related with parental education and how these impact on children's educational outcomes. Findings suggest that highly educated parents are associated with better family income as well with better educational access and outcomes for their children. With U.K and U.S. data sets, Blanden et al. (2003), Blanden and Machin (2004), and Machin and Vignoles (2004), analyse the impact of parental relative income position on child educational outcomes. Their results argue that the educational gap between children with rich and poor parents has widened over time. Also their results suggest a widening gap in educational attainment for children based on parental education, although the gap in cognitive ability has declined. Galindo-Rueda and Vignoles (2005) further find that educational attainment increased far more for those with low ability and high income than for those with high ability and low income.

The fourth kind focuses on the effect of institutional variables, such as class size, teacher quality, peer effect on intergenerational education mobility. The main argument is that intergenerational mobility is correlated with certain characteristics of the educational system because there is heterogeneity in intergenerational education mobility over time (Heineck and Riphahn, 2007). Although the level of education and the extent of upward mobility increased over recent decades, those who are more likely to modify the trend are the children of highly educated parents (Heineck and Riphahn, 2007). Using evidence from 20 countries, Chevalier et al. (2003) suggest that the expansion of access to higher education has increased the impact of paternal education on schooling choices for their children in most countries. In Germany, however, educational reforms did not affect educational choices or the correlation between child and parent educational outcomes. This is because the main beneficiaries of the education expansion in Germany have been the children of parents with high levels of education (Heineck and Riphahn, 2007).

In this paper we focus on changes in the relationship between parental education and children's educational access. As such, the paper is not about nature-nurture or the causal effect of parental education. We model the slope of the relationship between parental education and children's educational access for different cohorts of parents and children, net of wealth and other social and regional factors, in six countries. With this, we hope to achieve insights into potential contextual differences both within countries and between countries. Within countries we have cohorts of parents and children who experienced different educational systems. Between countries, we have six SSA countries that have

pursue different policies to achieve UPE. Thus, our main research questions are: (i) are there changes in the slope of the relationship between parental education and children's access to education, (ii) are these changes mainly driven by differences in the educational system experienced by children, differences in the educational system experienced by their parents or age of entry into motherhood (or a combination of these).

## II. Background Literature

Patterns of educational advantage and disadvantage tend to be predictable across generations. Empirical work in economics and sociology literature reveal that education is positively associated with intergenerational mobility. Both sociological and economic approaches suggest that social status is related with the intergenerational transmission of education, especially educational attainment (Belzil and Hansen, 2003; De Graaf and Kalmijn, 2001). Sociologists have given special emphasis to the importance of family on education (Croll, 2004). Family background, has been identified as a key indicator of socio-economic origin for children and young people and a determinant of schooling decisions, human capital and income among others (Croll, 2004). For example, children living in low income families are more likely to drop out of school, commit crime, and misbehave at school (Hobcraft & Kiernan, 1999 in Feinstein et al. 2004). Children from low income families score lower than children from richer families on health assessments, cognitive development, school achievement and emotional well-being (Brooks-Gunn et al., 1997 in Feinstein et al. 2004).

Family size affects the amount of resources that are available per child at home. Economic models of fertility choices predict that the greater the size of the family the lower future educational attainments and earnings for children since every additional child receives relatively fewer parental resources (Becker & Tomes, 1976 in Feinstein et al. 2004). Moreover, the family plays an important role in defining an adequate educational environment. Many studies show that children raised by highly educated parents tend to receive more schooling than children raised by less educated parents. One possible mechanism is that highly educated families earn more income, and this is associated further schooling and better educational outcomes (Plug and Wim Vijverberg, 2003). There is also evidence that suggests that maternal education play a more important role than paternal education. Currie and Moretti (2003) found a positive relationship

between mother's education and child birth weight which is a strong predictor of child health. A study that focus on the impact of maternal education on home environments and on child outcomes, using data from the female participants of the National Longitudinal Survey of Youth 1979 (NLSY79) and their children, shows that an additional year of mother's schooling increases the child's performance on a standardised math test, and reduces the incidence of behavioural problems (Carneiro, et al., 2007). Chevalier et al., (2005) suggested that children's early school leaving (at age 16) may be due to variations in permanent income, parental education levels, and income shocks and that the impact of maternal education was stronger on sons than on daughters.

Nevertheless, not all empirical findings back up the idea that the impact of maternal education is more important than that of paternal education. Oreopoulos, et al., (2003) find that the influence of the mother's schooling is as important as the influence of father's schooling on grade repetition. Furthermore, the results do not change even when the sample used is restricted to low-educated parents. In another study, using a sample of twin mothers and twin fathers (with different levels of schooling), Behrman and Rosenzweig (2002) find that the effect of father's education is significant and large in magnitude, but the effects of maternal education on child schooling is insignificant ( ).

There are also behavioural studies that analyse teen parenthood that provide evidence that there are differences between children of teenage parents and other children (Pagani, et al. 1997). Studies of inter-generational effects show that children of teenage parents are more likely to become teenage parents themselves (Kiernan, 1997; Manlove, 1997). One possible explanation is that young mothers may be unprepared for motherhood and may have less adequate parenting skills (Furstenberg et al., 1989 in Feinstein et al. 2004). Mothers' age also have been associated to children education, for example, Feinstein et al., (1999) argue that young mothers' children score poorly on cognitive measures and are at higher risk of poor school attainment than children of older mothers. Although it remains unclear whether it is age of the mother or less favourable conditions that children of teen parents are brought up in.

### III. Reconceptualising Educational Access

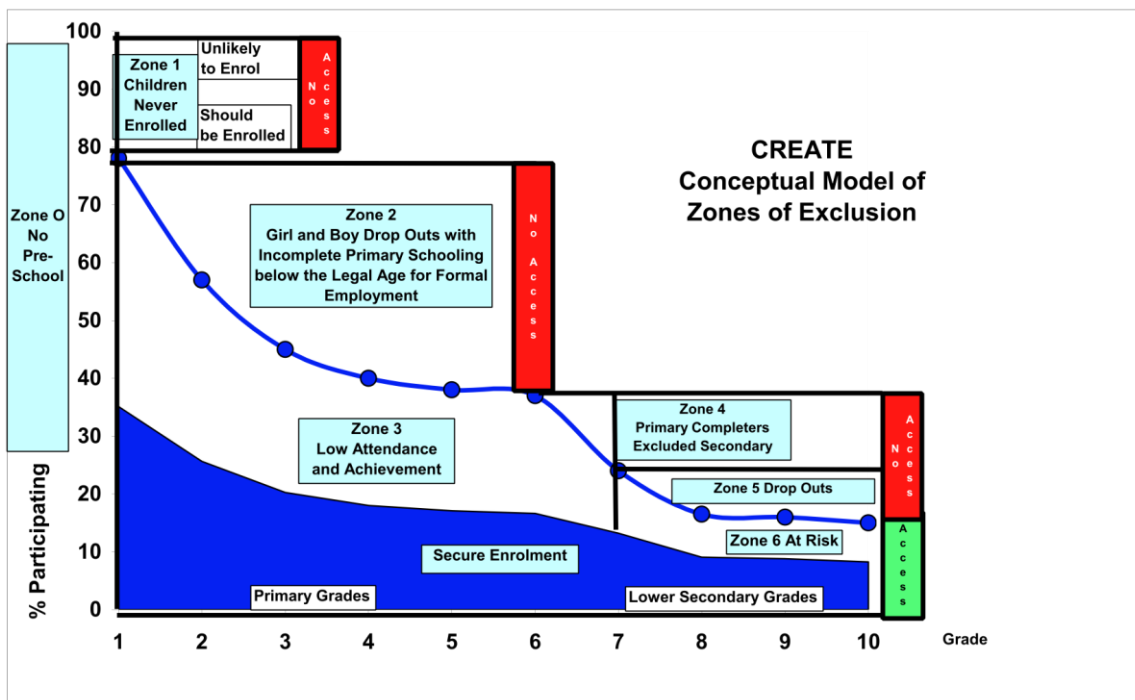
There has been great progress in universalising primary education. For example, since 1999 enrolment rates in sub-Saharan African countries have been increasing (UNESCO, 2010). Nevertheless, by



2015 according to current trend, 56 million children will be left out of school and the ones that are more at risk are those with the fewest resources. Initial access to primary education has little meaning unless it results in secure enrolment and regular attendance, progression through grades at appropriate ages, meaningful learning which has utility, and reasonable chances of transition to lower secondary grades, especially where these are within the basic education cycle (Lewin, 2007). In addition, more equitable opportunities for the poor and marginalised children as well as less variation in quality between schools are necessary to achieve equitable access to education

According to the CREATE model, there are six zones of exclusion from primary and secondary schooling (Figure 1). Zone 1 contains those denied any access. Expansion of schooling can enrol a proportion of these children, but not all. Zone 2 includes all children who are excluded after initial entry, that means that these children have dropped out. Typically, drop out increases as children grow older due to the high opportunity cost of schooling, in particular for children living in poverty (Caine, 1977; Fentiman, Hall and Bundy, 1999; Boyle et al 2002). Those dropping out usually become permanently excluded with no pathway back to re-enter. Zone 3 includes those in school but at risk of drop out. Children who remain formally enrolled in school may be silently excluded if their attendance is sporadic, their achievement so low that they cannot follow the curriculum, or if they are discriminated against for socio-cultural reasons. Nutritional deficiencies and sickness can compound these problems.

Figure 1: CREATE zones of exclusion (Lewin, 2007).



Zone 4 contains those excluded from lower secondary school as a result of failing to be selected, being unable to afford costs, or dropping out before successful completion of primary school. Access to secondary schooling promotes the social mobility needed to give poor households more access to higher income employment. Zone 5 includes those who have entered lower secondary school but who fail to progress to the end of the cycle. In most countries lower secondary is now considered part of basic education. Many who fail to complete the cycle will be below the legal working age if they are in the appropriate grade for their age. The reasons for drop out include poor performance, affordability, and loss of interest. Finally, zone 6 contains lower secondary children at risk of drop out. As with Zone 3 some will be silently excluded though enrolled and at risk as a result of poor attendance and low achievement. Meaningful access is achieved by those who complete a good quality lower secondary schooling and achieve the level of knowledge and competencies to fully participate in society.

To our knowledge, none of the above empirical studies have applied such as broad concept of educational access when looking at the impact of parental education. This broad conceptualisation of educational access is particularly important in the context of resource constraint educational systems where a significant number of children are still denied access to the most basic form of education.

#### IV. Methodology, Data and Variables

Data for this paper come from two rounds of Demographic Health Surveys (DHS) in six African countries (Kenya, Malawi, Nigeria, Tanzania, Uganda, and Zambia). One of the DHS surveys for these countries took place in the early nineties (1990 for Nigeria; 1992 for Malawi; 1993 for Kenya; 1995 for Uganda; 1996 for Tanzania and Zambia), whereas the other in the beginning of this century (2003 for Kenya and Nigeria; 2004 for Malawi; 2006 for Uganda; 2007 for Tanzania and Zambia). The key methodological aspect of these surveys is that there is at least 10 year gap between these rounds of data collection which enable us to identify three cohorts of parents and two cohorts of children who experienced education at different time periods (from the mid 1940s until the late 1970s for parents and from the early 1980s to the late 1990s for children). We estimate inequalities in educational access according to parental education and changes over time using these cohorts of parents and children.

With the exception of Kenya, all DHS surveys are nationally representative of the target population, which are women aged 15 to 49. In Kenya, the 1993 DHS excluded all three districts in the North Eastern Province and four northern districts (Samburu and Turkana in Rift Valley Province, and Isiolo, and Marsabit in Eastern Province). In order to make the 1993 sample as comparable as possible to the 2003, we omit the North Eastern Province from the 2003 survey. However, since we do not have information at the district level, it is impossible to drop individuals from the four northern districts who were not included in the 1993 survey. In all countries, two-stage sample selection procedures are followed and appropriate weights are derived, which we use in our empirical analyses.

In some countries, we had to make adjustment to the areas selected from the DHS. This is because geographical boundaries changed between surveys, so we adjust the regional variables to make this comparable across time. In Nigeria, for example, we aggregated state level indicators provided in 2004 to obtain regions comparable to the ones in 1990 (Northeast, Northwest, Southeast and Southwest).<sup>1</sup> In Tanzania, homogenous regions were selected according to the 1996 geographical limits (Central, Northern, Eastern, Dar Es Salaam, Southern, Southern Highlands, Western,

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<sup>1</sup> All regions in 1999 and 2003 can be matched to the 4 main regions in 1990 except for the state of Kogi, which did not exist in 1990. In 1991, parts of the states of Kwara in the northwest and of Benue in the southeast were divided to form Kogi. For this report, all individuals in Kogi are included as part of the northwest region.

Lake and Zanzibar). In Uganda, regions in 2006 were aggregated to match geographical regions in 1995 (Central, Eastern, Northern and Western).

For each of the DHS, we selected children aged 15 to 19 years and their respective mothers and fathers. The intuition behind this sample selection is as follows: children aged 15 to 19 should have completed the full cycle of primary and lower secondary school. Hence, we are able to estimate the likelihood that these children have transited over the different zones of exclusion, or their proxy measures.<sup>2</sup> We also kept 15 to 19 year olds whom we were able to identify their mother or father. DHS data on relationship structure only refers to individuals' relationship to the head of the household. So, 15 to 19 year olds who were not sons or daughters (natural or adopted) of the head of the household could not be linked to at least one of their parents to be able to undertake the empirical analysis of this paper. Selected 15 to 19 year olds therefore represented around 75 to 85 per cent of all young people of this age group in the data.

For young people aged 15 to 19, DHS contains information about their schooling which will be used to identified zones of exclusion; their parents' education to measure inequalities in educational access according to parental education; household wealth and other demographic characteristics which are used as controls in the empirical analysis.

*Outcome Variable Exclusion in Educational Access:* Information about current educational status was provided for all 15 to 19 year olds living in the household. We focus here on two particular indicators to identify the different zones of exclusion (see Table 1). The first indicator relates to the highest educational attainment, which could be no education, incomplete primary, complete primary, incomplete secondary and complete secondary. The second indicator is whether the young person is still in school. So, 15 to 19 year olds who have achieved no education and are not in school are considered to be in zone 1, never enrolled. Those who had some primary education but not completed and are not in school are considered to be in zone 2, drop out from primary school. Any 15 to 19 year old still in primary school is considered to be in zone 3, these young people are over age but still in school. Those who completed primary school and are not in

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<sup>2</sup> A seven year old, for instance, can only be located in zones of exclusion 1 (never enrolled), 2 (drop-out) or 3 (enrolled by not attending or not performing academically). Hence age will be a strong determinant of the probability of entering into different zones of exclusion, not because younger children have a higher likelihood of being excluded from zones 4 or 5 but because they have not yet reached the cycle of education that corresponds to zones of exclusion 4 or 5.

education anymore are considered to be in zone 4, completed primary school and not making the transition into secondary education. Zone 5 is identified for those young people who made the transition into secondary school but dropped out whereas those who are still in secondary education are considered to be in zone 6, at risk of dropping out. Finally, all 15 to 19 year olds who have completed secondary or higher education are considered to have meaningful access.

Table 1: Categorisation of zones of exclusion in DHS data for 15 to 19 year olds

<i>Highest educational attainment</i>	<i>Still in school?</i>	<i>Zone of exclusion</i>
No education	No	Zone 1: Never enrolled
Incomplete primary	No	Zone 2: Drop-out primary school
Incomplete primary	Yes	Zone 3: In primary school over age
Complete primary	No	Zone 4: Completed primary & drop-out
Incomplete secondary	No	Zone 5: Transition into secondary school & drop-out
Complete primary	Yes	Zone 6: In secondary school over age
Complete secondary or higher	No or Yes	Meaningful access

Source: DHS data from household roster information on education.

The identification of some of the zones of exclusion is not exactly related to the conceptual definition provided by Lewin (2007). This is particularly the case for zone 3 and zone 6, for which data is needed on school attendance and achievement to identify those children who are at risk of dropping out. We use over age as a proxy measure for risk of dropping out. Recent studies have shown that over age is closely linked to drop out. Hunt (2008) highlights that over age is one of the precursors of the process of dropping out from school. EPDC (2009) findings using 35 developing countries suggests that during the final year of primary school, children who are over age by two or more years have the highest drop out rates in all 35 countries. Hence, we believe that 15 and 19 year olds still in primary or secondary schooling have a higher risk of dropping out than children who are in their correct age-in-grade.

Main Explanatory Variable Parental Education: Information was collected on parents highest level of school attended and the highest grade at the level. With these two indicators DHS data offers a derived variable for years of education, which we use as our indicator for parental education. The slope of the relationship between parental years of education and children's

educational access is our measurement for inequality based on parental education. It measures how much more likely are children to achieve educational access for every year of education of their parents.

Three cohorts of parents were selected as follows. First, parents were selected according to the age of the young people, i.e. 15 to 19 year olds. Parents aged 35 to 54 contained around 85 per cent of all parents in the study. Second, since the two rounds of DHS data are separated by at least one decade, we divided parents into two groups, those aged 35 to 44 and those aged 44 to 54. For the survey in the early 90s, parents aged 45 to 54 represented the oldest cohort. For the survey in the early 2000s, parents aged 35 to 44 represented the youngest cohort. Parents aged 35 to 44 in the 90s survey will be those aged 45 to 54 in the 2000s survey and hence they represent the middle cohort.

The oldest cohort of parents experienced schooling from the mid 1940s to the end of 1950s. During this period all the African countries used here were still under the colonisation of the United Kingdom<sup>3</sup>. The middle cohort experienced schooling from the mid 1950s to the end of 1960s, during a time where independence from the UK occurred and the youngest cohort from the mid 1960s to the end of 1970, a period of independence. Although there is overlapping between the schooling experiences that were received by the oldest cohort of parents and the middle cohort of parents, there is no overlap between the oldest and the youngest cohorts (see Table 2). Therefore, the paper uses differences in the educational periods when children experienced education, as well as differences in the educational periods when their parents experienced education, to investigate changes in the slope of children's educational access according to parental education. The focus in the slope is to deal with inequalities, and the use of cohort comparisons is to measure widening or narrowing of such inequalities and whether these changes are mainly due to educational experiences of parents, children or age of entry into parenthood.

Table 2: Schematic representation of two cohorts of children and respective cohorts of parents

Children aged 15 to 19 in 1990s (studied between 1977 & 1990)	Children aged 15 to 19 in 2000s (studied between 1987 & 2000)
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<sup>3</sup> Independence from the UK occurred in all these countries between 1960 and 1962.

(A) Parents aged 35 to 44 (studied between 1952 & 1970)	(B) Parents aged 45 to 54 (studied between 1942 & 1960)	(C) Parents aged 35 to 44 (studied between 1962 & 1980)	(D) Parents aged 45 to 54 (studied between 1952 & 1970)
<i>Middle cohort</i>	<i>Oldest cohort</i>	<i>Youngest cohort</i>	<i>Middle cohort</i>
<p>Comparisons</p> <p>(A) vs (B) &amp; (C) vs (D) Children under same educational system; parents in somehow different educational systems</p> <p>(A) vs (D) Children under different educational systems; parents same educational system</p> <p>(B) vs (C) Children under different educational systems; parents different educational system</p> <p>(A) vs (C) &amp; (B) vs (D) Children under different educational systems; parents same age and somehow in different educational system</p>			

Table 2 makes explicit the different comparisons that can be done using the three cohorts of parents and the two cohorts of children. We can compare slopes of parental education and children's educational access for children who experienced the same educational system. This can be achieved using data on children aged 15 to 19 in 1990 (or in 2000) and compare the slopes of parental education for two cohort of parents. Two drawbacks of this analysis are the fact that parents have different ages so we are comparing younger parents versus older parents. It has been shown in the literature that age of parents is related to their schooling and also to the schooling of their children (e.g. Feinstein, Duckworth and Sabates, 2008). The second issue is that although the educational experiences of the two cohorts of parents were somehow different, there is a degree of overlap.

In order to deal with these issues we make some further comparisons. We compare slopes for parents who experience the same educational system. These are the parents of the middle cohort. To do this we use children aged 15 to 19 in the early 1990s and in the 2000s and their respective parents from the middle cohort. Parents experienced the same educational system but not their children. Also, parents in the 1990s data had children at a younger age than parents in the 2000s data.

Another comparison is to use children whose parents belong to the oldest cohort and those whose parents belong to the youngest cohort. In this comparison, both parents and children experienced different educational systems and, in addition, there are differences in the age of parenthood between these two cohorts of parents. The final comparison is between parents of the same age whose children experienced different educational systems. For this, we compare parents aged 35 to 44 whose children were 15 to

19 in the 1990s data with parents of the same age but whose children were 15 to 19 in the 2000s data (hence children experienced a different educational system). The educational experience of these parents was somehow different, as there is a certain degree of overlap. A similar comparison is done for parents aged 45 to 54 in the 1990s and those of the same age in the 2000s data and their respective children.

Other control variables: Individual level control variables include age and gender of the child. Another main control in the analysis is household wealth. Household wealth is derived from information about the characteristics of the household dwelling and ownership of various assets. Filmer and Pritchett (1999, 2001) suggest using information from more than twenty of these assets variables and principal component analysis to obtain a total score which represents the wealth index for each household. Filmer and Pritchett have shown that the index is a good proxy for long-run wealth and it can be compared both over time and across countries.<sup>4</sup> We also use family characteristics and regional controls. Family characteristics are defined by household size, the number of children under the age of 5 living in the household, and the structure of the household, which is defined by the number of adults living in the household. Regional controls include indicators for urban and rural areas as well as specific regional indicators for each country.

#### IV. Estimation Method

An ordered probit model is used to estimate the likelihood that children aged 15 to 19 moved out of the different zones of exclusion and reached meaningful access. The analysis of this model is based on Wooldridge (2002). The ordered probit model is built around a latent regression of the unobserved variable  $y^* = X\beta + \varepsilon$ , where  $X$  is a matrix of explanatory variables and  $\beta$  is a vector of unknown parameters to be estimated and  $\varepsilon$  is a vector of unobservable characteristics.

We do not observe  $y^*$  but what we do observe is the variable  $y$  which can take different values depending on the model specification. For the case of the ordered probit,  $y$  increases due to an underlying ordering:

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<sup>4</sup> All wealth indices were available in the data.



$$\begin{aligned}
y &= 0 && \text{if } y^* \leq 0 \\
&= 1 && \text{if } 0 < y^* \leq \mu_1 \\
&= 2 && \text{if } \mu_1 < y^* \leq \mu_2 \\
&\cdot \\
&\cdot \\
&= J && \text{if } \mu_{J-1} \leq y^*.
\end{aligned} \tag{1}$$

In this setting the  $\mu$ s are also unknown parameters or cut off points to be estimated with the  $\beta$ s.

In our model we are interested in estimating the expected value of access to education given a set of observable explanatory variables, among which is parental education by cohorts interacted with the time dimension. For the ordered probit the expected values or probabilities are specified using the standard normal distribution. The estimation method implies to find the value of the unknown parameters that maximises the likelihood function (or the logarithm of the likelihood function).

The main parameters of interest in this paper are the ones measuring the association between parental education and children's likelihood to achieve meaningful access. There are four parameters, one for parents aged 35 to 44 in the early 90s, which is our middle cohort, another for parents aged 45 to 54 in the early 90s, which is our oldest cohort, another for parents aged 35 to 44 in the early 2000s, which is our youngest cohort and finally another parents aged 45 to 54 in the early 2000s, which is our middle cohort a decade later. We estimate the slope of the relationship of parental education to children's access to education for these four cohorts and compare comparisons between all possible combinations of parent-children cohorts.

## V. Results

Table 3 shows results of the model estimating the likelihood that children will move out of the zones of exclusion and will reach meaningful access. We use only mothers' education and the oldest cohort of mothers as comparison group. As mentioned before, the oldest cohort of mothers experienced education from the early 1940s until the late 1950s and the estimated parameter relates to their children's education during the late 1970s and up to the early 1990s. Taking the case of Kenya, compared to the middle cohort of mothers, who experienced education from the early 1950s to the late 1960s and whose children experienced education during the same time as the children from the oldest cohort of mothers,

we estimate that there are no differences in the slope (estimated parameter  $-0.002$ , not statistically significant) or in the intercept (estimated parameter  $-0.002$ , not statistically significant) of this relationship. However, compared with children who experienced education during the late 1980s and up to the early 2000s we estimate that the slopes of the relationship between maternal education and children's access to education are steeper (estimated parameters  $0.049$  &  $0.046$ ) and have lower intercepts (estimated parameters  $-0.509$  &  $-0.498$ ) than for children of mothers of the oldest cohort. Therefore, on average, for mothers with the lowest levels of education, children's likelihood to exit zones of exclusion will be lower for those who experienced education during the 1990s compared with those who experienced education during the 1980s and whose mothers belong to the oldest cohort. In addition, the relationship between mothers' education and children's likelihood to achieve meaningful access is higher for children educated during the 1990s compared with those educated during the 2000s whose mothers belong to the oldest cohort. This, to us, indicates increasing inequalities in the intergenerational transmission of educational success, i.e. children of educated mothers benefited more during the 1990s than during the 1980s.

In Malawi, the situation is different than in Kenya. Children's access to education is still strongly associated with mothers education (estimated parameter  $0.18$ ), but less so for children who experienced education in the 1990s and whose mothers belong to the middle and youngest cohort compared with children whose mothers belong to the oldest cohort (estimated parameters  $-0.048$  &  $-0.087$ , respectively). We further found that children who experienced education in the 1990s have a higher intercept in the relationship with mother's education compared with children who experienced education in the 1980s and whose mothers belong to the oldest cohort. Hence, in Malawi, compared with children of mothers of the oldest cohort, there have been average improvements in the likelihood to achieve meaningful access and more equity for children who experienced education during the 1990s. In addition, we found that the slope of the relationship between mothers' education and children's access is less steep for children whose mothers belong to the middle cohort and who experienced the same educational system as children of mothers of the oldest cohort (estimated parameter  $-0.076$ ). It is possible that this issue arises due to the age of the mother, as mothers of the middle cohort are younger than those of the oldest cohort in the early 1990s dataset. Hence, if age of entering into motherhood is related to achievement of education, the oldest cohort of mothers

could have a higher proportion of educated mothers, making the relationship between mothers' education and children' educational access steeper. Another possible explanation may be greater perceptions of the benefits of education for mothers of the middle cohort compared with mothers of the oldest cohort. Therefore, there may be greater access for children of mothers of the middle cohort compared with children of mothers of the oldest cohort.

The situations in Nigeria and Uganda are somehow similar to Malawi. In Nigeria and Uganda we also estimate a reduction in the slope of the relationship between maternal education and children's educational access, in particular for children of the youngest cohort (estimated parameter for Nigeria -0.041 and for Uganda -0.069). The two cohorts of children used in this comparison experienced different educational systems and also their mothers. Hence, the flatter slope between mother's education and children's educational access may be due to the combination of the different educational systems experienced by children and mothers. In Uganda, we further find that children educated during the 1990s, whose mothers belong to the middle cohort, have also a flatter slope with respect to mothers' education compared with children of mothers of the oldest generation (estimated parameter -0.084). In Nigeria, this was not the case. Hence, we believe that in Uganda our results support the explanation that differences in the slope may arise from differences in the educational system experienced by children (as in Kenya and Malawi) but in Nigeria it may be due to the different educational setting experienced by the mothers.

Table 3: Parameter estimates [standard errors] for access to education for children aged 15 to 19 and association to mothers' education in six SSA countries

VARIABLES	Kenya	Malawi	Nigeria	Tanzania	Uganda	Zambia
<i>Comparison: Oldest cohort</i>						
Middle cohort (1990s)	-0.002 [0.073]	0.156 [0.103]	0.143 [0.097]	-0.063 [0.069]	0.071 [0.103]	-0.091 [0.094]
Middle cohort (2000s)	-0.509*** [0.083]	0.603*** [0.094]	0.653*** [0.112]	0.450*** [0.092]	0.588*** [0.112]	-0.122 [0.109]
Youngest cohort	-0.498*** [0.081]	0.706*** [0.098]	0.595*** [0.107]	0.504*** [0.099]	0.570*** [0.110]	-0.042 [0.094]
Mothers yrs education	0.060*** [0.012]	0.183*** [0.023]	0.086*** [0.016]	0.043*** [0.015]	0.153*** [0.027]	0.096*** [0.014]
Education*middle cohort (1990s)	-0.002 [0.015]	-0.076*** [0.026]	-0.025 [0.020]	0.035* [0.018]	-0.046 [0.030]	0.018 [0.017]
Education*middle cohort (2000s)	0.049*** [0.016]	-0.048* [0.026]	-0.025 [0.019]	0.031 [0.021]	-0.084*** [0.028]	0.011 [0.020]
Education*youngest cohort	0.046*** [0.014]	-0.087*** [0.026]	-0.041** [0.018]	0.023 [0.020]	-0.069** [0.028]	-0.031* [0.017]
Gender child (girls)	0.044 [0.039]	-0.184*** [0.046]	-0.067 [0.051]	0.093** [0.042]	-0.079* [0.044]	-0.061 [0.041]
Wealth poorer	0.095 [0.061]	0.269*** [0.080]	0.11 [0.079]	0.168** [0.066]	0.201*** [0.073]	0.170** [0.066]
Wealth middle	0.222*** [0.061]	0.467*** [0.072]	0.388*** [0.097]	0.243*** [0.068]	0.262*** [0.075]	0.340*** [0.066]
Wealth richer	0.427*** [0.069]	0.422*** [0.072]	0.706*** [0.082]	0.395*** [0.069]	0.446*** [0.077]	0.845*** [0.084]
Wealth richest	0.591*** [0.087]	1.007*** [0.090]	1.005*** [0.091]	0.783*** [0.086]	1.001*** [0.101]	1.419*** [0.105]
Household Size	0.011 [0.010]	0.028** [0.012]	-0.002 [0.009]	-0.002 [0.010]	0.045*** [0.009]	0.018** [0.009]
# Children Under 5	-0.094*** [0.024]	-0.121*** [0.029]	-0.065** [0.026]	-0.087*** [0.026]	-0.113*** [0.024]	-0.045* [0.024]
Two adults in household	-0.424 [0.464]	1.015*** [0.175]	-0.152 [0.318]	0.071 [0.503]	0.147 [0.292]	0.131 [0.625]
Three or more adults in household	-0.427 [0.462]	0.952*** [0.158]	-0.422 [0.303]	0.14 [0.498]	0.177 [0.284]	0.134 [0.622]
Observations	3985	3110	3386	3874	2739	3011

Source: DHS. Notes: Asterisks \*, \*\*, \*\*\*, represents statistical significance at 10, 5 and 1% level, respectively. All estimations control for age & region. Estimations weighted and adjusted for survey design.

Fewer changes in the relationship between mothers' education and children's educational access were estimated for Tanzania and Zambia. In Tanzania we only estimated differences in the intercept, with children who experienced education during the 1990s having higher levels of educational access, on average, than children who experienced education in the 1980s and whose mothers

belong to the oldest cohort. In Zambia, we found only a statistical difference in the slope of the relationship between maternal education and children's access to education for children of the youngest cohort compared with children of the oldest cohort (estimated parameter -0.031). This relationship, however, was statistically significant at 10 per cent level.

The rest of the controls used show some expected results. Girls are less likely to achieve meaningful access in Malawi and Uganda and more likely in Tanzania than boys. In the rest of the countries (Kenya, Nigeria and Zambia) we found no gender differences on the likelihood to achieve meaningful access. Children who live in richer households are more likely to achieve meaningful access to education on average than children who live in the poorest households. This result was consistent in all countries. Children living in larger households were more likely to achieve meaningful access in Malawi, Uganda and Zambia. But, in general, children living in households with children under five were associated with lower likelihood to achieve meaningful access. Perhaps due to the costs of childcare and future educational needs of children under 5, older children, who are the topic of investigation of this paper, need to contribute to household costs and hence we estimate a lower likelihood of achieving meaningful access (Hunt, 2008). Finally, the structure of the household, whether children aged 15 to 19 are living with one, two or three or more adults in the household, does not seem to be related to meaningful access, only in Malawi, where children living with two or more adults have a higher likelihood of access to education compared to those living with only one adult. We believe that this results is consistent with the sample selection that we have, which is older children, in some cultures considered already adults (aged 15 to 19), hence whether there are other adults in the household ex-post is not related to the likelihood to achieve education. Of course, ex-ante, changes in household structure can be related to decisions to continue in education for children as it has been the case for the impact of HIV-AIDS on educational access (Henderson, et al. 2009; Cáceres, et al. 2008).

In order to provide more insights into the potential changes in the intergenerational transmission of educational success in SSA countries Table 4 shows the result of the test of equality between estimated parameters in the model for all possible combinations of cohorts of mothers with their respective cohorts of children. The aim of these results is to gain insights on whether estimated differences are due to children experiencing different educational

systems, mothers experiencing different educational systems or age of entry into motherhood (or a combination of these).

In Kenya, results of the relationship between children of the middle cohort of mothers and the rest of the children is the same as the one obtained in Table 3 for children of mothers of the older cohort. There is more inequality in the estimated relationship of maternal education and children access to education for children who experienced education during the 1990s compared with children who experienced education during the 1980s and whose mothers belong to the middle cohort. But there are no differences in the intergenerational parameters, either slope or intercepts, between children who experienced the same educational systems. Hence, differences in Kenya are the result of children experiencing different educational systems and the more recent data shows greater inequality with respect to maternal education.

In Malawi, there are differences in slopes of parental education across the two cohorts of children and also for children who experienced the same educational system. But interestingly the potential impact of age of entering into motherhood is strong in Malawi, as we obtained that there are weak differences between children of different generations but whose mothers had the same age. In Table 3 the estimated difference in the intergenerational parameter between the oldest cohort of mothers (aged 45 to 54 in the early 1990s) and the middle cohort of mothers (aged 45 to 54 in the 2000s) was only significant at 10 per cent level (estimated parameter  $-0.048$ ). There are no differences in slopes between children whose mothers were 35 to 44 in 1990s and those whose mothers were the same age but in 2000s. Hence the main differences in Malawi arise from age of entering into motherhood and linked to this the educational system experienced by mothers.

Table 4: Wald test of hypothesis for intergenerational parameters

	Kenya	Malawi	Nigeria	Tanzania	Uganda	Zambia
Intercept: Middle cohort (1990s) vs middle cohort (2000s)	-0.507*** [0.085]	0.447*** [0.087]	0.510*** [0.117]	0.512*** [0.092]	0.517*** [0.104]	-0.032 [0.113]
Intercept: Middle cohort (1990s) vs youngest cohort	-0.496*** [0.081]	0.550*** [0.089]	0.452*** [0.109]	0.567*** [0.096]	0.499*** [0.100]	0.049 [0.095]
Intercept: Middle cohort (2000s) vs youngest cohort	0.011 [0.088]	0.103 [0.080]	-0.058 [0.086]	0.054 [0.113]	-0.018 [0.071]	0.08 [0.114]
Slope: Middle cohort (1990s) vs middle cohort (2000s)	0.051*** [0.015]	0.028 [0.018]	0.001 [0.017]	-0.004 [0.018]	-0.038** [0.018]	-0.007 [0.017]
Slope: Middle cohort (1990s) vs youngest cohort	0.048*** [0.013]	-0.011 [0.018]	-0.016 [0.015]	-0.012 [0.017]	-0.023 [0.018]	-0.049*** [0.014]
Slope: Middle cohort (2000s) vs youngest cohort	-0.002 [0.015]	-0.039** [0.017]	-0.016 [0.013]	-0.008 [0.019]	0.015 [0.014]	-0.042** [0.017]

Source: DHS. Notes: Asterisks \*, \*\*, \*\*\*, represents statistical significance at 10, 5 and 1% level, respectively.

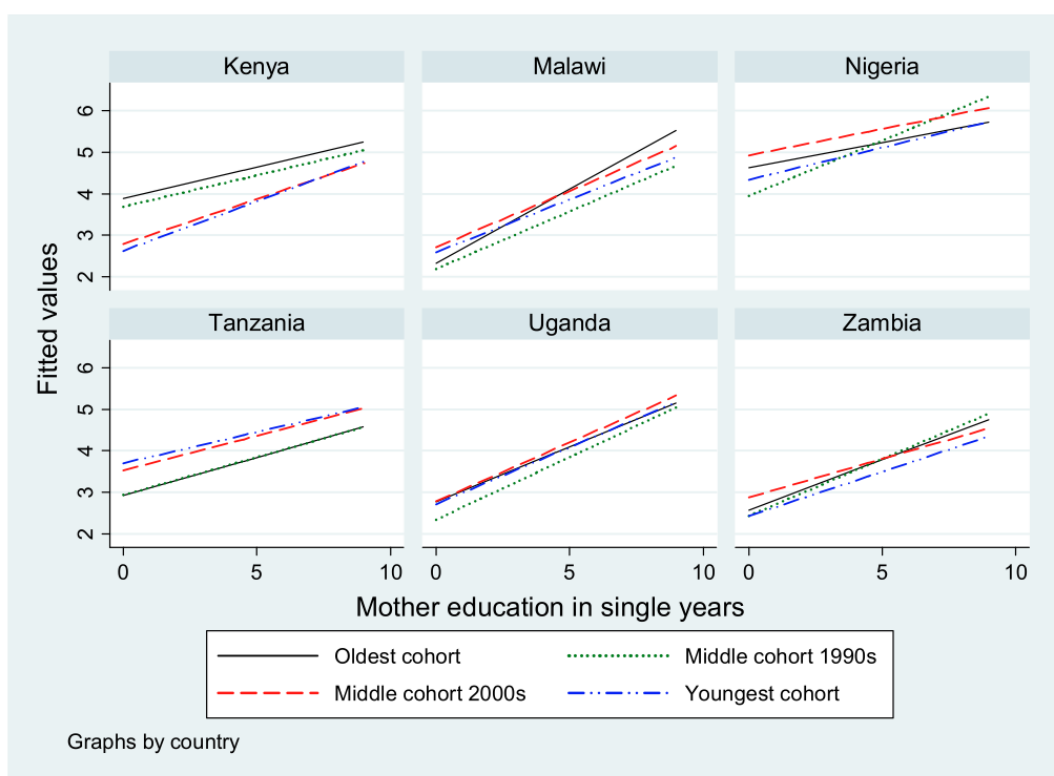
Wald test for parameters

In Nigeria and Tanzania we only found statistical differences in intercepts indicating that, on average, children who experienced education in the 1990s have higher levels of access to education but the same gradient with respect to their mothers' education. In Nigeria, the only difference in slopes is between mothers of the oldest and the youngest cohorts. These mothers experienced different educational systems. In Tanzania there are no changes in the gradient of educational access for children according to maternal education.

In Uganda and Zambia there are some differences in the slope of the intergenerational transmission of education. In Uganda, children of mothers who experienced the same educational system (the middle cohort of mothers) differ, with children who access education during the 1990s having a less steep slope with respect to the education of their mothers than for children who access education in the 1980s. This is a movement towards equality that is not due to the mothers experience of education but rather due to children different educational systems. In Zambia there are differences between children of the middle cohort of mothers (1990s) and children of the youngest cohort. Again, differences in these slopes may be due to the different systems of education for the children. Interestingly for Zambia, we found that for children who experienced the same educational system there are differences in the slope of mothers' education, between the middle cohort of mothers and the youngest cohort of mothers. This may be a combination of age of mothers and the educational experience of mothers.

Figure 2 presents a graphical representation of our results. On the y-axis we show the average level of educational access (from 1 to 7 according to the zones of exclusion) and on the x-axis we show mothers' years of education, from 0 meaning no education to 9 or more years. Each of the lines represents the fitted values for this relationship for each of the cohorts of mothers. In Kenya we clearly see lower access to education for children who experience education during the 1990s as opposed to children who experienced education during the 1980s. We also see that there is greater inequality for children who experienced education in the 1990s compared with those who experienced education in the 2000s. Malawi, Uganda and Zambia show a flattening of the intergenerational gradient. The steepest slope was for children of mothers of the oldest cohort. For children of the middle and youngest cohorts of mothers, the slope has become flatter.

Figure 2: Estimated slope of the intergenerational transmission of education in SSA countries.



Tanzania shows mainly differences in the intercept, with average improvements in educational access at all levels of maternal education. In Zambia, in addition, the fitted line is in accordance with our estimated results which show very little variation in children's access to education according to their mothers' education for different cohorts of mothers. Finally, in Nigeria, there seem to be little differences too with respect to



the slope of the intergenerational transmission of educational success.

## VI. Conclusion

This paper has focus on the relationship between mother's education and children's educational access in six SSA countries. In all six countries there has been a push towards the universalising primary education, supported from international donors and national governments, more children have now access to basic education than they did two decades ago. Nevertheless, all these countries still show very large inequalities in educational access, whether measured by economic resources, such as wealth or income, or by socio-cultural resources, such as parental education and occupational prestige. Children who live in poverty are less likely to enter education than rich children. If they do enter into education, they are less likely to complete the cycle of basic education, and even if they do complete the cycle, the quality of the educational provision they received is worse than that for rich children.

That inequalities in educational access according to parental education exist is not new for research. Even in developed nations there is a sharp gradient in educational access for children based on the education of their children. Our findings confirm the existence of the gradient in educational access in all countries. Parents with high levels of education are likely to have children who complete the basic cycle of education whereas parents with low levels of education will have children struggling to continue in education. The main question is whether this situation has changed somehow in the last decade. If it has, then the follow up question will be to distinguish the main elements that are related to this change.

We believe that methodologically we are able to explore some of these issues empirically. We have datasets that are nationally representative and spread over a decade. With these datasets we are able to identify cohorts of children who experienced different educational systems. We are also able to identify cohort of parents who also experienced different educational systems. Then, we estimate whether the gradient in educational access according to maternal education is different for children who experienced the same educational system, for children who experienced different educational system, for parents who experienced the same educational systems and for parents of the same age. These

combinations enable us to understand whether any of these issues are behind any observed change in these gradients.

Our first remark is that there have not been consistent changes in the gradients for children's educational access according to maternal education. In Kenya there has been an increase in the gradient; in Malawi and Uganda a decrease in the gradient and to a lesser extent in Nigeria and Zambia too. In Tanzania there have been no changes in the gradient. Secondly, estimated changes in the gradient were found for different combinations of parents-children, supporting different explanations in different countries. In Kenya, the increase in the gradient was mainly found for children who experienced education in the 1990s compared with children who experienced education in the 1980s. In Malawi, our results support the hypothesis that age of the mother was important. In Nigeria, the main explanation seems to be differences in the educational system experienced by mothers, whereas in Uganda it may be due to differences in the educational experiences of children (as in Kenya) but towards greater equality. Finally, in Zambia, it seems to be a combination of the educational experience of mothers as well as age of entry into motherhood.

We hope that the paper is methodologically robust and interesting to investigate further relationships. In this paper we have not undertaken an in depth review of the historical changes in the educational systems of these countries (pre and post colonisation). We have not undertaken the analysis by gender of the child to estimate the gender dimension of these relationships. Lastly, education of the father is also important, and has not been investigated in this paper yet. These issues are part of our next research agenda.

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