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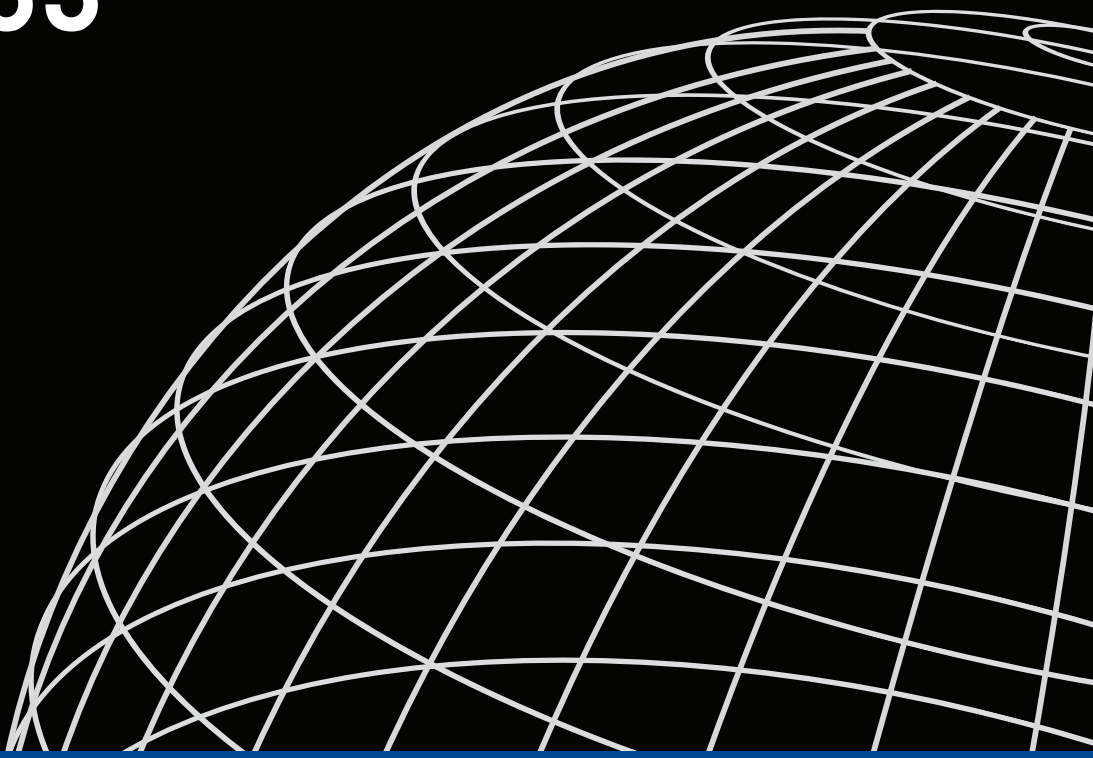
EDUCATION AND FERTILITY IN SUB-SAHARAN AFRICA: A LONGITUDINAL PERSPECTIVE

DHS ANALYTICAL STUDIES 33



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MEASURE DHS assists countries worldwide in the collection and use of data to monitor and evaluate population, health, and nutrition programs. Additional information about the MEASURE DHS project can be obtained by contacting MEASURE DHS, ICF International, 11785 Beltsville Drive, Suite 300, Calverton, MD 20705 (telephone: 301-572-0200; fax: 301-572-0999; e-mail: reports@measuredhs.com; internet: www.measuredhs.com).

The main objectives of the MEASURE DHS project are:

- to provide decision makers in survey countries with information useful for informed policy choices;
- to expand the international population and health database;
- to advance survey methodology; and
- to develop in participating countries the skills and resources necessary to conduct high-quality demographic and health surveys.

DHS Analytical Studies No. 33

Education and Fertility in Sub-Saharan Africa:

A Longitudinal Perspective

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Calverton, Maryland, USA

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Preface

One of the most significant contributions of the MEASURE DHS program is the creation of an internationally comparable body of data on the demographic and health characteristics of populations in developing countries.

The *DHS Comparative Reports* series examines these data across countries in a comparative framework. The *DHS Analytical Studies* series focuses on analysis of specific topics. The principal objectives of both series are to provide information for policy formulation at the international level and to examine individual country results in an international context.

While *Comparative Reports* are primarily descriptive, *Analytical Studies* comprise in-depth, focused studies on a variety of substantive topics. The studies are based on a variable number of data sets, depending on the topic being examined. A range of methodologies is used in these studies, including multivariate statistical techniques.

The topics covered in *Analytical Studies* are selected by MEASURE DHS staff in conjunction with the U.S. Agency for International Development.

It is anticipated that the *DHS Analytical Studies* will enhance the understanding of analysts and policymakers regarding significant issues in the fields of international population and health.

Sunita Kishor
Project Director

Executive Summary

The study provides a longitudinal perspective on the relationships between education and fertility in sub-Saharan Africa. It analyzes long-term trends in level of education and their relationships with the fertility transition. The analysis is based on 79 Demographic and Health Surveys (DHS) and 5 related surveys in 34 African countries. Level of education is measured as the Average Years of Schooling (AYS) for adults age 20 and older.

In a first step, the study reconstructed cohort trends in level of education for cohorts born between 1900 and 1985. In a second step, period trends were reconstructed for the working-age population (20-59) and for fertile women age 15-49, for each country, and for urban and rural areas separately. Trends in fertility were matched with trends in level of education, as well as with trends in income per capita and in urbanization.

Results show a marked increase in the level of education throughout Africa, for men and women alike. For the continent as a whole, the AYS increased from 0.7 years for men born in 1900 to 2.0 years for men born in 1930, and to 6.9 years for men born in 1985; for women, the AYS increased from 0.2 years in 1900 to 0.7 years in 1930, and 5.6 years in 1985. The gap between men and women first increased for cohorts born before 1954 (gap of 2.5 years), then decreased to 1.4 years in 1985. Four countries, all located in Southern Africa, exhibit higher level of education for women among the most recent cohorts. The increase in level of education was not regular for cohorts born after 1930. In several countries the level of education remained steady for relatively long periods, and in some countries the level of education declined, especially for the men. The level of education had a weak relationship with income per capita, and had large variations according to cultural factors, in particular religion and culture of colonization before independence. Islam was associated with lower levels of education. British colonization was associated with higher levels of education compared with other colonial experiences.

The relationship between long-term trends in education and in fertility was weak and complex. Countries with a higher level of education in the mid 1970s had an earlier onset of fertility decline. However, the speed of the fertility transition, once underway, was not correlated with the level of education. Furthermore, periods of fertility stalls were associated with a somewhat slower increase in level of education, whereas periods with education stalls were not associated with changes in fertility trends.

After the onset of the fertility transition, the total fertility rate (TFR) had only a minor relationship with the level of education. In multivariate analysis, changes in level of education explain only a small part (13%) of the fertility decline from 1975 to 2005. The study discusses these results in light of changing attitudes and behaviors and expanding family planning programs in Africa.

Key Words: Level of education: Years of schooling; Fertility transition; Fertility decline; Economic development; Colonization; Cultural factors; Religion; sub-Saharan Africa.

Introduction

0.1 Longitudinal versus cross-sectional approach

The role of education in the decline of fertility has been a source of endless debate in the demographic literature. There are two approaches to this issue: cross-sectional and longitudinal. In the cross-sectional approach, one compares at a given point in time the fertility level according to the level of education. This can be done either at the individual level (level of education of mother or father) or at the household level (highest level of education in the household). During the course of the fertility transition, the relationship between education and fertility is almost universally straightforward: groups with more education have lower fertility. However, this relationship is not necessarily true before the transition, in natural fertility situations, nor after the transition, when most groups have reached replacement fertility or below. All final country reports of the Demographic and Health Surveys (DHS) include a table on period fertility by mother's level of education, which invariably show the same relationship. Numerous reviews have addressed the relationship of fertility and education in a cross-sectional perspective, in particular since the early days of the World Fertility Survey (WFS) (Adamchak and Ntseane 1992; Bongaarts 2010; Casterline 1985; Castro-Martin 1995; Chimere-Dan 1993; Cleland and Rodriguez 1988; Cochrane 1979; Jejeebhoy 1995; Kravdal 2002; NRC 1999; Rodriguez and Aravena 1991; Rutstein 2002; Singh and Casterline 1985; United Nations 1995)

The second approach, the longitudinal perspective, studies the relationships between the dynamics of the level of education and the dynamics of the fertility level. These relationships are less often studied since they require different types of data, in particular long-term time series of fertility rates and levels of education. In their classic study of the European fertility transition, van de Walle and Knodel (1980) found virtually no correlation between onset and speed of the fertility transition and various socioeconomic indicators, such as levels of education, urbanization, income, or industrialization.

Cleland (2007) briefly addressed the possible difference between cross-sectional and longitudinal approaches. Lloyd et al. (2000) attempted to analyze the cross-sectional DHS surveys in a longitudinal perspective. Recently, Shapiro (2011) also addressed the same issue. However, studies similar to the detailed European Fertility Project are lacking for developing countries, particular in sub-Saharan Africa, mainly because of a lack of long-term time series data and a lack of vital registration data. This study was undertaken to help fill this gap in knowledge.

0.2 Open questions in a longitudinal perspective

A longitudinal perspective can address a number of open questions:

- How does the level of education prior to the onset of fertility decline affect the fertility transition?

- Is there a relationship between the time of onset of fertility decline and the mean level of education in the adult population?

- Is the fertility transition more rapid among the more educated group?

- Is there a threshold of level of education necessary for fertility decline?

- What are the interactions between level of development, income per capita, urbanization, level of education, and the fertility transition, measured by onset and speed?

- Are trends in level of education consistent with trends in fertility?

- Are periods of stagnating fertility related to periods of stagnating educational attainment?

- Are periods of stagnating or regressing levels of education related to changing fertility trends?

- How are longitudinal and cross-sectional approaches related?

Note that these open questions are very different from the more common question: "What are the fertility differentials by level of education?"

0.3 Fertility transitions in Africa

As this report deals with trends in education and the fertility transition in sub-Saharan Africa, a number of peculiarities of the African fertility transition need to be recognized, as discussed in an abundant literature (Blacker 2007; Caldwell et al. 1992); Caldwell 1994; Camlin et al. 2004; Cleland et al. 1994; Cohen 1998; Harwood-Lejeune 2000; Gaisie 1996; Garenne and Joseph 2002; Garenne 2004; Garenne et al. 2007; Garenne 2008; Gould and Brown 1996; Kirk and Pillet 1998; Lesthaeghe and Jolly 1995; Mbacke 1994; Mostert et al. 1988; Moultrie and Timaeus 2003; Ngom and Fall 2005; Shemeikka et al. 2005; Swartz 2003; UN-ECA 2001; United Nations 2007; van de Walle and Foster 1990).

First, with respect to data, there are no reliable vital registration systems and therefore no reliable birth statistics that could be used for computing long-term time series, as was done in studying the European fertility transition. Therefore, one has to rely on survey data to reconstruct fertility trends. An earlier DHS comparative report presented a way of reconstructing fertility trends from DHS data (Garenne 2008). In brief, one computes fertility rates in the 10 years before each survey and uses the cumulative fertility by age 40 as an indicator of the TFR. This approach is precise and allows the researcher to identify and test periods of increasing, stalling, and decreasing fertility, as well as the date of onset of fertility decline.

Second, the main characteristics of the fertility transition in Africa are that it is rather late compared with other continents, that the dynamics in urban and rural areas differ, and also that the dynamics differ by country depending on the precocity and intensity of family planning (Garenne 2008).

Third, fertility transitions in Africa have not always been smooth after their start, and researchers have identified a number of 'fertility stalls'–that is, periods during which fertility stays at a steady level, and sometimes even increases, following a period of fertility decline (Bongaarts 2006; Garenne 2009 and 2011; Machiyama 2010; Shapiro and Gebreselassie 2008; Westoff and Cross 2006).

Finally, even if the fertility transition has started everywhere in urban areas of Africa, a few countries, particularly in Sahelian West Africa and Central Africa, remain where it has not yet started in remote rural areas, or has started very recently.

As with respect to birth statistics, there are no reliable statistics on education or schooling in African countries that could be used for computing long-term trends. Therefore, one has to rely on survey data. One could also use census data, but the number of countries that have released census data is still too small to be used for such a study.

0.4 Aims of the report

Matching long-term trends in education with trends in fertility requires several steps:

1) Reconstructing cohort trends in level of education, for adult men and women, in urban and rural areas separately, since the earliest cohorts available (e.g. >= 1890);

2) Reconstructing period trends in level of education of the adult population age 20-59 for the 1950-2005 period;

3) Reconstructing period trends in level of education of fertile women, in urban and rural areas separately, for the 1950-2005 period;

4) Relating trends in education of fertile women with trends in fertility, in urban and rural areas separately;

5) Matching this information with socioeconomic correlates and development indicators and with cultural factors;

6) Discussing differences between longitudinal and cross-sectional approaches.

This report follows basically this plan, starting with a section on data availability and data quality.

Data and Methods

1 Demographic Data

1.1 DHS surveys

African DHS surveys contain several indicators of level of education in various data files. For the cohort study it was important to have as much information as possible for the earlier cohorts, by sex, and for urban and rural areas separately. Thus, the Household Membership files (labeled 'PR' file in the DHS filing system) were selected for this study. These files contain all the needed information, well standardized, and comparable to a census: level of education of residents in the household with age, sex, place of residence and numerous other variables.

The sample includes all DHS or related surveys conducted in sub-Saharan Africa with a PR file containing information on level of education, available in early 2012. Related surveys include the AIDS Indicator Surveys (AIS) and Service Provision Assessments (SPA). Table A-1 provides a list of surveys included in the study. The sample covers 34 countries, accounting for about 90% of the population of sub-Saharan Africa. A total of 84 surveys were included, of which 79 were DHS surveys from round II to round V, plus four AIS surveys (Cote d'Ivoire 2005; Mozambique 2009; Tanzania 2003 and 2009) and one SPA survey (Congo-Brazza 2009). Note that DHS surveys from round I (1986-1990) do not include the variables on education, and therefore were not included.

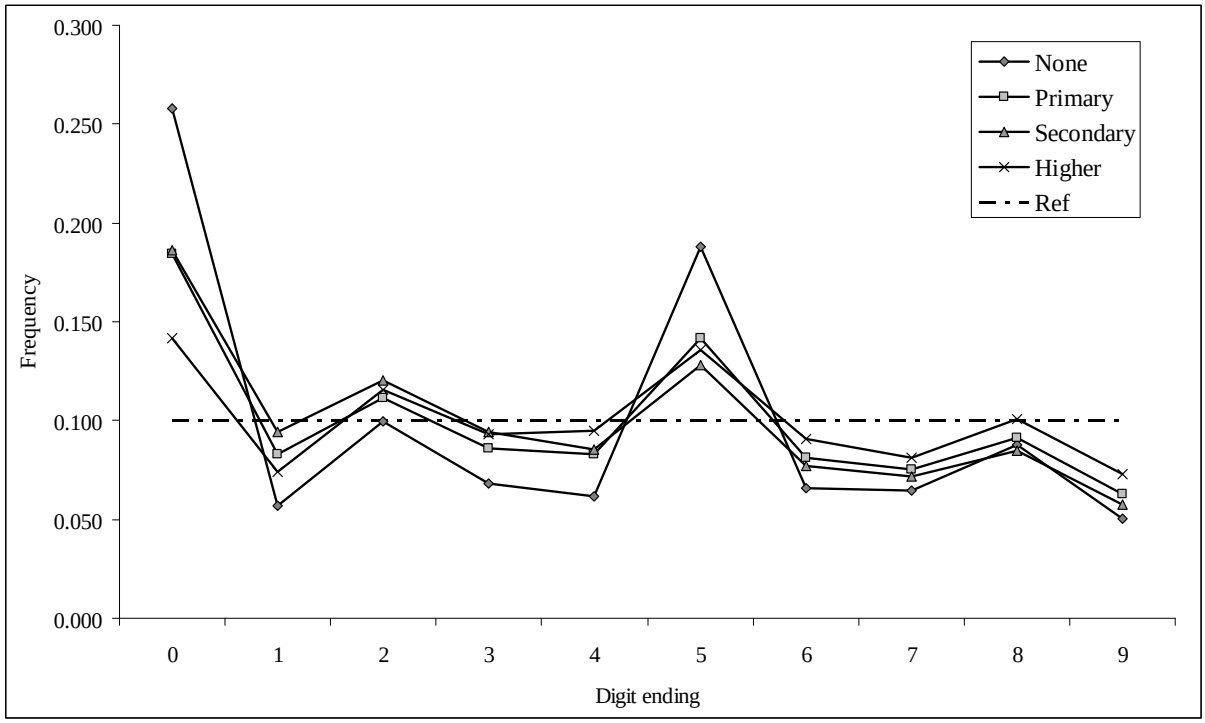
On average, each country was covered by 2.5 surveys, and a majority of countries (18/34) were covered by three or more surveys, which provided a larger sample size and a better estimation of level of education by cohort. Some 10 countries had only one survey, likely to have poorer estimation of cohort level of education, and the other 6 countries had two surveys each.

1.2 Data issues: age misreporting

In PR files, the birth cohort was computed as the year of the survey minus the age of the respondents. For instance, women age 20 in a survey conducted in 2005 were considered to be born in 1985. As a consequence, age misreporting had an influence on the birth cohort determination, with consequences for the mean level of education by cohort.

Figure 1 displays the average pattern of age misreporting in PR files used for the study, for adults age 20 and above. Altogether for Africa, age misreporting was widespread, with major concentration in ages ending into 0 and 5. The Whipple index, indicating the concentration on digits ending in 0 and 5, for all countries together was 187, a very high value (values above 175 are considered very poor quality data). The Whipple index was influenced by Nigeria, the country with the largest population and also with the highest Whipple index (234). But even without Nigeria, the average Whipple index for selected countries was 158. The Myers raw index, indicating overall age misreporting, was 18.2 and the Myers Blended index taking into account mortality was 16.8, both also very high values. This major problem with age misreporting was the rationale for the first adjustment of mean level of education by cohort. (See below § 3.1)

Figure 1. Age heaping in African DHS surveys, adults age 20+, by level of education



The magnitude of age misreporting varied by level of education, as defined by variable HV106 (highest level reached). Adults with no education had the highest value of the Whipple Index (223), followed by adults with primary education (163), with secondary education (157), and with higher education (139). (See Table 1 and Figure 1)

Table 1. Indices of digit preference for age of adults in African DHS surveys

	Level of education (HV106)					
	None	**Primary**	**Secondary**	**Higher**	**Unknown**	**Total**
Africa						
Whipple Index	223	163	157	139	239	187
Myers Index	24.6	13.7	13.5	9.4	27.8	18.2
Myers Blended	23.9	12.0	10.4	10.0	27.6	16.8
By country (Whipple Index)						
Min	107	108	114	92	104	113
Max	288	220	184	150	288	234

Differences by country were large, with a range of Whipple index from 113 (Zambia) to 234 (Nigeria). Differences applied to all levels of education, although the range for higher levels of education was somewhat narrower. Low values of the Whipple index (indicating high-quality data) could be found at all levels of education, especially in countries of Southern Africa, whereas very high values (above 175) tended to be concentrated among low levels of education.

1.3 Data issues: sample size of birth cohorts

The second issue with data from DHS surveys was the small sample size of early cohorts, in particular those born before 1930, with implications for the precision of the mean level of education by cohort. The average size of yearly birth cohort by country was 515 persons for both sexes combined, with major variations by period of birth. For those born in 1900-1909, the average number of persons was very low, and estimates must be considered with great caution. For cohorts born in 1910-1919, the mean size of cohorts was 24 persons of each sex, and for cohorts born in 1920-1929, it was 72 persons of each sex. Cohorts born after 1930 had larger sample size, producing reasonable precision. For instance, a mean value of 2.09 years of schooling for a cohort of males born in 1930-1939 will be given with a standard error of 0.19, and for women a mean value of 0.89 years of schooling, with a standard error of 0.05. The degree of precision measured by the coefficient of variation (standard error/mean) was 6.0% for men and 3.4% for women on average for cohorts born after 1930. (See Table 2)

Table 2. Average size of yearly cohorts in African countries, and precision of estimates

Birth cohort		Average size of birth cohort		Average years of schooling		Standard deviation	
Min	Max	Men	Women	Men	Women	Men	Women
1900	1909	7.4	7.1	0.92	0.35	2.4	1.4
1910	1919	24.3	23.7	1.05	0.59	2.5	1.9
1920	1929	74.3	70.6	1.38	0.69	2.8	2.0
1930	1939	150.3	157.1	2.09	0.89	3.5	2.3
1940	1949	217.9	248.4	3.33	1.46	4.4	3.0
1950	1959	324.6	364.2	4.69	2.59	4.9	3.8
1960	1969	472.1	533.0	5.59	3.78	4.8	4.3
1970	1979	557.9	652.3	5.94	4.48	4.7	4.5
1980	1989	434.2	530.1	6.44	5.23	4.5	4.6

Of course, the degree of precision of yearly estimates of mean number of years of schooling depends on the sample size in each country, that is, on the number of surveys conducted and the size of each survey. The large fluctuations due to sample size for yearly cohorts were the rationale for the second adjustment made for yearly estimates. (See below § 3.1)

2 Definitions and Measures of Level of Education

2.1 Systems of modern education

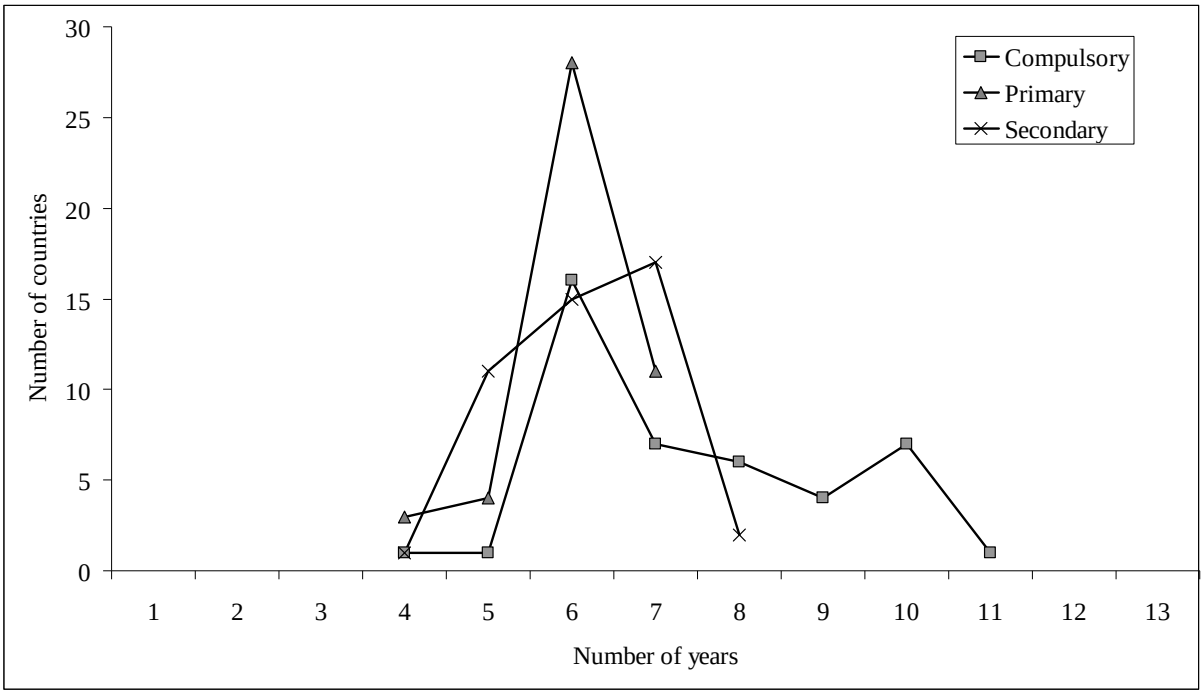
Systems of modern education developed since the early 20th century in Africa, first around mission schools and progressively through public and private schools. A wide variety of systems exist throughout the continent, depending on the colonizer (British, French, Belgian, Portuguese), the extent of public schools and private schools, the existence of religious schools (e.g. Christian missions), but not counting Arabic schools, Koranic schools, and schools in local languages, which are different systems. A full review of these systems is beyond the scope of this study, and only modern schools are considered in DHS surveys. More details can be found elsewhere (ADEA/SPESSA 1998; Lloyd et al. 2000; Ross and Genevois 2006; UNESCO website).

2.2 Compulsory schooling

The duration of compulsory schooling also varies greatly throughout Africa. According to UNESCO statistics, it ranges from 4 years (Angola) to 11 years (Gabon), with an average of 7.4 years and a mode of 6 years, corresponding to the end of Primary School in most countries (UNESCO website). Note that compulsory schooling ranges from 11 to 13 years in most developed countries, corresponding to the end of Secondary School. A majority of African countries request at least primary education (5-7 years of schooling), while some request the first cycle of secondary education (8-10 years). Despite the law, as will be seen below, a significant proportion of children do not go to school and do not comply with regulations, even among recent cohorts, so that the mean number of years of schooling (3.2 years) is about half that of compulsory schooling, and about a third of that in developed countries (9.5 years).

The mean duration of primary school varies by country, from 4 to 7 years, with an average of 6.0 years and a mode at 6 years. Only a minority of countries have shorter duration of primary schooling (15%), or longer duration (24%), than the modal value. Likewise, the mean duration of secondary school varies by country, from 4 to 8 years, with an average of 6.2 years and a mode at 6 years. If children attain both primary and secondary schooling, they are expected to stay for an average of 12 years (range 10-13 years). (See Figure 2)

Figure 2. Distribution of official duration of schooling in African countries



Source: UNESCO statistics

2.3 Level of education in DHS surveys

Four variables are available in PR files for studying the level of education:

HV106: Highest level reached (3 categories)
HV107: Number of years completed within level
HV108: Total number of years of schooling
HV109: Highest level completed (5 categories)

Because of the great variety of education systems in Africa, using the categories of level completed would have been misleading. It was considered unfair to merge 4 years of primary or secondary schooling in one country with 7 or 8 years in another country. Therefore, this study is based primarily on the total number of years of schooling (HV108). In addition, having a quantitative variable makes statistical calculations much easier, in particular for computing means and standard deviations. Comparisons in time and space of the Average Years of Schooling (AYS), the main indicator for this study, are likely to be straightforward and meaningful. However, it should be recognized that the quality of education and the value of each year of schooling varies among countries, over time in the same country, between urban and rural areas, and even within schools themselves.

2.4 Inconsistencies in the coding of level of education in DHS surveys

A number of inconsistencies were noted in the coding of the variables related with level of education in the household files (HV106, HV107, HV108, HV109). Since the total number of years of schooling (HV108) is usually derived from the level achieved (HV106) and the number of years spent in that level (HV107), one therefore expects that HV108 is equal to HV107 + the minimum number of years spent in the lower levels (below the level marked by HV106). For instance, if a person spent 4 years in secondary school and if 6 years are spent in primary school, the total number must be equal to 10 years. A few inconsistencies were noted in the following cases:

a) Coding of HV108

- Madagascar 1992: The coding of HV108 was inconsistent with HV106 and HV107. HV108 had only selected values (0, 5, 12-19). However, HV108 could be recoded from HV106 and HV107.

- Madagascar 2003: Here again, the coding of HV108 was inconsistent with HV106 and HV107. HV108 could not take some values (10-11). However, HV108 could be recoded from HV106 and HV107.

- Mali 1995 and Togo 1998: In both files, the recoding seems to have mixed "higher education" with "higher secondary school" (*Lycée*), so that HV108 could take extremely high and unrealistic values. In Mali, 4 years were discounted when HV108≥ 15. In Togo, 7 years were discounted when HV108≥ 17.

These inconsistencies were corrected in order to obtain a consistent value of AYS.

b) Coding of HV107

- In some surveys (Tanzania 1999 2003, and 2004, and Mozambique 2003), the recoding of HV108 appeared realistic but was not fully consistent with HV106 and HV107.

- In other surveys (Liberia 2007, Namibia 1992, and Tanzania 2003), the coding of HV107 (years of schooling within level achieved) was not consistent with standard DHS procedures, and confused with HV108 (total years of schooling).

- In surveys conducted in Ethiopia (2000 and 2005), the coding of HV107 was not continuous for the higher level of education. This led to erratic values of HV108 above 12 years (13, 15, 18).

These inconsistencies were not corrected, since the study relied primarily on HV108 (total years of schooling).

2.5 Investments and trends in level of education

Investments in education infrastructure (schools) and manpower (teachers) make the trends in level of education potentially erratic. Opening new schools offers new opportunities to cohorts of eligible students compared with earlier cohorts. Opening a new training center for teachers will lead to increasing the supply of teachers a few years later, and also to increasing step by step the number of classes. Conversely, not building enough schools or not training enough teachers for coping with rapid population growth will usually lead to decreasing access to schools, unless the number of pupils per class and per teacher increases. In addition, changing laws and regulations, such as those affecting compulsory schooling, may lead to sudden changes in level of education for new cohorts. All these reasons explain why trends in level of education are likely to be erratic in countries with rapid population growth, fluctuating trends in income per capita, changing educational policies and programs, and political instability.

3 Methods

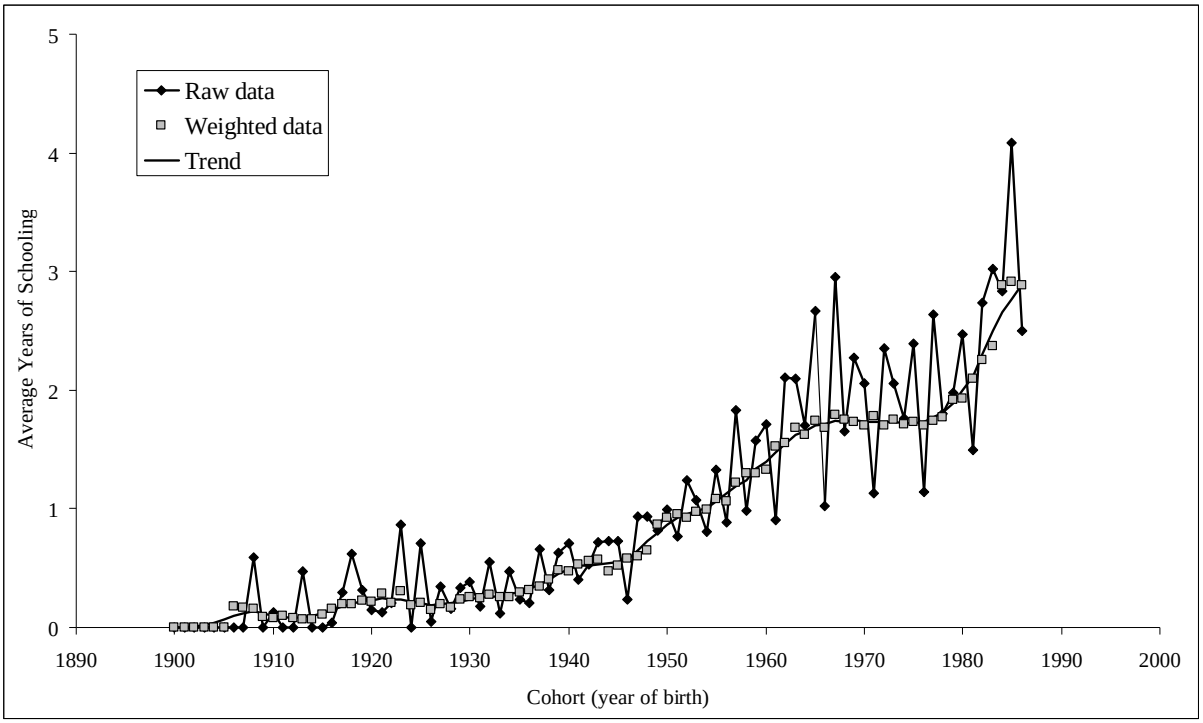
This study focuses on long-term trends in level of education. The core of the study is therefore devoted to the reconstruction of cohort trends in level of education of adults, with its main focus on women. Since the average level of education is low in Africa, and the proportion of persons who go to school beyond age 20 is small, the study focuses on the level of education of the population age 20 and older. This section explains the strategy followed for the computations of mean level of education, while taking into account age misreporting and sample size, as explained above (see §2.1 and 2.2).

3.1 Cohort trends

The estimation of the mean level of education (average years of schooling) of each cohort (year of birth) was done in several steps. First, the mean number of years of schooling was computed for each available survey, for all adults age 20 and older by cohort, sex, and area of residence (urban, rural). Second, surveys conducted in the same country were aggregated, again by year of birth, sex, and area of residence. Third, the weighted average of the five cohorts centered on cohort ‘c’ was calculated (weights being 0.1, 0.2, 0.4, 0.2, 0.1 for cohorts c−2, c−1, c, c+1, c+2, respectively). This was done in order to reduce the “noise” due to attraction of ages ending into 0 and 5. Fourth, trends were estimated by the moving average of yearly cohorts, in order to account for random fluctuations. Moving averages were calculated over the five cohorts centered on cohort ‘c’, with equal weights. Moving averages were preferred to other methods of parametric smoothing because trends were expected to be irregular and susceptible to rapid changes. Fifth, missing values for the early cohorts were completed by prolonging the trends backwards, and very often the mean value of AYS was taken as 0 for those born very early, e.g. before 1910.

Figure 3 shows an example of this reconstruction, for women in Benin. The raw data show major heaping of mean levels of education due to age misreporting in the surveys. The weighted data smooth this pattern but still show irregularities. The trend data are smooth and still follow the ups and downs in trends, as in the original data.

Figure 3. Reconstruction of trends in the level of education of women in Benin



3.2 Period trends for the labor force

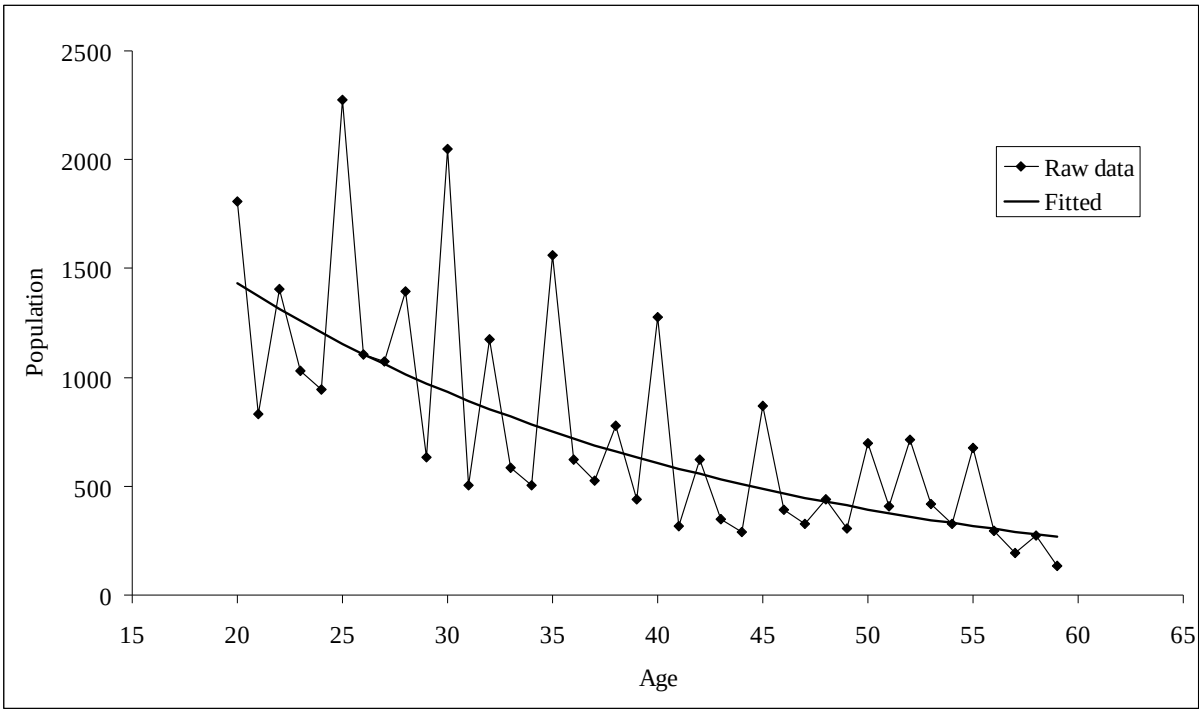
Period trends in level of education for the active population (the labor force) were calculated by applying an age structure for the population age 20-59 to the cohort trends. This can be expressed by the following formula:

$$EDUC(t) = \sum_{a=20}^{59} Educ(a,t) \times c(a)$$

where c(a) is the age structure of the 20-59 population, with ∑c(a)= 1, and Educ(a,t) is the level of education of cohort age (a) at time (t).

Period estimates were calculated for each year between 1950 and 2005 for men and women age 20-59. The age structure was calculated as a stable population with the same growth rate and no mortality. The growth rate of the size of cohorts age 20-59 was calculated directly from the same data (PR files in DHS/AIS/MIS surveys) for men and women separately, using linear regression of the logarithm of the population age 'a'. Figure 4 provides an example of such an adjustment, for the female population in Benin.

Figure 4. Average age structure, female population age 20-59, Benin



3.3 Period trends, fertile women

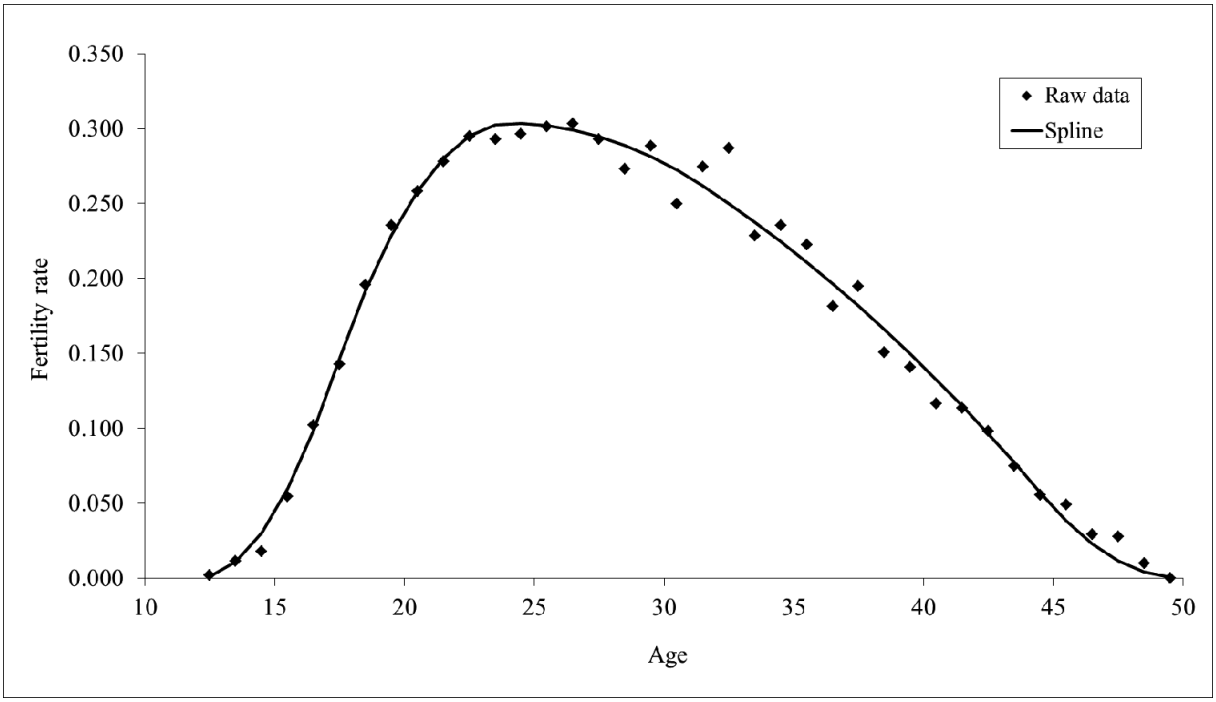
The level of education of fertile women was needed in order to match trends in education of women who deliver with trends in the total fertility rate (TFR). Since the TFR is calculated as the fertility of a synthetic cohort with the same age-specific fertility rates as the period rates, the same logic was followed for level of education. Calculating the level of education of women who deliver at time (t) required applying weights proportional to age-specific fertility rates to cohort levels of education. This can be expressed by the following formula:

$$EDUC(t) = \sum_{a=15}^{49} Educ(a,t) \times f(a)$$

Where f(a) is the age pattern of fertile women, defined by age-specific fertility rates, with $\sum f(a) = 1$, and Educ(a,t) is the level of education of cohort age (a) at time (t). Period estimates of level of education of fertile women were calculated for each year between 1950 and 2005, separately for urban and rural areas.

The age patterns of fertility were calculated from the same DHS data (Individual Recode file, or 'IR' files). An average pattern was first calculated for each survey in the five years preceding the survey, by single year of age. These were merged by country, by single year of age, and for urban and rural areas separately. Country data were smoothed by quadratic splines, following the method developed by Schmertmann (2003), and for urban and rural areas separately. Figure 5 provides an example of such adjustment, for the rural female population in Benin.

Figure 5. Average age pattern of fertility, rural women, Benin



Once cohort and period trends in level of education were reconstructed, they were merged with trends in level of fertility. The reconstruction of trends in fertility has been explained elsewhere and published in an earlier DHS comparative study (Garenne et al. 2008).

The relationships between trends in education and trends in fertility were explored in various ways. First, trends were compared by date. Second, the date of onset and the speed of the fertility transition were matched with the level of education. Third, periods of fertility stalls were investigated separately and compared with trends in level of education. Finally, periods of stagnation or reversal in trends in education were investigated separately and compared with fertility levels and trends. (See below § 7.5)

Countries were merged together to produce an estimate for sub-Saharan Africa simply by applying a weight for each country, weights being proportional to the population in year 2000, for urban and rural areas separately. United Nations Population Division estimates of the 2006 revision of the World Population Prospects were used for the calculations (United Nations 2006).

3.4 Other data

While most of the analysis is based on DHS data, the analysis also used other data sources. Data on income per capita were taken from the database gathered by Angus Maddison and colleagues, in its latest version (Maddison 2008). This database provides estimates of Gross Domestic Product in Parity Purchasing Power (GDP-PPP) expressed in constant US dollars. The data are available for all African countries investigated, and for the 1950-2008 period. In this database, Ethiopia and Eritrea were merged together, so that the GDP for Ethiopia and Eritrea was considered that of Ethiopia, taken as a separate country in DHS surveys.

3.5 Country groups

Dynamics of level of education were quite different by country, particularly according to colonization experience. Five large groups were defined, corresponding to the colonizing country, or country of main cultural influence, and closely associated with the main language for formal schooling:

C1: 'British': 14 countries under British influence during colonization, all anglophone;

C2: 'French': 15 countries under French influence during colonization, all francophone;

C3: 'Belgian': 2 countries under Belgian influence during colonization (Congo-Kinshasa and Rwanda), both francophone;

C4: 'Portuguese': 2 countries under Portuguese influence during colonization (Mozambique and Sao-Tome and Principe), both lusophone;

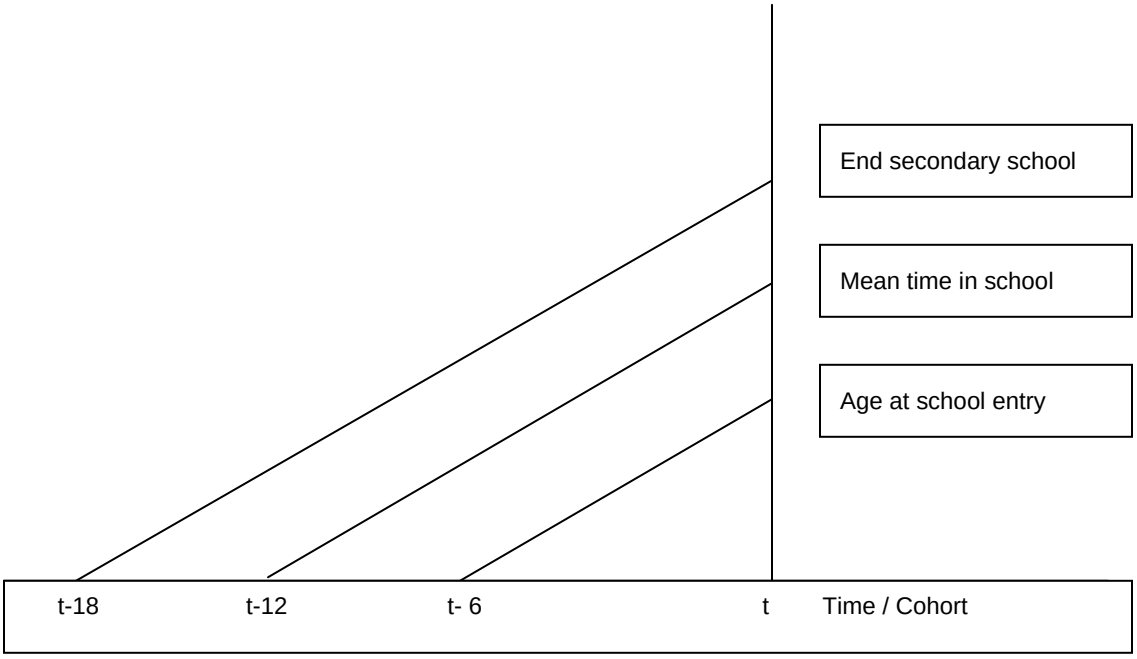
C5: 'Others': 1 country (Ethiopia).

Only the main colonizer was considered in most countries and in mid-period, say around 1930 when modern education began to spread. We ignored the changes that occurred after World War I, that is the shift from German influence to others after 1920. South Africa and nearby countries were classified in the C1 category.

3.6 Cohort and period

Since schooling may last for any duration from 0 to 12 years or more, the relationship between period and cohort indicators is complex. Figure 6 displays this relationship in a Lexis diagram framework, which shows how an event occurring at time (t) might influence the cohorts born 6-18 years before, and potentially any cohort born less than 6 years before if the event has a long-term impact (opening new schools, changing duration of compulsory schooling, etc.). In brief, cohorts born 18 years before are unlikely to be affected by such an event; cohorts born 12-17 years before may be affected if they stay long enough in school; cohorts born 6-11 years before will be affected, and this effect might be large if the proportion of children in school is high; cohorts born after 't-6' are likely to be affected, unless the event has only a short-term effect.

Figure 6. Lexis diagram showing the cohorts likely to be affected by an event



3.7 Correlations with GDP

Two types of correlations of the level of education with GDP per capita were investigated:

Country correlation: the table is ordered by period, and the correlation coefficient is calculated for each period across countries. This allows measuring the changing relationship between education and GDP over time.

Period correlation: the table is ordered by country, and the correlation coefficient is calculated for each country, across periods. This allows measuring the variations of the relationship between education and GDP across countries.

3.8 Multivariate analysis

A variety of multivariate analyses were investigated using standard linear regression (OLS), since the dependent variable is quantitative and continuous. These regressions were run mainly at the aggregate level, where the unit of analysis was the country, the area of residence, and the time period (year). Similar regressions were run for studying the factors of level of education, and for studying its relationships with fertility.

Results

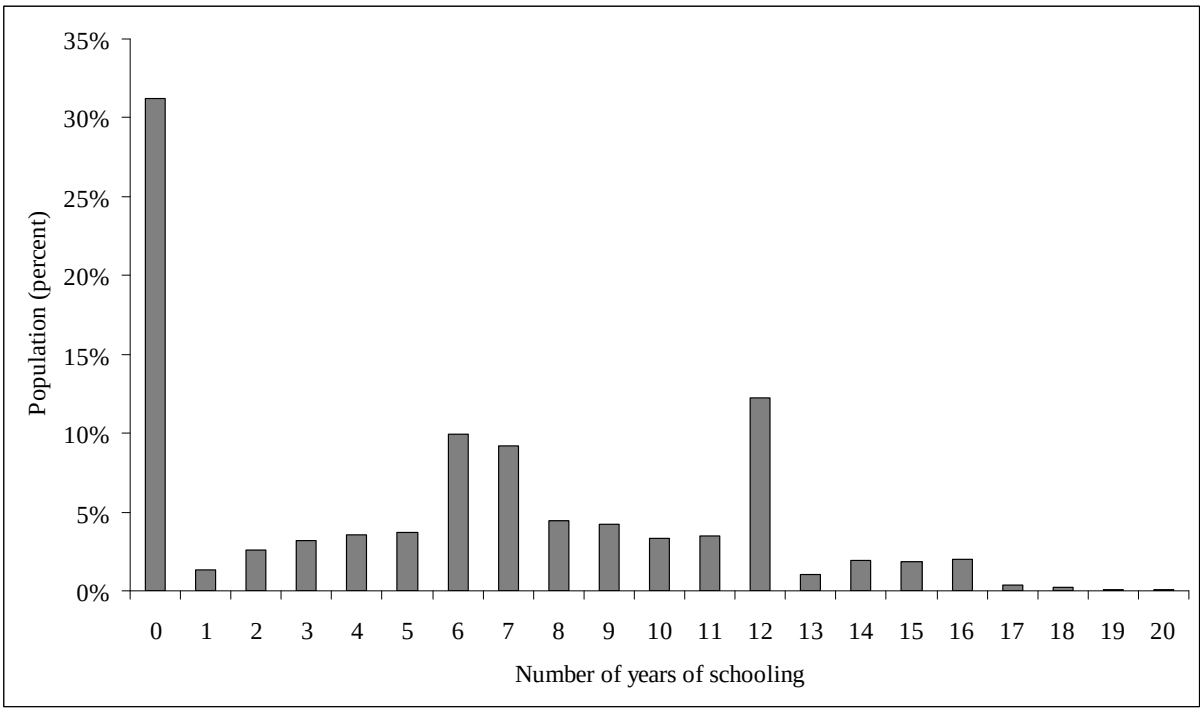
4 Levels of Education in Africa

This section provides an overview on levels of education in Africa, their distributions, and their main statistical features.

4.1 Distribution of years of schooling in Africa

Levels of education are typically erratic, because of the grade/level system (levels are defined by achieving certain grades) and because of regulations (compulsory schooling, level required for certain occupations, etc.) Figure 7 provides the distribution of years of schooling achieved at adulthood for the cohort born in 1970-1979. First, about one-third (31%) of this cohort never attended school. Second, about one in every five adults (19%) finished primary school (6-7 years of schooling in most countries). Then, a group with 12 years of schooling, corresponding to the end of secondary school in most countries, accounts for 12% of the cohort. The intermediate level of adults who stopped in mid-secondary school, a common pattern in many francophone countries, is contained in the 8-10 AYS category shown in Figure 7. Finally, a small group completed higher education, usually 2 to 4 years after secondary school.

Figure 7. Distribution of the number of years of schooling of adults, cohort 1970-1979, 34 African countries



4.2 Standard deviation of AYS

For statistical purposes, it is important to have an estimate of the standard deviation of the average years of schooling, in order to perform statistical testing. Although in most cases this can be done readily from the empirical data, an average for the whole sample is provided below for quick calculation. The

relationship was calculated for each of the 34 countries considered, and for the ten 10-year cohorts to provide a wide range of variations of the level of education. The overall relationship is non-linear, and could be approximated by a hyperbolic curve:

$$SD = \frac{a \times AYS}{1 + b \times AYS}$$

Where SD stands for Standard Deviation, AYS stands for the Average Years of Schooling, and 'a' and 'b' are the two parameters, provided in Table 3.

4.3 Level of education and AYS

Since this study is organized around the concept of AYS, Table 3 also provides the relationship between AYS and the level of education as defined in DHS surveys (HV109), in five categories: incomplete primary, complete primary, incomplete secondary, complete secondary and higher education. These levels include different years of schooling in different countries. For the first level, the same relation was used as that for the standard deviation (hyperbolic relation). For the other levels, a second degree polynomial was used, as:

$$Pct = a \times AYS^2 + b \times AYS$$

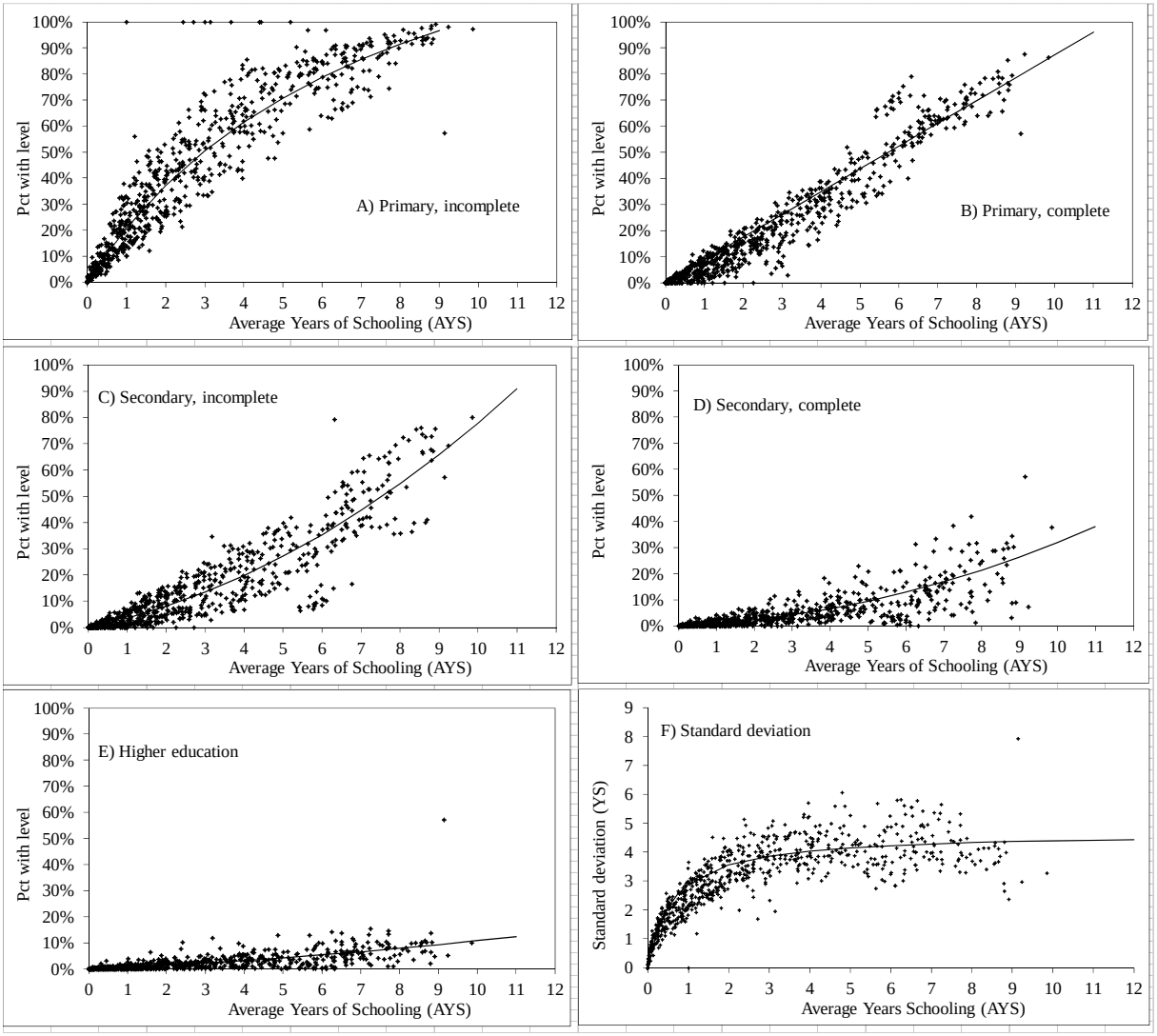
Where Pct stands for the proportion of persons who achieved at least a given level of education, AYS stands for the Average Years of Schooling, and 'a' and 'b' are the two parameter. (See Table 3)

Table 3. Parameters of the relationships of indicators of level of education with AYS (obtained from 84 surveys × 10 cohorts of 10 years)

Variable	Level	A	B	Median	Mean
Level (HV109)	Incomplete primary	0.23428	0.13117	3.0	3.7
	Complete primary	0.08724	0.00000	5.7	6.8
	Incomplete secondary	0.00473	0.03057	7.5	9.2
	Complete secondary	0.00261	0.00578	12.8	12.1
	Higher	0.00048	0.00603		15.2
St. Dev.	Standard deviation	7.54372	1.61917		

Note: Equations are provided in text. The median is computed from the relationships displayed in Figure 8-A to E (median = AYS corresponding to 50% of population achieving at least a given level). The mean of AYS was calculated directly from the data, at each level of HV109.

Figure 8. Relationships of indicators of level of education with AYS (84 surveys × 10-year cohorts)



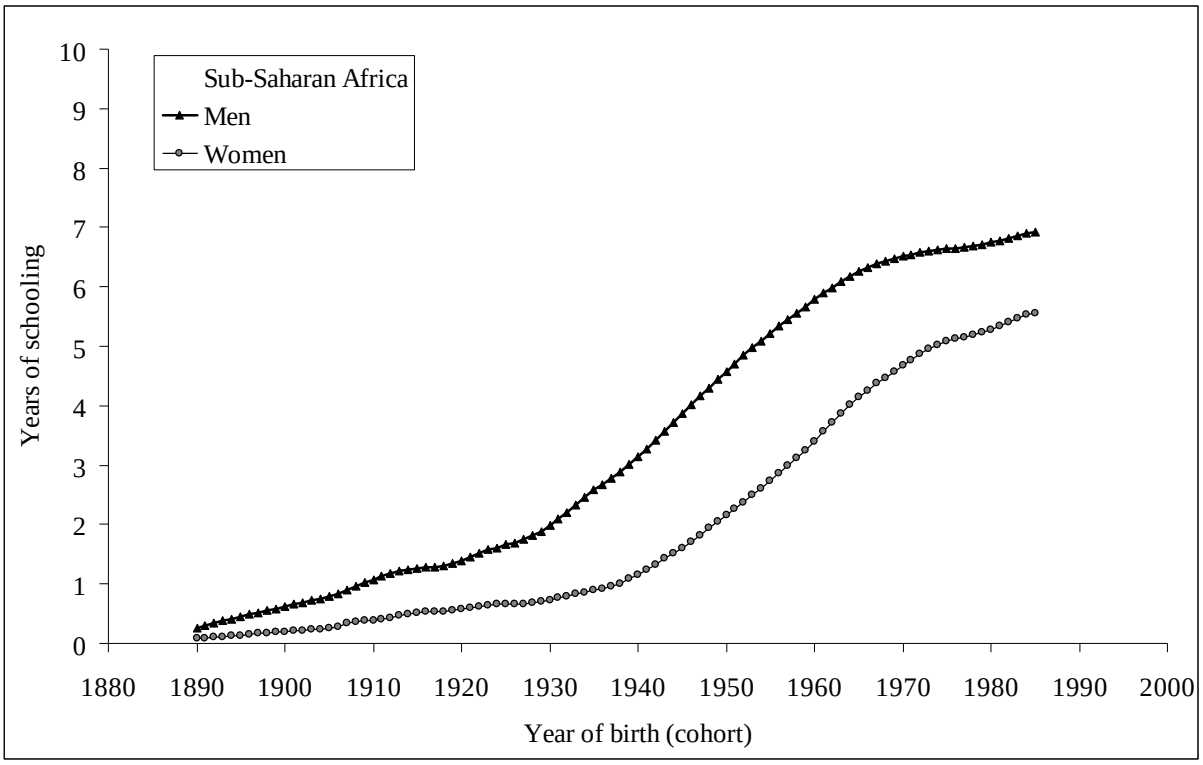
Results show various shapes of the relationships. For "complete primary" the relationship is almost linear, with 6 AYS corresponding to about half the persons who completed primary level, and 10 AYS to almost universal primary level. For "incomplete primary" the relationship is convex, with 3 AYS corresponding to about 50% of adults who had some primary level. For "incomplete secondary" and "complete secondary" the relationship is rather concave. Table 3 provides precise medians derived from the fitting procedure. They compare closely with the AYS computed for each level separately (and not for an "at least level"). Roughly speaking, the five levels of education selected for DHS surveys correspond to mean values of 3, 6, 9, 12, and 15 years of schooling.

5 Cohort Trends and Factors in Level of Education

5.1 Cohort trends in level of education: Africa

On average for the 34 African countries selected for this study, the mean level of education increased rapidly during the 20th century, from nearly no education for those born around 1890 to about 6.2 years of schooling for those born in 1985—that is, roughly speaking, achieving an average primary school level in the course of one century. About half of the population born in 1985 had completed at least primary school by 2005. (See Figure 9)

Figure 9. Reconstructed cohort trends in mean level of education, by sex, 34 countries in Saharan Africa

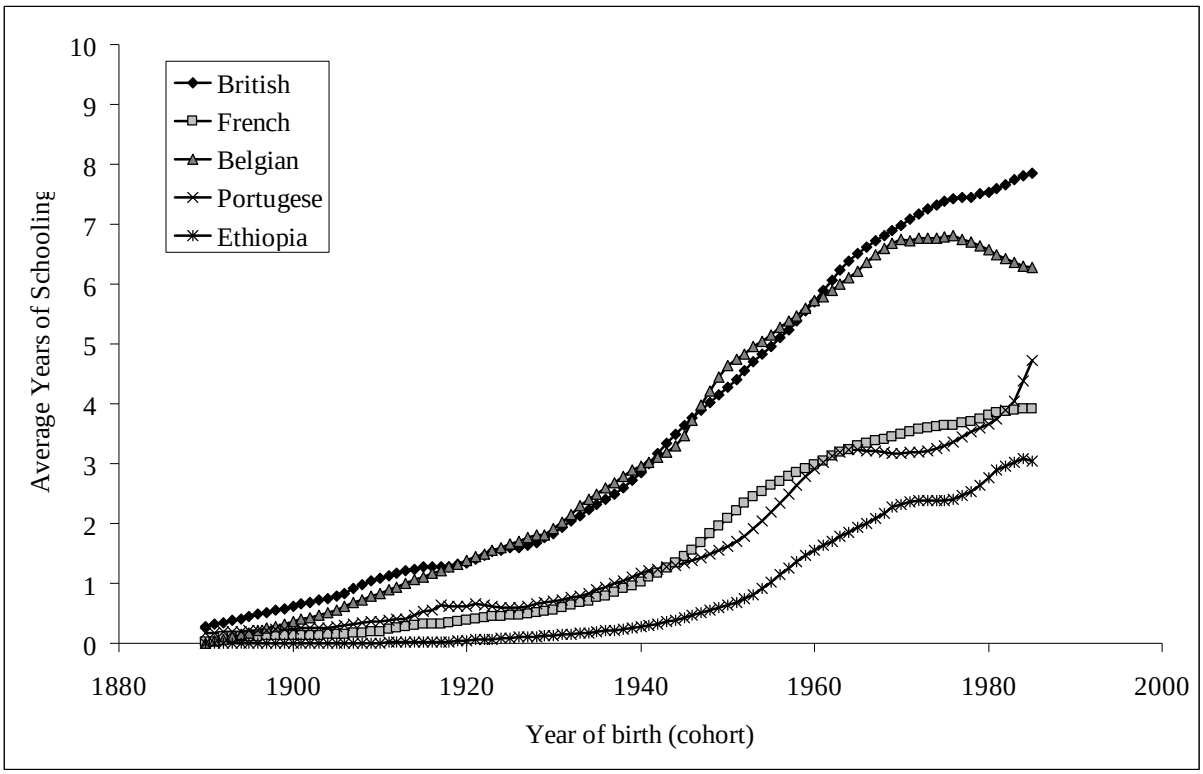


Trends were not regular and were not following a sigmoid curve leading to a maximum of 12 years, as one could have expected. For the continent as a whole, and for men, the increase in level of education was slow for cohorts born before 1930, rapid for those born between 1930 and 1965 (AYS from 2.0 to 6.3), and slow again afterwards, with only minor changes from 1965 to 1985 (AYS from 6.3 to 6.9). For women, trends were similar but delayed by about 10 to 20 years. Changes in level of education were slow before 1940, rapid from 1940 to 1975 (1.2 to 5.1 years), then slow again up to 1985 (5.6 years). As a result of these delayed dynamics, the difference between male and female mean level of education first increased, from 1890 (virtually no gap) to 1954 (2.5 years gap), then decreased steadily, and was reduced by about half by 1985 (1.3 years gap).

5.2 Cohort trends in level of education by culture of colonization

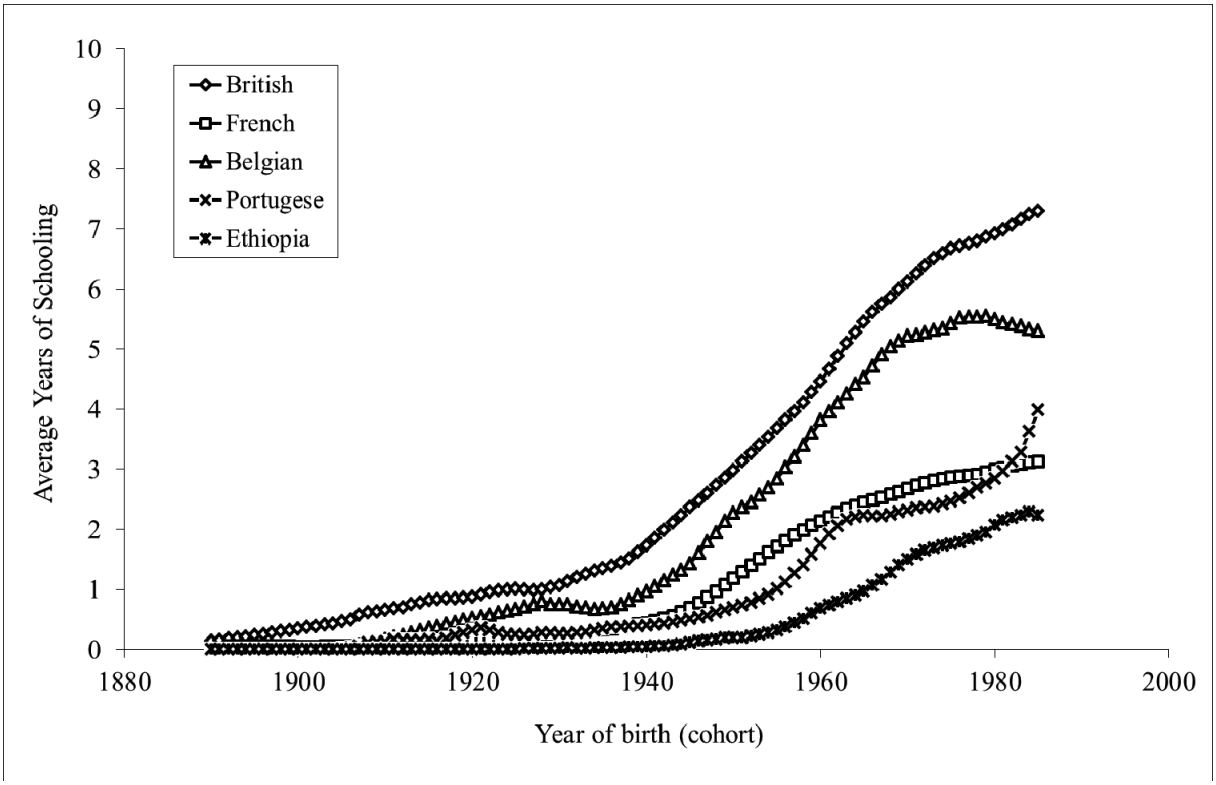
Cohort trends in mean level of education varied by colonial experience. For Anglophone countries, the mean level of education was always higher and the increase steadier compared with other countries, except during the last few years. The two countries colonized by Belgium were doing almost as well until cohort 1970, after which they underwent a severe decline. The countries colonized by France were somewhat behind from 1900 to 1970, despite a significant rise, but the mean level of education stagnated for cohorts born after 1970. For the Lusophone countries, the increase was rapid in the early years but stopped in the early 1960s, to resume again after 1975, corresponding to a difficult decolonization period (1975-1990). In Ethiopia, the mean level of education was very low for a long time, then started rising for cohorts born after 1950, and increased steadily up to the most recent cohort, with a slowing in educational attainment for cohorts born between 1971 and 1976, who were supposed to start school just after the 1975 revolution. (See Figure 10)

Figure 10. Reconstructed cohort trends in mean level of education, by colonial experience, large group of countries, among 34 countries in Saharan Africa (both sexes combined)



The same analysis was repeated for women. Trends for women were similar to those for both sexes combined, as well as the ranking of groups of countries. The only difference was that women in the Belgian group did not do as well as women in the British group, while men were doing as well. (See Figure 11)

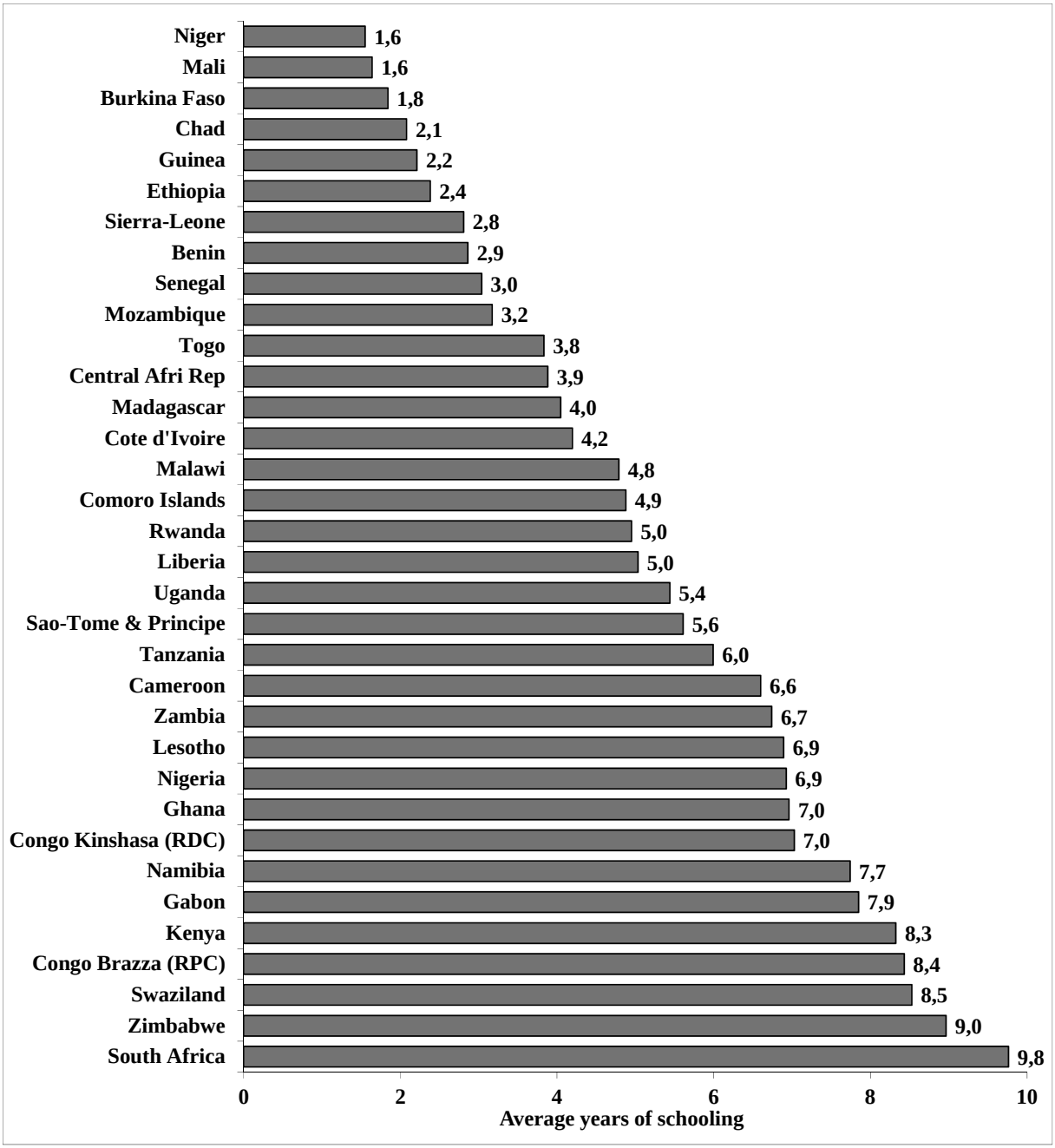
Figure 11. Reconstructed cohort trends in mean level of education of women, by colonial experience, by large group of countries, among 34 countries in Saharan Africa



5.3 Country differences in level of education

Country differences in levels of education were very large. (See Figure 12) The 1970-1979 cohorts were selected as typical cohorts of young adults around year 2000. For these cohorts, the AYS ranged from 1.6 years (Niger, Mali), which are among the lowest values found anywhere in the world, to 9.0 years (Zimbabwe) and 9.8 years (South Africa), which are values often found in European countries. (In UNESCO statistics, for nine European countries the AYS are between 9.0 and 9.9.)

Figure 12. Country differences in mean level of education, both sexes, cohort 1970-1979



Using another indicator of level of education, the proportion of women who completed primary education, gave a similar range of variations, from 9% (Mali) to 86% (South Africa). The ranking of AYS for both sexes and of the proportion of women who completed primary school was also similar (rank test not significant, P= 0.94). Among the notable exceptions were Lesotho, Tanzania, and Madagascar, where females were relatively advantaged compared with males. At the other extreme, in Congo-Kinshasa females were rather disadvantaged compared with males. For the rest of the 34 countries, the differences in ranking, ordered by AYS and by proportions who completed primary school, were small (<= 5 ranks). (See Figure 13)

Figure 13. Country differences in proportion of women who completed primary education

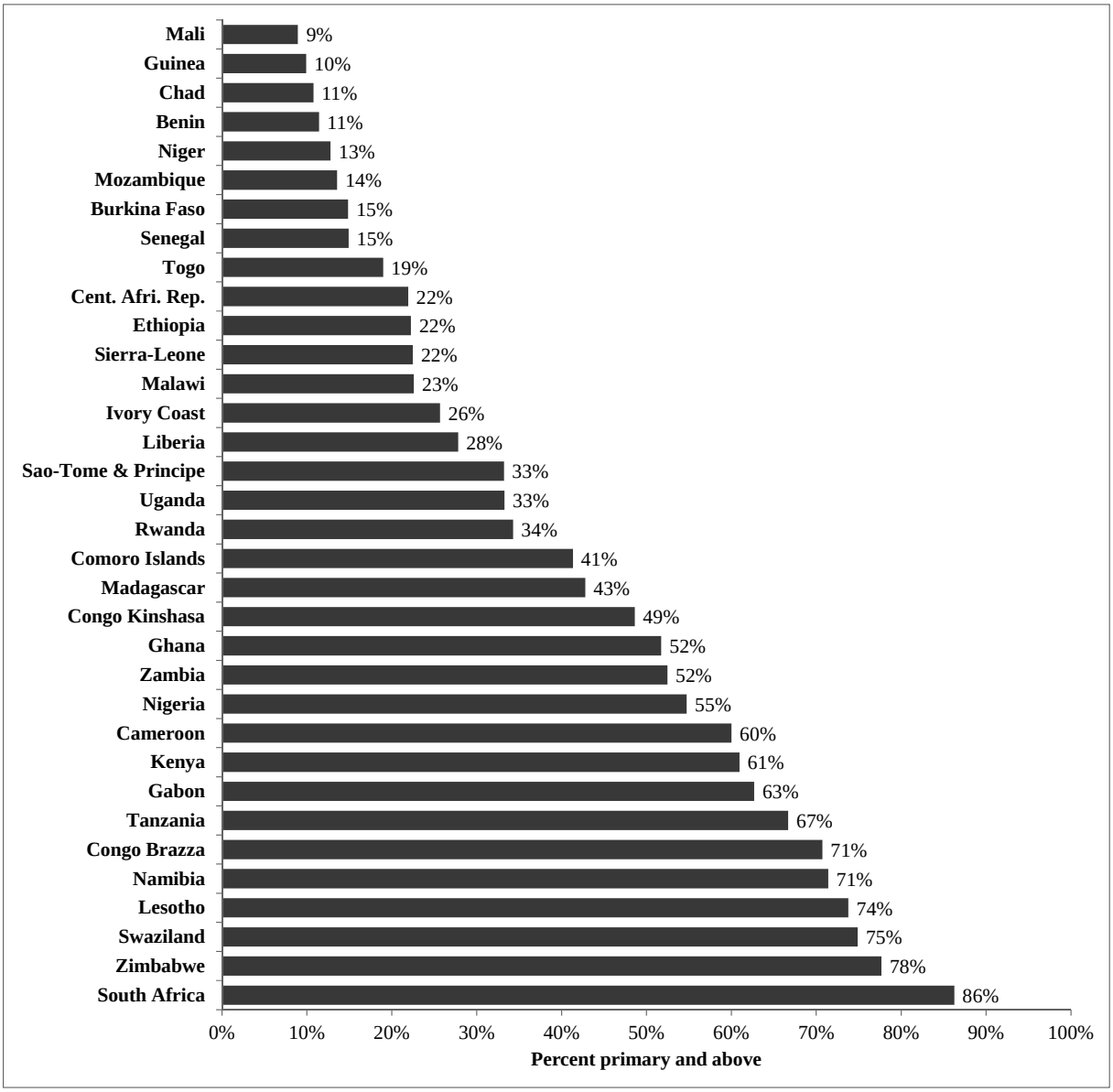
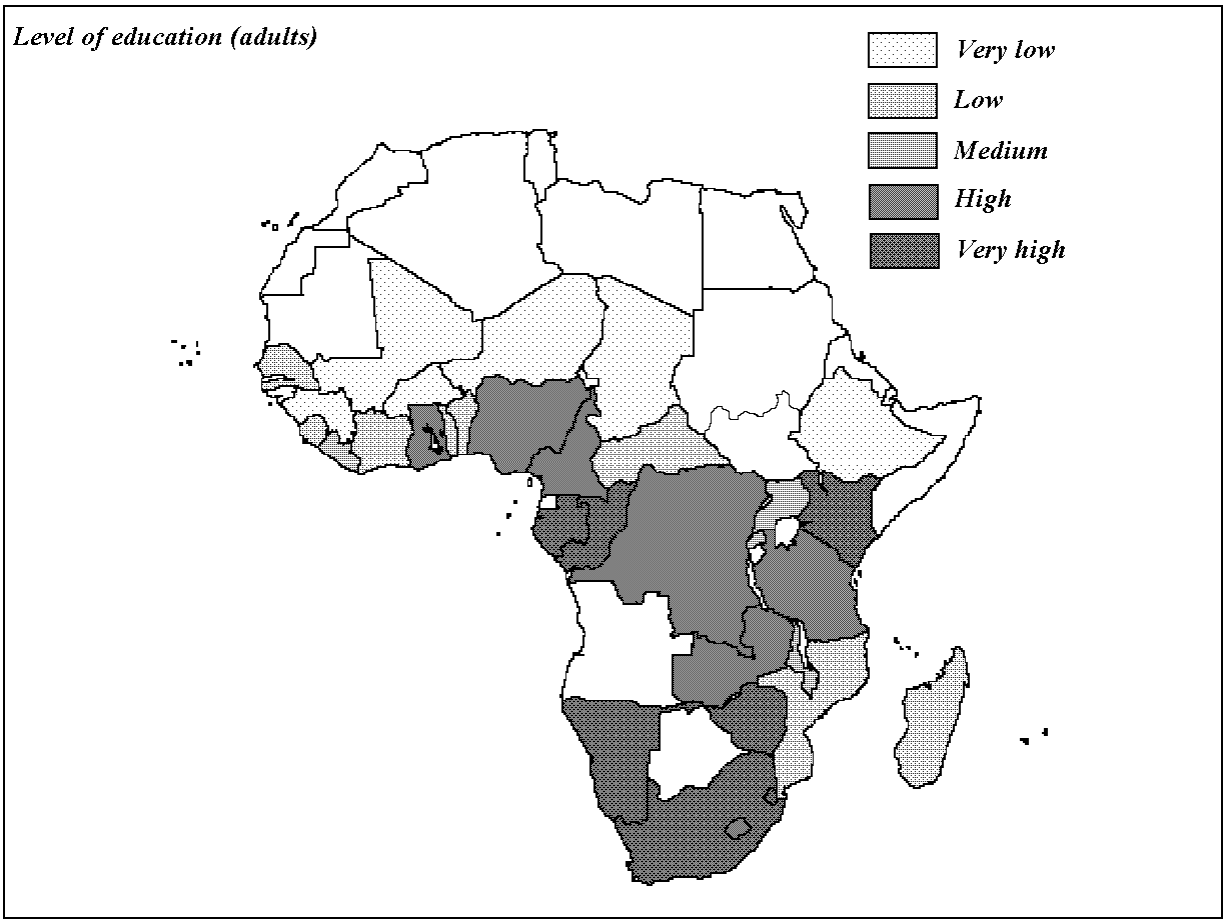


Figure 14 presents a geographical pattern of mean level of education. Countries with the highest level of education were countries located in Southern Africa (South Africa, Namibia, Zimbabwe, Swaziland), two francophone countries in Central Africa (Gabon, Congo-Brazza), and one country in Eastern Africa (Kenya). Then, followed countries with high levels in the intermediate band going from Nigeria to Tanzania, plus Cote d'Ivoire. Countries with the lowest level of education were located in the Sahelian band, going from Mali to Ethiopia, along with contiguous Guinea.

Figure 14. Geographical pattern of country differences in mean level of education, both sexes, cohort 1970-1979.



NB. Countries with no grid were not included in the study

5.4 Sex differences at country level

Sex differences in education also varied dramatically by country, and were the product of the gap between schooling trends for males and for females. In absolute value (difference between average years of schooling), they were highest for countries with fast increase and a large gap (as in the two Congo's), and lowest for countries with a low level of education (as in Niger). Measured in relative terms, as the ratio of the difference between males and females to the average of males and females for the 1950-1959 cohorts, they were highest (ratio > 1) in Chad, Niger, Ethiopia, Liberia, Guinea, Sierra-Leone, Comoro-Islands, Central African Republic, and Mozambique. They were lowest (ratio < 0.5) in most Southern African countries (South Africa, Namibia, Lesotho, Swaziland, Zimbabwe, Zambia), as well as in Gabon and Madagascar.

Four countries, all in Southern Africa, had a higher mean level of education for women than for men in recent cohorts—South Africa (since 1971), Namibia (since 1966), Swaziland (since 1971), and Lesotho (since 1900). In Lesotho the real effect might be exaggerated by migration. Educated men are more likely to work outside the country (mainly in South Africa), and thus women who stay in the country may appear to be even more educated compared with men than they would be otherwise. In any case, in these four countries female cohorts born after 1970 advanced in education more than male cohorts: the mean

schooling gap was around −0.6 years for cohorts 1980-1989, whereas it was +0.7 years 30 years earlier (cohorts 1950-1959) and +0.3 years 60 years earlier (cohorts 1920-1929). (See Table 4)

Table 4. Gap between mean levels of education of men and women, by cohort, selected countries with higher female level of education

	Cohort (year of birth)		
Country	**1920-1929**	**1950-1959**	**1980-1989**
Lesotho	−0.31	−1.41	−1.87
Namibia	+0.48	+0.59	−0.77
South Africa	+0.26	+0.78	−0.57
Swaziland	+0.63	+1.10	−0.05

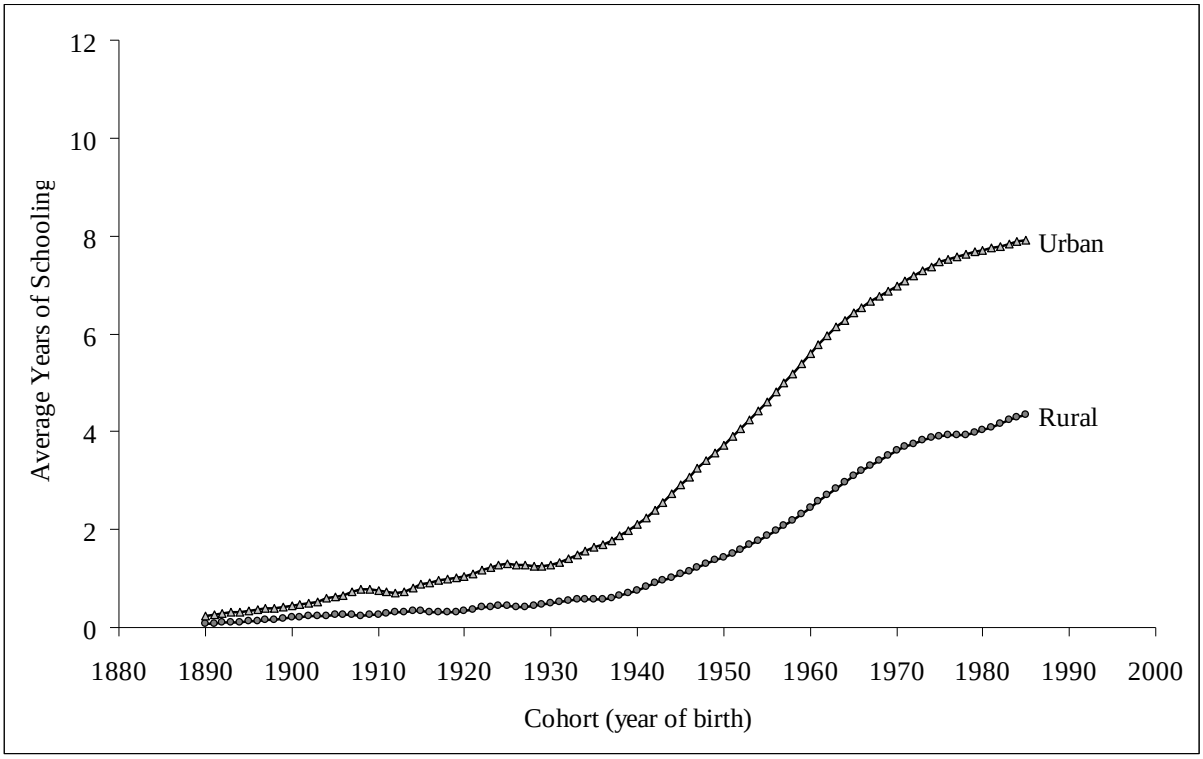
NB. Differences (gaps) are calculated as AYS for males − AYS for females. A negative value means lower level of education for men (higher level of education for women).

5.5 Urban and rural trends in women's level of education

Since the dynamics of the fertility transition differ markedly between urban and rural areas, this study investigated the differentials in level of education by area of residence for adult women. (See Figure 15) Overall for the continent, the mean level of education of women increased earlier and faster in urban than rural areas. By 1985, women in urban areas averaged 8.0 years of schooling, almost twice the level for women in rural areas (4.5 years), meaning that today a large proportion of rural women have not completed primary school, and therefore many remain illiterate.

The education gap between urban and rural areas first increased slowly from 1890 to 1930, then rapidly from 1930 to 1960. Thereafter, it continued to increase slowly to a peak in 1979 (3.7 years gap), and then the gap declined slowly (3.5 years gap in 1990 for the most recent cohort). The stagnation for the recent cohorts seems mostly a feature of urban populations, especially for those born after 1980, whereas the mean level of education continued to slowly increase for rural areas. This could be the effect of structural adjustment policies that aimed to reduce the rural handicap. (Rose 1995)

Figure 15. Reconstructed cohort trends in level of education of adult women, by area of residence, 34 African countries



5.6 Urban-rural differences at the country level

Countries with the largest differentials between urban and rural areas for the 1970-1979 female cohorts had a high level of education in urban areas and a low level in rural areas. Ethiopia had the largest differential (5.5 years gap), followed by selected countries in West Africa: Liberia, Sierra Leone, Nigeria, and Burkina Faso (gap from 3.8 to 4.4 years), and by selected countries in Central and Eastern Africa: Congo-Kinshasa, Uganda, and Malawi (gap from 3.7 to 4.2 years). In contrast, the lowest education differentials between urban and rural areas for the same cohorts were either in countries with a high level of education in both urban and rural areas or in countries with a low level in both urban and rural areas. The lowest gap was found in Sao-Tome and Principe (1.0 year gap), followed by selected countries in Southern Africa: South Africa, Lesotho, Swaziland, and Zimbabwe (gap from 2.1 to 2.3 years); and by selected countries elsewhere: Mali, Madagascar, Tanzania, Chad, and Cote d'Ivoire (gap from 1.9 to 2.1 years).

5.7 Country dynamics in level of education

The dynamics in level of education varied markedly by country, for both sexes, and for both areas of residence, depending on a variety of factors, including public and private investments, local culture and religion, development of urban and rural areas, level of income, etc. Rather than trying to provide a full typology of these complex dynamics, the study analyzed some key features, below.

a) Early starters (cohorts 1910-1919)

Some countries started early providing modern education to children, so that cohorts born in 1910-1919 already had an average level far above zero. These countries are mostly in Southern Africa, and many are mining countries and countries with a sizeable population of European origin: above all South Africa (3.9 average years of schooling), Zimbabwe (1.9 years), Lesotho (1.8 years), Swaziland (1.0 years), Namibia (1.4 years), Malawi (1.2 years), Zambia (1.1 years), and Congo-Kinshasa (1.1 years), to which Madagascar should be added (1.1 years). Another group was somewhat less advanced but still above zero, all Anglophone countries: Ghana, Nigeria, Kenya, Tanzania, and Uganda (AYS ranging from 0.7 to 1.0).

b) High achievers (from cohort 1930 to cohort 1980)

Countries that made the most impressive progresses between cohort 1930 and cohort 1980 were similar to the early starters, and most reached the highest levels in recent cohorts. These were, ranked by order of increase in AYS between 1930 and 1980: Kenya (+6.8 years), Swaziland (+6.7 years), Gabon (+6.7 years), Congo-Brazza (6.5 years), Nigeria (+6.3 years), Zimbabwe (+6.2 years), Namibia (+5.9 years), Cameroon (+5.8 years), South Africa (+5.5 years), Ghana (+5.3 years), Zambia (+5.1 years), and Congo-Kinshasa (+4.8 years). In contrast, many other countries made only little progress, with an increase in AYS ranging from 1.6 to 2.7 years over the 50 years. Many were Sahelian countries: Chad, Ethiopia, Burkina Faso, Mali, and Niger, as well as Togo, Sierra Leone, and Madagascar. Madagascar was the only country among the early starters that did not achieve a high level of schooling by 1980.

c) Regular increase

Only a few countries had a regular or quasi-regular increase in level of education over a long period of time: Namibia, South Africa, and Uganda. It is possible that in South Africa a short regression of the mean level of education occurred early, for men born between 1919 and 1924, and for women born between 1923 and 1928, but this point would require further investigation with more precise data. Note that the level of education continued to increase in Uganda even during the troubled years under Idi Amin Dada (1971-1979).

d) Cases of stagnation or regression

For the other countries (31 of the 34 studied), there were periods during which the mean level of education stagnated or even regressed for a few years, for men, women, or both, and for cohorts born after 1930. Most of these periods occurred in the 1960s and 1970s, with a mean of 1971 and a range from 1954 to 1985 for the date of onset of the troubled period. Surprisingly, the periods were not the same for men and women. There were more cases of stagnation or regression for men (31/34 countries) than for women (25/34 countries); the date of onset was somewhat earlier for men (1968) than for women (1973); the duration was longer for men (10.9 years) than for women (6.6 years); and the magnitude of the regression measured by the difference in average years of schooling (end – beginning) was more pronounced for men (–0.4 years) than for women (–0.1 years). Some cases of stagnation or regression were short-lived, that is less than 5 years (5 cases for men, 7 for women), but many lasted for 15 years or more (11 cases for men, 5 cases for women).

Long periods of stagnation or regression were usually associated with civil wars, political instability, or economic recession, although the relationships between political and economic crises and level of education appear to be complex.

Two surprising cases stand out among the many cases of stagnation or regression, which have some similarities in the magnitude of the regression and its rationale not counting their geographic proximity:

Congo-Brazza and Gabon. In both countries, both former French colonies of Central Africa, the level of education began to rise rather late (around cohort 1920-1930 for men and cohort 1940 for women) and increased rapidly for about 30 years, reaching a high peak in the 1960s for men (10.1 years and 8.5 years respectively) and in the 1970s for women (7.7 years and 7.5 years respectively), far above the African average. However, in both countries the level of education regressed afterwards for a long period of time. In Congo-Brazza, the regression lasted 24 years for men, with a loss of 1.9 years (1961-1985), and lasted 8 years for women, with a small loss of 0.1 years (1977-1985); in Gabon the regression lasted 16 years for men, for a loss of 0.7 years (1964-1980), and 9 years for women, with a loss of 0.4 years (1971-1980). In Congo-Brazza, the regression in men's level of education occurred long before the economic recession in the country from 1984 to 2000; however, this recession could explain the regression in level of education among women. In Gabon, the economic recession affected the country from 1976 to 1987, and could explain some of the regression for women, but less so for men.

The other cases of long-lasting stagnation or regression in level of education are easier to understand. Liberia and Congo-Kinshasa went through troubled times with major economic recession and civil wars; Zambia and Madagascar went through major economic crises due to an external shock (Zambia) and severe mismanagement (Madagascar); Tanzania and Guinea remained poor and endured severe mismanagement; Zimbabwe went through several political crises, at the time of independence, and later due to severe mismanagement. These case studies would require further detailed investigation, beyond the scope of this study.

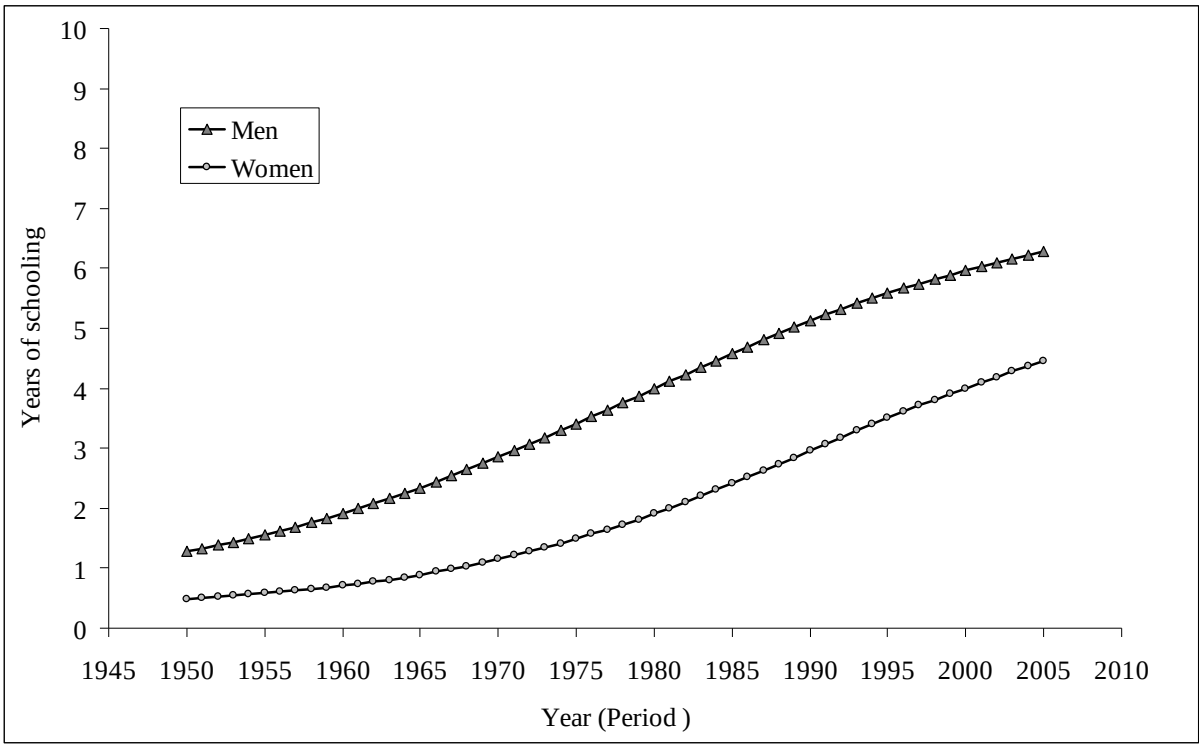
6 Period Trends in Level of Education and Relationships with GDP

The relationships between level of education and income per capita, measured by the Gross Domestic Product in Purchasing Power Parity per capita (GDP-PPP) are complex, bi-directional, with an age pattern and with a time lag. The level of education of adults of working age (taken here as age 20-59) has an effect on GDP, since more educated persons tend to have a higher economic productivity. In turn, higher GDP at time 't' usually implies a higher investment in education for school age children (taken here as age 6-18 at time 't'). This section briefly investigates these relationships for the 1950-2005 period. Details of the reconstruction of the cohort and period levels of education were presented above. (See § 3.2)

6.1 Period trends, active population

The reconstructed period trends in the average years of schooling of adults age 20-59 (the labor force) were regular, as expected since they are the product of cohort trend and age structure, so that erratic cohort patterns tend to be smoothed out by the age structure. For African men, the AYS increased from 1.3 to 6.3 years from 1950 to 2005, and for women from 0.5 to 4.5 years over the same period. (See Figure 16)

Figure 16. Period trends in average level of education, adults age 20-59, Africa

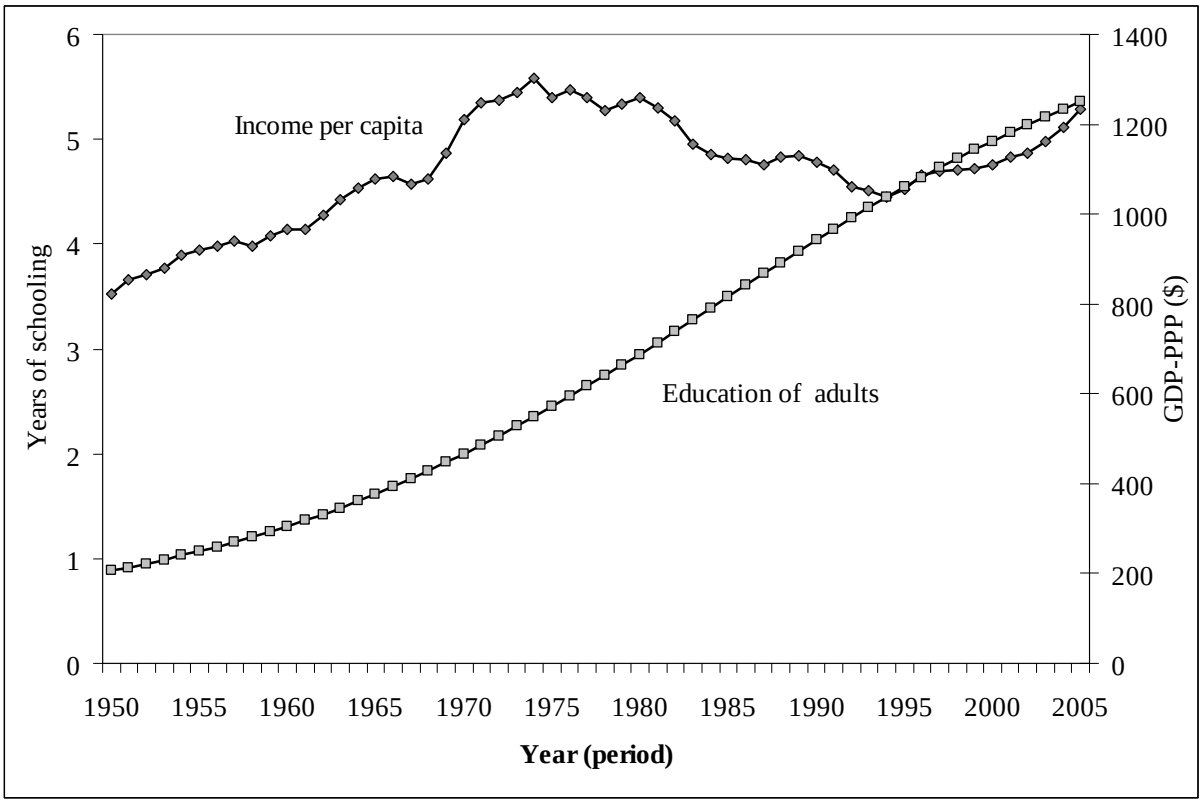


Since the level of education tended to increase earlier for men than for women, the gap between them first tended to increase, to a maximum of 2.2 years in 1985-1989. Thereafter, women's level of education tended to catch up, so that the gap fell to 1.8 years in 2005, and has continued to decline since.

6.2 Relationship of GDP with the level of education of the adult population

The overall trends of GDP per capita and level of education of the adult population were discordant. Whereas trends in the AYS of the labor force for both sexes combined were steady, trends in GDP per capita were erratic, with ups and downs, for numerous reasons—in particular the oil shocks in 1973 and 1979, widespread state mismanagement, and numerous economic and political crises due to external or internal reasons. (See Figure 17)

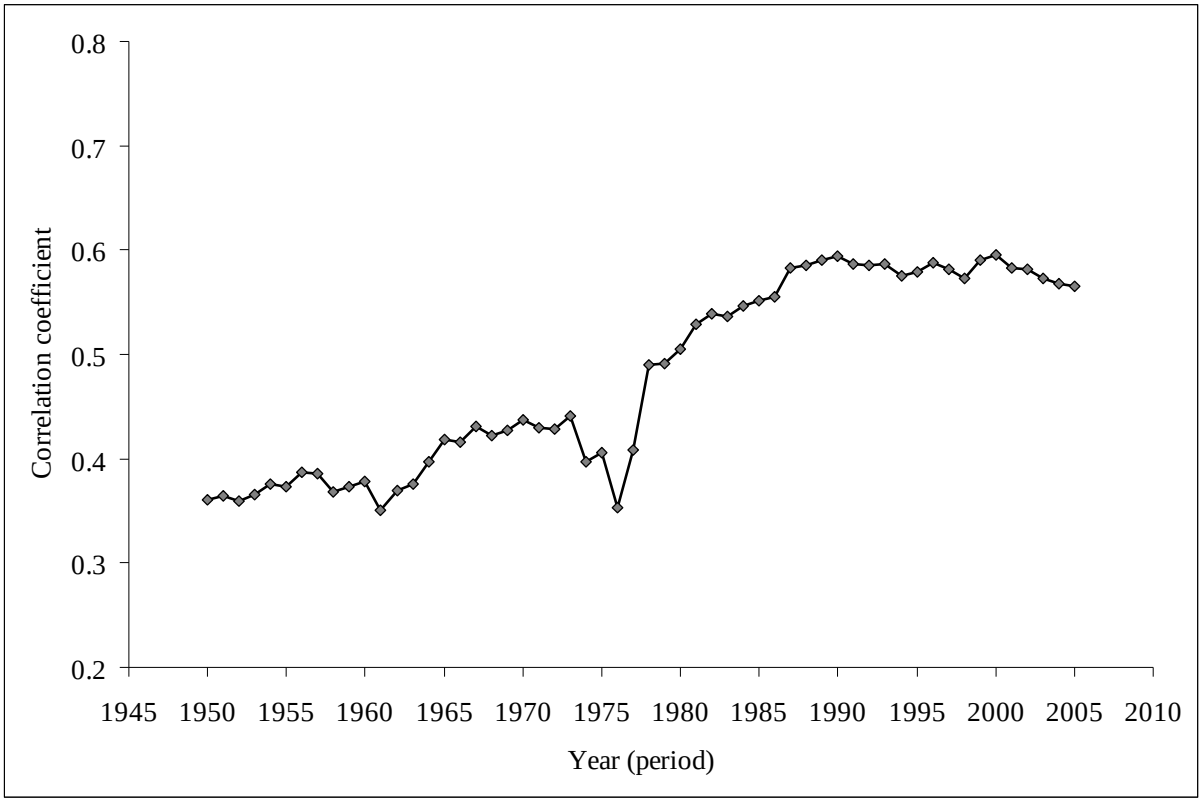
Figure 17. Period trends in income per capita and level of education, adults age 20-59, Africa



As a result, the country correlation between income per capita and level of education changed over time. The correlation coefficient between GDP-PPP and AYS was never high. Surprisingly, it was already low in 1950 (ρ= 0.36), tended to increase up to 1973 (ρ= 0.44), collapsed at the time of the first oil shock (ρ= 0.35), recovered and tended to increase despite the continuing recession, then peaked in 1990 (ρ= 0.59) and remained roughly steady with a mild declining trend. (See Figure 18)

The correlation between changes in income per capita and changes in level of education during the three main periods (1950-1973, 1973-1990, 1990-2005) were even more surprising. The correlation during the first period (1950-1973) was moderate (ρ= +0.44), meaning that countries with a higher increase in level of education also had a higher increase in income per capita. However, this correlation became negative in the second period (1973-1990) (ρ= −0.22), which was a period of recession, suggesting that countries with a higher increase in level of education suffered even more from the recession, probably because they were more vulnerable. In the last period (1990-2005), the correlation became again positive, but very low (ρ= +0.11), suggesting substantial independence between both trends. This pattern matches the earlier observation of countries with a stagnating level of education despite an increase in income per capita in recent years.

Figure 18. Country correlation between income per capita and level of education of adults age 20-59, Africa



The time correlation by country for the whole period 1950-2005 was also surprising. The overall correlation was positive and moderate (ρ= +0.46), meaning that with time both education and income increased. However, differences by country were striking, with a range of correlation coefficients from +0.99 (Lesotho) to −0.95 (Central African Republic). In fact, there were almost as many countries (16 of 34) where the correlation was negative as countries (18 of 34) where it was positive. Among the countries with the lowest negative correlation were those where level of education increased while income per capita decreased, the most striking case being Congo-Kinshasa. Among countries with the highest positive correlation were those where both income and education increased steadily over time, even at very low levels, as in Mali, Guinea, and Burkina Faso. All these observations indicate substantial independence between the dynamics of level of education and income per capita

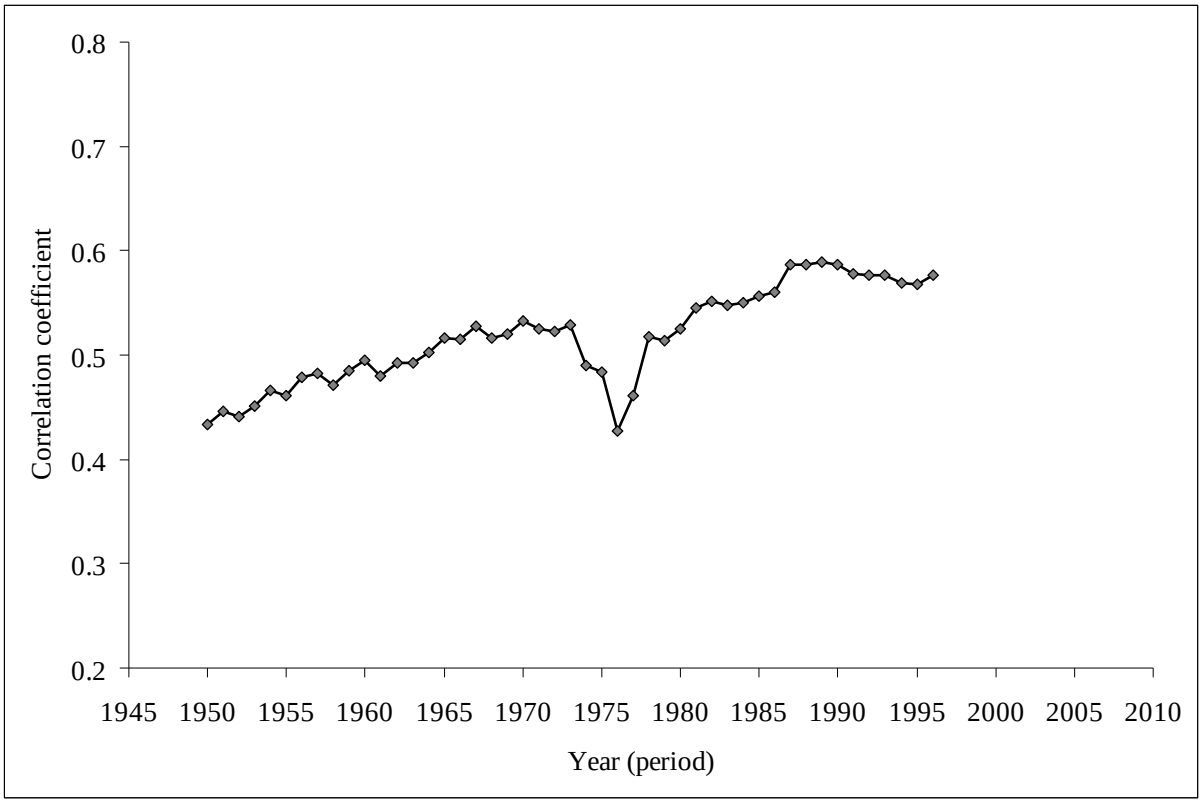
6.3 Relationship of level of education with GDP at time when cohorts were of school-age

In this section, income per capita at time (t) is correlated with the level of education of cohorts who were of school age at the same time (t). This procedure was developed to investigate the other relationship, that of investment in children associated with level of income per capita. Calculations were done the same way as for adults. The level of education of cohorts age 6-17 years at time (t) was calculated using the age structure of the population age 6-17.

Results indicate a pattern of increasing country correlation over time, with a major divergence at the time of the first oil shock, as income decreased while investment in education continued. (See Figure 19)

Time correlations by country also ranged from high positive values (+0.97 in Swaziland) to very low negative values (−0.66 in Central African Republic), in a pattern similar to that for adults. This seems to be due to the same reason—that is, independence between investments in education and fluctuations in income per capita.

Figure 19. Country correlation between income per capita and level of education of cohorts when they were of school age, Africa



7 Period Trends in Level of Education of Fertile Women and Relationships with Fertility

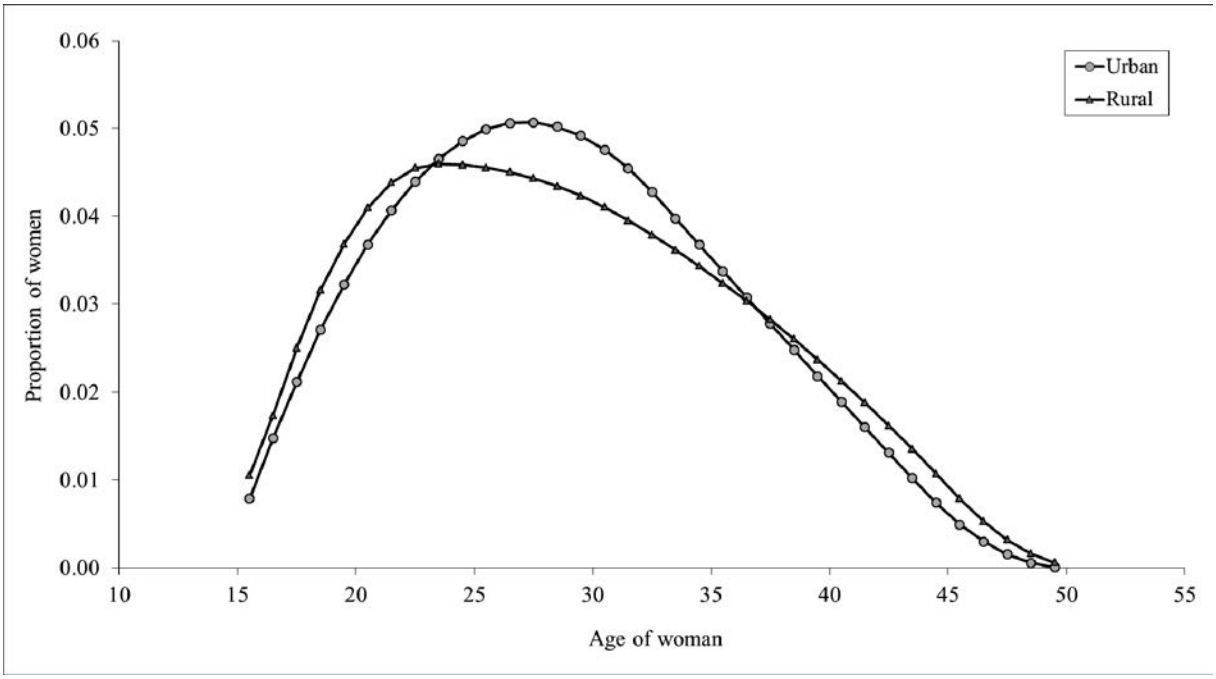
The previous chapter showed a substantial independence between long-term trends in education and long-term trends in income per capita, whether education was considered as a factor of economic growth or whether income per capita was considered as source of financing for education. This section analyzes similar correlations in trends in education and trends in fertility. Another report has analyzed the correlations between trends in fertility and trends in income per capita using the same data, also in a longitudinal perspective (Garenne 2008). The previous study showed that both trends not only were largely independent but also were related in an unexpected direction: from a long-term perspective in Africa (1950-2005), fertility increased when income per capita increased (1950-1975), but declined during the following recession (1975-1995), and continued to decline when income started to increase again after 1995. This pattern reflects the fact that in the first period improving health of mothers led to increasing fertility, but then after 1975 the development of family planning programs led to decreasing fertility, whether or not income increased or decreased, as women were better able to space and limit births.

This section focuses on trends in education and fertility by country, in urban and rural areas separately. Here again, the level of education is taken as the average years of schooling of women who deliver in a given year. (See § 3.3 for details.)

7.1 Age pattern of fertility in urban and rural areas

The age pattern of fertility was different in urban and rural areas, with consequences for the computation of the level of education of fertile women. Childbearing was earlier among women in rural areas, with a peak at age 23 due to early marriage, and later in urban areas, with a peak at age 27 due to later marriage. (See Figure 20)

Figure 20. Average age pattern of fertility in Africa



The mean age at childbearing varied by country and by area of residence. (See Table 5) The mean age at childbearing was 28.9 in urban areas and 29.1 in rural areas, a gap of 0.2 years. The mean age at childbearing ranged from 27.4 (Gabon) to 30.8 (Rwanda) in rural areas, and from 27.5 (Kenya) to 30.3 (Rwanda) in urban areas. The gap between urban and rural areas ranged from -1.1 year (Namibia) to 0.9 years (Sao-Tome & Principe). All these differences in age patterns of fertility were taken into account, since the age pattern of fertility was calculated in each country for each area of residence separately.

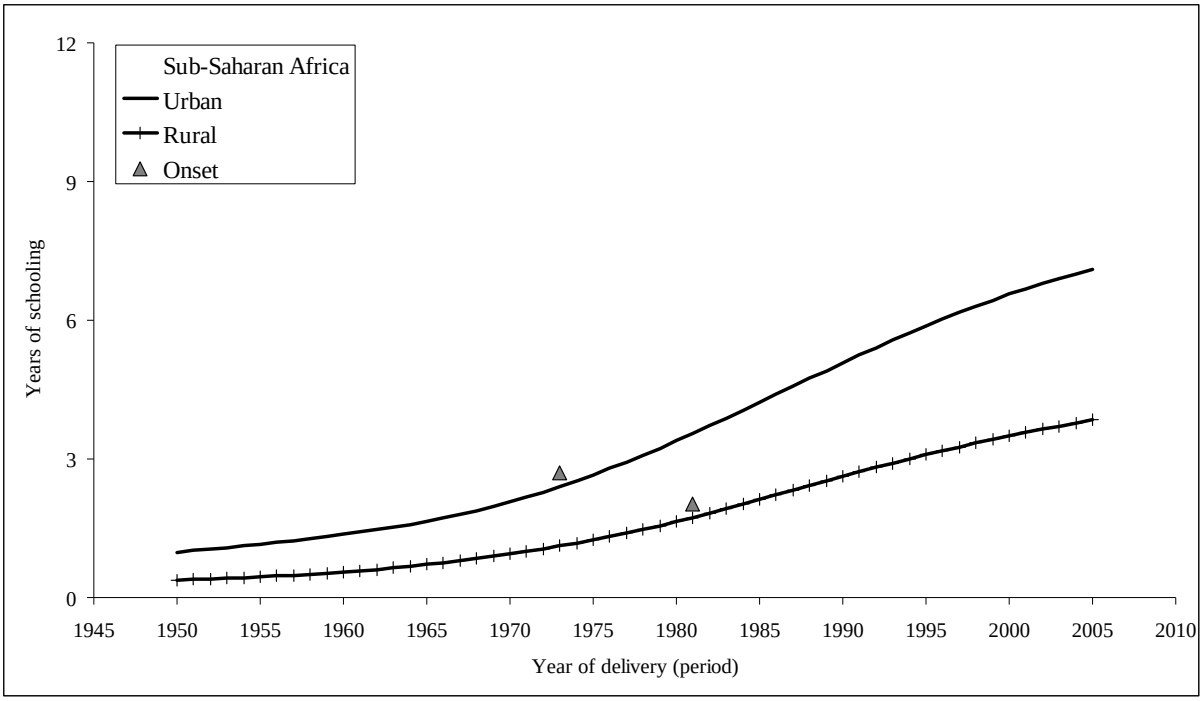
Table 5. Mean age at childbearing, 34 African countries

	Urban	Rural	Gap Urban–Rural
Mean age at childbearing	28.9	29.1	-0.2 years
Min	27.4	27.5	-1.1 years
Max	30.8	30.3	+0.9 years

7.2 Period trends in level of education of fertile women

The reconstruction of trends in level of education of fertile women indicates a steady improvement over the study period (1950-2005). For the continent as a whole, the average years of schooling of fertile women increased from 1.1 in 1950 to 7.4 in 2005 in urban areas, and from 0.4 to 3.8 in rural areas. The onset of fertility decline in urban areas, on average, occurred in 1973 at a relatively low level of education (3.0 AYS), and in rural areas, on average, in 1981 at an even lower level of education (1.7 AYS) (See Figure 21). At this level of education, a majority of women are still illiterate.

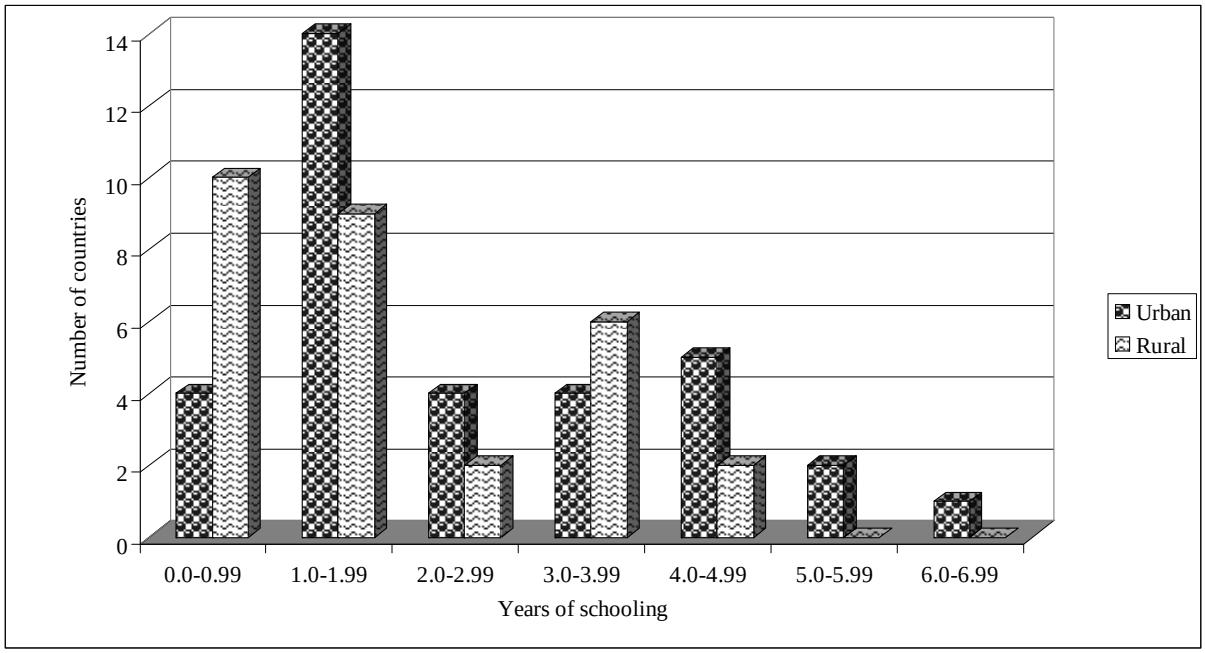
Figure 21. Trends in mean level of education of fertile women, 34 African countries



7.3 Level of education at onset of fertility decline

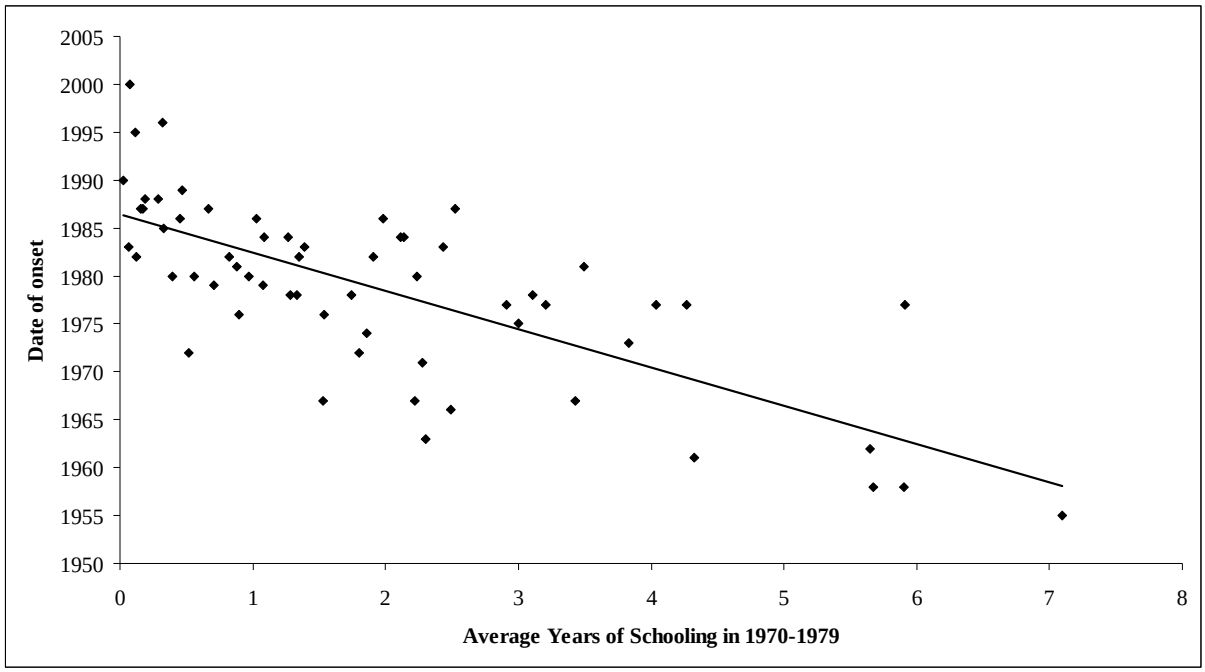
The mean level of education of fertile women could be computed at the time of onset of fertility decline for each country and each area of residence. (See Annex B for details of each country.) Results show a wide variety of situations. In most cases the onset of fertility decline occurred at an average level of education below 3 years, and in only one case in urban areas (Lesotho) it occurred at a level above 6 years, when about half of women are still illiterate. (See Figure 22)

Figure 22. Distribution of level of education of fertile women at onset of fertility decline, 34 African countries



There was a negative correlation between the date of onset of fertility decline, ranging from 1955 (South Africa, urban) to 2000 (Chad, rural), and the level of education achieved at mid-period, here taken as 1970-1979—the 10-year period just preceding the average date of onset of fertility decline (1979). This was true both in urban areas ($\rho = -0.69$) and in rural areas ($\rho = -0.68$). However, the overall correlation hides large differences by country. For instance, even at a low level of education (say AYS= 2), the time lag between dates of onset of fertility decline of earlier starters and later starters could be as much as 30 years. If most early starters (onset < 1965) had a relatively high level of education (AYS> 4), this was not the case for Rwanda, urban (onset in 1963, AYS= 2.3), and a few others. Likewise, if most countries with very low level of education in 1970-1979 started a fertility decline late (after 1980), some started somewhat earlier, as for Niger, urban (onset in 1972, AYS= 0.5). On average, an increase of 3 years in AYS leads to a 12-year earlier onset of fertility decline, which corresponds, on average, to improvements in education made over 33 years in Africa. Above all, this correlation seems to mean that countries that were more advanced in the development of their education systems were also more advanced in the fertility transition. (See Figure 23)

Figure 23. Correlation between date of onset of fertility decline and level of education of fertile women in 1970-1979, 34 African countries

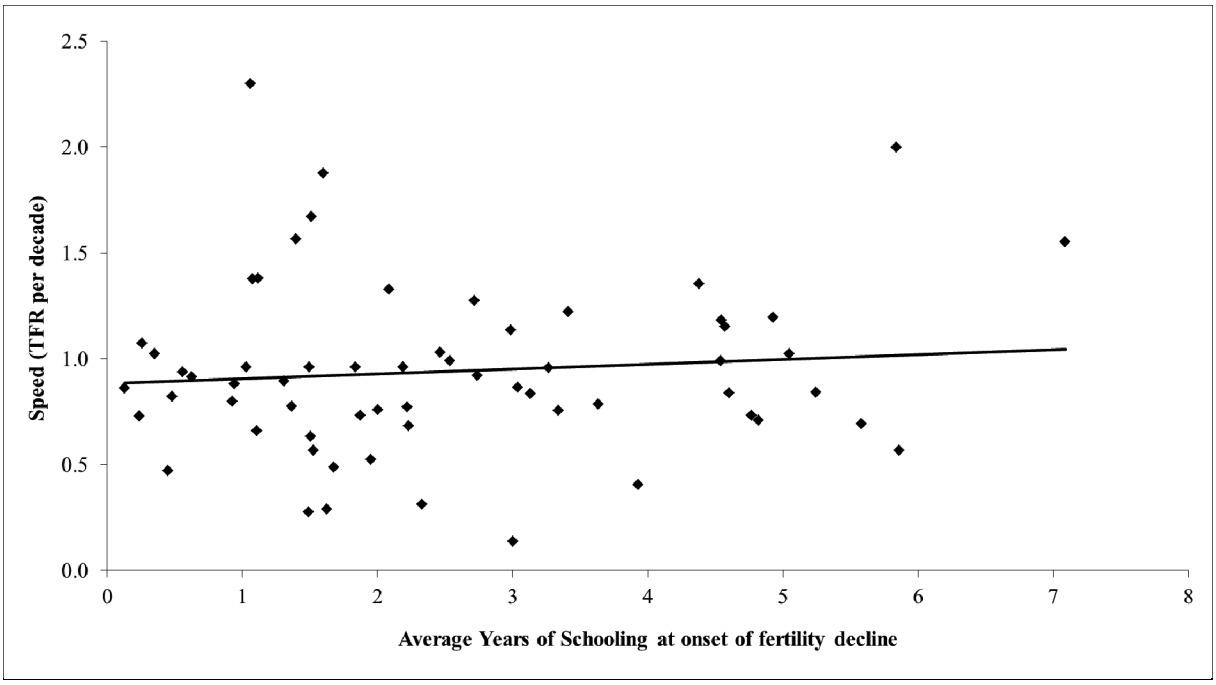


7.4 Level of education and speed of fertility decline

The speed of fertility decline was computed as the change in TFR from the date of onset of the fertility decline to the last point available, expressed in number of children per decade. The average duration covered was 25 years (32 years in urban areas, 24 years in rural areas). An average speed of 1.0 implies an average decline of –1 child per decade (for instance, from a TFR of 6.0 to 5.0 children per women between 1980 and 1990). The average speed for the 34 countries together was 0.58 children per decade (0.61 in urban areas, 0.39 in rural areas), with major variations by country and area of residence. The variation in speed ranged from 0.14 children per decade (Zambia, rural from 1980 to 2007) to 2.0 children per decade (Gabon, urban from 1985 to 2000).

The speed of fertility decline was not correlated with the level of education at onset ($\rho = +0.05$), and this was true in both urban areas ($\rho = -0.02$) and rural areas ($\rho = -0.11$). Even at a low level of education one could find a fast fertility decline, as in Ethiopia, urban (education= 1.1 AYS; speed= 1.9 children per decade), and even at high level of education one could find a slow fertility decline, as in Congo-Kinshasa (education= 5.0 AYS; speed= 0.7 children per decade). This result, which might seem surprising at first glance, indicates that numerous factors other than education operate to accelerate or to slow the fertility transition. (See Figure 24.)

Figure 24. Correlation between speed of fertility decline and level of education of fertile women at onset, 34 African countries



7.5 Level of education and fertility stalls

Several cases of fertility stalls have been documented in Africa, the stall being defined as a period during which fertility stayed steady or increased after a period of fertility decline. (Garenne 2009 and 2011). There has been some controversy about the case definition, the periods of the fertility stalls, and even the countries where they occurred. Thus this analysis is restricted to well documented cases with statistically significant stalls. (See Garenne 2011 for details)

Periods of fertility stalls were documented in five urban and six rural areas. They usually occurred after periods of fast fertility decline (average speed= –1.5 child per decade), faster than the average for Africa for the 1990-2005 period (average speed= –0.7 child per decade). The periods before the stall (period of fast fertility decline) were associated with periods of rather rapid increase in education (average of +1.35 AYS per decade), whereas periods of fertility stall were associated with periods of slower increase in education (average of +0.83 AYS per decade). This was true in 10 of the 11 documented cases, with the sole exception of Nigeria, rural, where the change in level of education was the same before and during the stalling period. The difference in changing level of education was particularly marked in urban areas of Ghana and Kenya, and in rural areas of Kenya, Madagascar, Rwanda, Tanzania, and Zambia. (See Table 6)

Table 6. Fertility and education before and during periods of fertility stalls

		Period of fertility stall		Changing fertility		Changing education	
Country	**Area**	**Begin**	**End**	**Before**	**During**	**Before**	**During**
Ghana	Urban	1998	2005	–1.20	+0.23	1.49	0.46
Kenya	Urban	1994	2002	–1.43	+0.39	1.88	1.22
Kenya	Rural	1994	2002	–2.12	+0.27	1.89	1.10
Madagascar	Urban	1988	1994	–1.10	+0.70	1.29	1.16
Madagascar	Rural	1988	1998	–0.80	–0.18	0.94	0.37
Nigeria	Rural	1988	1998	–3.97	+0.72	1.25	1.30
Rwanda	Urban	1989	1997	–3.05	+0.59	1.78	1.50
Rwanda	Rural	1997	2005	–1.20	+0.65	1.20	0.54
Senegal	Urban	2002	2005	–0.69	+0.82	0.68	0.45
Tanzania	Rural	1996	2005	–0.47	–0.02	1.46	0.62
Zambia	Rural	1997	2005	–0.64	+0.64	0.97	0.37
Average				–1.51	+0.44	1.35	0.83

Note: Change in fertility = change in TFR per decade; Change in education = change in AYS per decade. Fertility stalls are truncated to 2005 because the study of level of education stops that same year. Some stalls continued afterwards.

7.6 Stalls in level of education and fertility changes

This section analyzes the situations where the decline in cohort level of education was so pronounced that it induced a stagnation, or at least a much slower increase, in the period level of education of fertile women, labeled here “education stalls”. Nine case studies were selected, all of them in rural areas.

On average for these nine case studies, the change in the AYS during the selected periods (+0.46 years per decade) was less than half of what it was in the preceding 15-year period (+1.14 years per decade). However, this did not seem to have an impact on fertility trends. For the average of the nine countries, the fertility decline during the education stall periods (–0.56 children per decade) was rather faster than the average for Africa (–0.46 children per decade). In most countries it was not possible to assess whether the fertility changes were different before and during the education stall periods because the fertility transition had not yet started or had lasted for too short a period. In only two cases was there a discernable effect. In rural Rwanda, fertility change during the education stall period (–0.49 children per decade) seemed to be smaller than before, but was still quite rapid for rural areas. In Tanzania, rural, the fertility seemed to have stalled during the education stall period, but this could be fortuitous. In conclusion, the slowing in change of the level of education since 1990 in rural areas seems so far to have had no visible impact on fertility trends, and even in cases of severe reversal of cohort level of education the effect on period level of education was small and the effect on fertility so far was nil, with the possible exception of Tanzania. (See Table 7)

Table 7. Fertility and education before and during periods of education stalls

		Period of education stall		Changing education		Changing fertility	
Country	**Area**	**Begin**	**End**	**Before**	**During**	**Before**	**During**
Cameroon	Rural	1990	2005	1.14	0.49		–0.44
Central African Rep.	Rural	1990	2005	0.49	0.25		–1.00
Comoro Islands	Rural	1995	2005	1.19	0.74		–0.46
Congo-Brazza	Rural	1995	2005	1.87	0.62		0.15
Gabon	Rural	1990	2005	1.70	0.41		–0.40
Madagascar	Rural	1990	2005	0.89	0.19		–1.07
Mali	Rural	1990	2005	0.30	0.10		–1.22
Rwanda	Rural	1995	2005	1.18	0.64	–1.04	–0.49
Tanzania	Rural	1995	2005	1.52	0.67	–0.51	–0.07
Average				1.14	0.46		–0.56

Note: Change in fertility = change in TFR per decade; Change in education = change in AYS per decade. Fertility trends are truncated right at last point available and left at the beginning of the fertility decline. Missing values for fertility in the 'before' period were due to the fact that fertility decline started too late to be investigated.

8 Synthesis: Multivariate Analysis

This chapter is devoted to multivariate analysis of earlier results. It focuses on aggregate level regression analysis. (See Methods section § 3.9)

8.1 Main factors of level of education of adults age 20-59

Main factors of period level of education of adults of both sexes achieved at time (t) were investigated at the country level. They include: time trend (year or period), income per capita (in Log of GDP-PPP), urbanization (in proportion urban), religion (percent Muslim or Christian), and culture of colonization (coded as dummy variables with 'British' as reference category).

Results indicate that all factors were highly significant, with the exception of percent Christian. (See Table 8) There was a positive time trend in addition to a positive relationship with income per capita and with urbanization. Percent Muslim had a strong negative effect on level of education. Compared with British culture, all the others were doing less well in educational attainment, although the effect of Belgian colonization was less pronounced (–0.5 AYS instead of –1.5 to –1.9 in the other categories). This is mostly due to the high level of education in Congo-Kinshasa, despite a low level of development.

Table 8. Coefficients of regression model on level of education of adults age 20-59 (AYS), 34 African countries, 1950-2005 period

	Factor	Coefficient	Standard Error	P-value	Signif.
Baseline	Constant	–122.6470	2.9946	3.7E–263	*
Development	Time period (year)	0.0622	0.0015	2.2E–271	*
	Income per capita (Log)	0.3939	0.0403	4.9E–22	*
	Urbanization (%)	4.0243	0.2027	8.1E–80	*
Religion	Islam (%)	–1.8505	0.0931	4.5E–80	*
	Christianity (%)	0.0801	0.0886	3.7E–01	NS
Culture of	Belgian	–0.5064	0.0847	2.6E–09	*
colonization	French	–1.5036	0.0446	9.2E–196	*
	Portuguese	–1.5216	0.0809	1.6E–72	*
	Ethiopia	–1.8994	0.1128	2.1E–59	*
	British (Ref.)				

8.2 Net effects of factors of level of education of fertile women

The same regression model was run on the level of education of fertile women, for urban and rural areas separately. The net effect was measured by the effect of one standard deviation of each independent variable for quantitative variables, and as the elasticity for the dummy variables describing the culture of colonization. (See Table 9)

Table 9. Net effect of selected factors on level of education of fertile women (AYS), 34 African countries, 1950-2005

		Fertile women			
	Factor	Total	Urban	Rural	Signif.
Baseline	Constant (AYS)	1.89	3.23	1.69	*
Development	Time period (year)	+1.01	+1.75	+1.01	*
	Income per capita (Log)	+0.43	+0.51	+0.46	*
	Urbanization (%)	+0.23			*
Religion	Islam (%)	–0.58	–0.72	–0.58	*
	Christianity (%)	–0.13	–0.16	+0.00	NS
Culture of	Belgian	–0.74	–1.03	–1.03	*
colonization	French	–1.41	–2.11	–1.34	*
	Portuguese	–1.57	–2.70	–1.46	*
	Ethiopia	–1.58	–2.06	–1.79	*
	British (Ref.)				

Note: Net effect = that of one standard deviation for quantitative factors (development and religion) and elasticity for qualitative factors (culture of colonization). (*) P values significant at P< 0.05

Among indicators of development, time period and urbanization were more important, while income per capita played a much smaller role. For both sexes combined, one standard deviation of time (16.2 years) induced an increase of 1.0 AYS, and the effect was even more pronounced for urban women (1.75 AYS). One standard deviation of proportion urban (14.2%) induced an increase of 0.43 AYS, whereas one standard deviation of Log(GDP) (0.60), corresponding to 83% higher income, induced an increase of 0.23 AYS only. Cultural factors were surprisingly important. Compared with countries colonized by or under

the influence of Great Britain, all the others were doing less well with regard to education of women, even after controlling for time trend, income per capita, urbanization, and religion. Countries colonized by France were disadvantaged: elasticity was −1.41 AYS for all women, and even more for urban women (−2.11 AYS). In comparison, francophone countries colonized by Belgium (Congo-Kinshasa and Rwanda) were doing somewhat better. Countries colonized by Portugal were also doing poorly, as was Ethiopia. Religion also had an effect, with Muslim countries seriously disadvantaged. The effect of one standard deviation of proportion Muslim (31%) was large (−0.58 AYS), and even larger for urban women (−0.72 AYS). Countries from Sahelian West Africa had many of these risk factors: low income per capita, low level of urbanization, high proportion Muslim, and French colonization, which explains their lower level of education. Regression coefficients were all highly significant ($P< 10^{-6}$), with the exception of proportion Christian, which was significant only for urban women ($P< 10^{-4}$). The differences in coefficients for 'French' and 'Belgian' were all significant at $P< 0.01$.

8.3 Factors of fertility decline

Similar regression models were run on the relationship between education and fertility. The dependent variable was the total fertility rate (TFR), by country and year, and the independent variables were the level of education of fertile women (AYS) plus the same development and cultural variables as in the previous regression model. When using the whole sample, the coefficient of time trend was positive, reflecting the improvement in the health situation of African women after 1950, and in particular the decrease in infertility. Therefore, the analysis was restricted to the period after the onset of the fertility transition, since the aim of the study was to document the factors of the fertility decline. Table 10 displays results for the whole model, including urban and rural areas.

Table 10. Coefficients of regression model on fertility (TFR), 34 African countries, period from onset of the fertility transition to year 2005

	Factor	Coefficient	Standard Error	P-value	Signif.
Baseline	Constant	112.6096	5.7972	4.4E–70	*
Development	Time period (year)	–0.0524	0.0029	5.0E–64	*
	Education (AYS)	–0.1747	0.0204	4.7E–17	*
	Income per capita (Log)	–0.3154	0.0495	3.0E–10	*
	Urbanization (%)	–1.6094	0.1830	7.6E–18	*
Religion	Islam (%)	1.9019	0.1105	2.6E–57	*
	Christianity (%)	1.2214	0.0807	4.5E–46	*
Culture of	Belgian	0.2535	0.1060	1.7E–02	*
colonization	French	0.0155	0.0567	7.8E–01	NS
	Portuguese	0.1439	0.0870	9.8E–02	NS
	Ethiopia	–0.4694	0.1542	2.4E–03	*
	British (Ref.)				

The four development variables had a negative effect—that is, they induced a decline in fertility. Among the cultural variables, all had a positive effect after controlling for time trend, education, income per capita, and urbanization, with the exception of the last coefficient, which reflects the rapid decline of fertility in urban Ethiopia, despite a low level of development. The effect of religion was large, and 100% Muslim implies a higher TFR by 1.9 children. This was mostly due to very early marriage among Muslim

populations. The effect of other cultural variables was minimal, inducing a small decimal change in the TFR (from 0.1 to 0.3).

8.4 Net effect of female education on fertility in urban and rural areas

The same regression model was applied to urban and rural areas separately in order to better capture the different dynamics of both areas of residence. Here again, the period was restricted to the years after the onset of the fertility transition, separately in each area. The level of education was that of fertile women.

The role of independent variables was quite consistent in the three models, indicating that the same factors were operating in urban and rural areas. In urban areas, the effect of time period, education, and income per capita were somewhat stronger, reflecting the faster changes in the cities. The effect of religion was similar in urban and rural areas. The effect of cultural variables was more complex. The coefficient for the 'French' group was negative for urban areas and positive for rural areas, possibly reflecting the somewhat faster fertility decline in urban areas of francophone Africa. A similar finding occurred in Ethiopia, reflecting the rapid decline in urban fertility (urban Ethiopia had a TFR below replacement fertility in 2005). The effect of cultural variables was not significant in rural areas.

The effect of one standard deviation of each development variable (net effect) remained small. A 10.4 year time lag induced a change of –0.63 children in TFR; a 1.9 increase in AYS induced a change of –0.21 children in TFR; an increase of +0.62 in Log(GDP) induced a change of –0.29 children; an increase of 14% in proportion urban induced a change of –0.19 children in TFR. (See Table 11)

Table 11. Net effects of various factors on fertility (TFR) from regression models, 34 African countries, period from onset of the fertility transition to year 2005

	Factor	Total	Urban	Rural
Baseline	Constant	6.14*	5.22*	6.49*
Development	Time period (year)	−0.54*	−0.73*	−0.59*
	Education (AYS)	−0.35*	−0.52*	−0.36*
	Income per capita (Log)	−0.20*	−0.33*	−0.16*
	Urbanization (%)	−0.23*		
Religion	Islam (%)	+0.56*	+0.49*	+0.54*
	Christianity (%)	+0.40*	+0.41*	+0.45*
Culture of colonization	Belgian	+0.25*	+0.63*	+0.18
	French	+0.02	−0.11*	+0.14
	Portuguese	+0.14	+0.44*	+0.03
	Ethiopia	−0.47*	−1.30*	+0.04
	British (Ref.)			

Note: Net effect = that of one standard deviation for quantitative factors (development and religion) and elasticity for qualitative factors (culture of colonization). Level of education of fertile women. (*) P< 0.05

8.5 Reconstructing the net effect of factors of the fertility transition

This last regression model allows a description of a full-scale fertility transition, where the TFR would decline by five children (say from seven to two children per women). Assuming that during this period the AYS would increase by 6 years (say from 2 to 8 AYS), the income per capita would grow at 3% a year, and urbanization would increase by 40% (say from 20% to 60%), all realistic values, then the transition would take about 50 years. According to this transition, the time trend would explain 62% of

the decline, and the other three factors would explain the rest, almost equally: 13% for education, 14% for income, and 11% for urbanization. These seem realistic values, underlying once more the rather small role of trends in education in the fertility decline. The effect of the time trend could be explained by exogenous factors, and in particular by family planning programs and by changing attitudes and behavior. (See Table 12)

Table 12. Reconstruction of a full fertility transition combined with development

Factor	Begin	End	Change	Net effect	Percent
Time trend (year)	1980	2030	50.8	–3.081	62%
Education (AYS)	2.0	8.0	6.0	–0.662	13%
Log(GDP)	6.5	8.0	1.5	–0.703	14%
Pct Urban	20%	60%	40%	–0.553	11%
Change in TFR	7.0	2.0	–5.0	–5.0	

Note: Computations from coefficients in Table 11

Note also that, given the regression coefficients found above, none of the factors other than the time trend could *per se* induce a full transition. They would require totally unrealistic values, whereas even without economic development, urbanization, and change in education, the transition would take place within about 80 years.

9 Reconciling Longitudinal and Cross-Sectional Approaches

The longitudinal analysis showed that trends in education had a very minor effect on fertility trends. This finding contrasts with a widespread literature on cross-sectional studies showing almost universally large differentials in fertility levels with levels of education. This section illustrates the difference between the two approaches and shows the potential danger in making conclusions on the fertility transition from cross-sectional approaches only.

A simple way to illustrate the difference in the two approaches is to assume two groups, one educated the other one uneducated, who undergo the fertility transition at the same speed, with a time lag. During the course of the transition, the cross-sectional differentials appear high, although they are not different before and after the transition. But the two groups undergo the same phenomenon, so that education is not a determinant of the fertility transition, but simply a source of delay and therefore a source of differentials.

9.1 The case of Zimbabwe

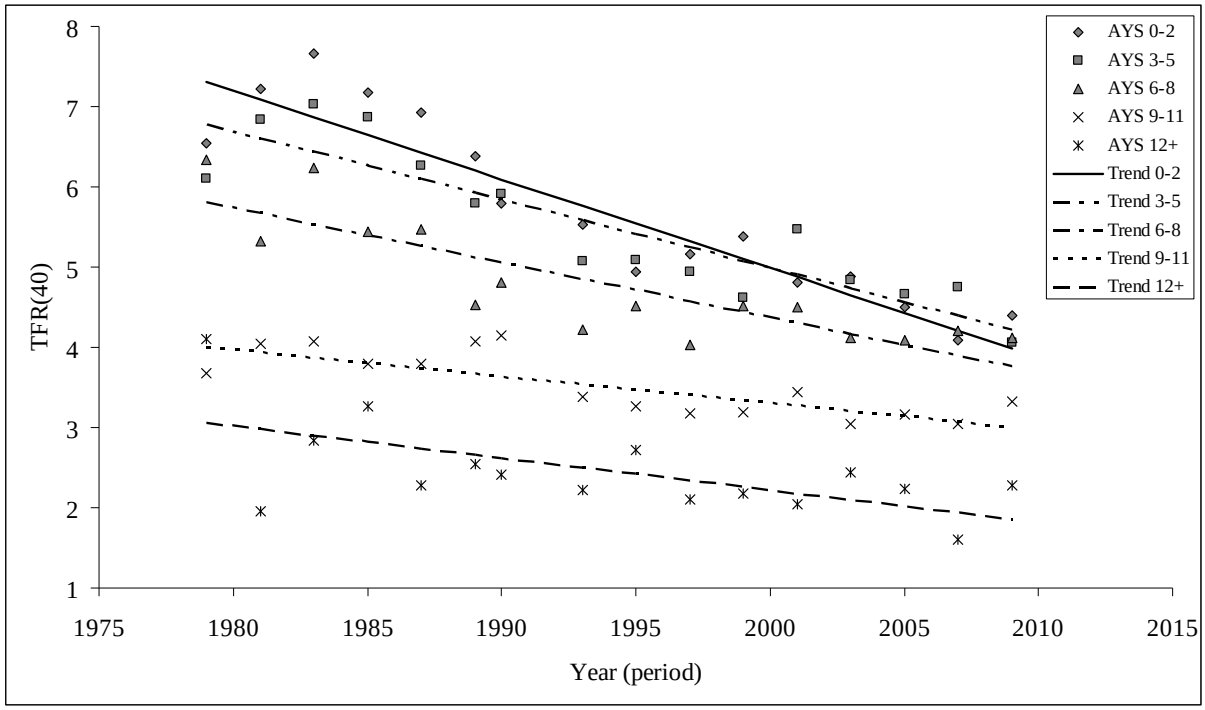
To illustrate this point, we reconstructed fertility trends in Zimbabwe by level of education for the 1978-2009 period, using data from the DHS surveys conducted in 1988, 1994, 1999, 2005, and 2010. The method is the same as that presented earlier for reconstructing trends by area of residence (urban and rural) (Garenne 2008). In brief, age-specific fertility rates were computed for the 10 years before the survey, and cumulated to compute the total fertility rate by age 40, noted as TFR (40). The five surveys were merged by adding births and person-years for each age group and for each calendar year. Five categories of level of education were selected, defined by years of schooling: 0-2 (very low), 3-5 (low), 6-8 (medium), 9-11 (high), and 12+ (very high). Results show precisely the point made above. The fertility transition is similar among the five groups, with similar slopes (same speed) and a time lag between the

five groups (different time of onset). As a result, at any point in time the more educated women have a lower fertility since they are more advanced in the course of the transition. (See Figure 25)

By 1978, the 'very high' and 'high' categories were already quite advanced, with a TFR(40) of 3.1 and 4.0, respectively, while the medium category had just started the transition, with a TFR(40) of 5.8, and the other two categories were still close to natural fertility, with a TFR(40) of about 7. By 2009, the 'very high category' was below replacement fertility, with a TFR(40) of 1.9, the 'high' category was getting close, with a TFR(40) of 3.0, the 'medium' category was underway, with a TFR(40) of 3.8, and the other two categories were similar, with a TFR(40) of 4.1, far below the TFR 30 years before.

The fertility transition could be better expressed as a time lag than by fertility differences, since all five groups seem to undergo the same phenomenon. There was a time lag of about one generation (30 years) between the 'very high' and the 'high' groups, also about one generation (25 years) between the 'high' and 'medium' group, and about half a generation (15 years) between the 'medium' group and the two 'low' and 'very low' groups. If anything, the transition seem to have accelerated over the period considered, and it appears rather faster for the 'low' and 'very low' groups, although data are lacking for making precise comparisons at the same level of fertility.

Figure 25. Reconstructed fertility trends by level of education, Zimbabwe 1978-2009



In any case, the Zimbabwe case study shows that the fertility transition is similar at all levels of education, and that the time lag explains most fertility differentials observed in cross-sectional studies.

Discussion

Fertility Transitions in Africa

Fertility transitions everywhere affect all social groups, all social classes, rich and poor, and people at all levels of education. This fact has been well documented in Europe, say between 1850 and 1930 (Coale and Watkins 1986; van de Walle and Knodel 1980). This seems also to be the case throughout the developing world, and Africa appears to be no exception, even though the transition among the least educated groups is still recent in sub-Saharan Africa and is far from being completed. In most sub-Saharan countries the transition is well advanced, and in some cases has already been completed among the most educated groups. The transition has started among other groups as well. These facts suggest that it is likely to follow the same path toward replacement fertility, even in poor countries with low levels of education.

In this respect, the hypothesis by Caldwell (1980) that universal primary education, or 'mass formal schooling', was a prerequisite for fertility decline is not verified in the African data. In most African countries fertility declined when far fewer than half of women knew how to read and write. In fact, on average, at time of onset of fertility decline (in 1979) women's mean level of education was only 2.2 AYS, which corresponds to only 18.8% of women with complete primary schooling, and to 2.5% with complete secondary schooling. This observation definitely refutes Caldwell's argument, which was purely hypothetical and not based on empirical data. The lack of correlation between the speed of fertility decline and the mean level of education at onset further support this counter-argument to Caldwell's hypothesis. So does the fact that in a country like Zimbabwe the fertility decline was similar at all levels of education, including among women who had never been to school, despite a time lag.

Our conclusions also differ from those of Lloyd et al. (2000). There are many reasons for this difference. Above all, the work of these authors is not based on a full-scale analysis of onset and speed of the transition and does not separate urban and rural trends. The authors themselves say that: "… our empirical assessment of Caldwell's hypothesis relies on description and deduction rather than on the estimation of multivariate models…" (Lloyd et al., p. 490). Their main argument is based on a statistical analysis combining cross-sectional and longitudinal approaches, which confuses the matter. They also included in the same analysis pre-transitional situations with situations of countries well advanced in the fertility transition. Furthermore, the indicator selected for level of education (persons with at least 4 years of schooling) is a dummy variable (educated / not educated) while we used a continuous variable, more apt to reveal long term changes. They also use a strict threshold (75% with at least 4 years to characterize mass schooling), again a dummy variable, whereas we used a continuous variable. Both education and fertility decline are continuous processes, for which no strict threshold has ever been documented. Their analysis appeared very partial compared with our comprehensive analysis. For instance they argue that "Only Madagascar and Rwanda appear to have begun the transition prior to the achievement of mass schooling", whereas we find that in most African countries the fertility transition started long before the AYS reached that threshold. Their argument that mass schooling is not only necessary but also sufficient for fertility decline is also not verified. A clear case in point is the comparison of Zambia and South Africa: both countries achieved quite early a high level of education, but if the fertility transition was very fast in rural South Africa, it hardly started in rural Zambia. Lastly, their argument about ethnic fragmentation (more languages implying more fragmentation, lower level of education and absence of fertility decline) appears very weak: a clear case is that of Ethiopia, a country with some 80 ethno-linguistic groups, from 4 large language groups, not colonized, with very low level education and low level of income, which still had one of the fastest fertility decline, already achieving replacement fertility in urban areas by year 2005.

Onset of the Fertility Transition and Family Planning Programs

As in other developing countries since 1950, most of the fertility decline in Africa seems to be induced by the use of modern contraception, even though in some countries other factors such as increasing age at marriage contributed to lower fertility to a certain extent. Correlating the date of onset of fertility decline with the emergence of modern contraceptive use is a difficult task, for several reasons. First, modern contraceptive use has a direct impact on fertility levels, so that the two variables are functionally linked (no fertility decline without modern contraception, no modern contraception without fertility decline). Second, if the date of onset of fertility decline can be determined with a reasonable degree of precision, the date of onset of modern contraceptive use is difficult to establish independently. In most countries, modern contraception was introduced in the late 1950s and early 1960s in private practices, although with a very small outreach, with a mean date of 1960 for countries with available data, and as early as 1957 in Kenya and Liberia.

In the 1960s and 1970s family planning clinics were introduced as part of a global effort led by IPPF and similar organizations, usually in urban centers. In some countries such organizations started to work very early (1960 in South Africa, 1961 in Ghana, 1962 in Kenya), while much later in other countries (1976 in Togo, 1977 in Mozambique, 1982 in Congo-Brazza), with a mean date of 1970. This effort was followed by national family planning programs, supported by the international community and in particular by UNFPA and USAID. Here again, the range of dates was wide, from 1961 (Seychelles) and 1965 (Mauritius) to 1996 (Ethiopia) or 1998 (Cote d'Ivoire), with a mean date of 1981. In most countries, an official population policy was put in place in the 1980s or 1990s, with a mean date of 1985. The whole process took some 40 years (1960-2000), the range of variation of dates of onset of fertility decline, and now reaches almost all countries in Africa.

Correlating dates of onset of fertility decline with dates of emergence of the use of modern contraception is difficult at the level of the continent because of the complexity of the processes. Only detailed case studies at the country level, separating urban and rural areas, could properly answer the question, a task well beyond the scope of this study. To give a few examples, in South Africa, the National Family Planning Program started in 1975 reaching even remote areas, which is also the date of the onset of fertility decline in rural areas; however, fertility had long been low in urban areas because of the availability of contraception, not counting the White/European population which followed a European pattern of fertility transition. In Kenya, family planning clinics were installed in 1962, which is also the date of onset of fertility decline in urban areas, whereas in rural areas the fertility decline started around 1968 when the national program really took off in these populations. In Senegal, family planning clinics started to operate in Dakar in 1974, shortly followed by a fertility decline in urban areas, whereas rural fertility decline really took off after 1990 when contraceptives became available in rural clinics. Sometimes, however, the timing is not as clear. For instance, in Burkina-Faso, the family planning program started officially in 1984, but fertility decline was earlier (1976) in urban areas, indicating that other things were happening. Similar situations could be found in Cote d'Ivoire and in Ethiopia.

With respect to the objectives of this study one could only say that, on average, countries with a higher level of education tended to be more advanced and to have earlier emergence of modern contraceptive use, whether through family planning associations or national family planning programs, or both, and therefore to have an earlier fertility decline. The transition was concentrated first among the most educated groups, then spread to other groups as well. There are some notable exceptions, however, such as Nigeria and the two Congo's, where use of modern contraception remains weak despite relatively high levels of education, especially in rural areas.

Speed of the Fertility Transition

One of the striking results of this study was the lack of correlation between the speed of the fertility transition and the mean level of education. The speed of fertility transition obviously depends on a number of factors and seems to depend primarily on the organization and success of family planning effort, whether public or private. With respect to the aims of this study, we can say that the level of education and the extent of family planning effort have had they own independent dynamics in African countries, and they are not correlated when studied at the level of the continent as a whole. The two processes have different rationales, different objectives, and different organizations that create the patterns observed in the empirical analysis.

Correlates of Fertility Transition: Urbanization, Education, and Income

The multivariate analysis showed a minor impact on fertility trends of the three main correlates studied in this report: education, urbanization, and income per capita. This is easily understood if put in a framework of an external intervention; the installation of family planning clinics and programs. Whatever the level of education, the extent of urbanization, and the level of income, if family planning is offered at free of charge or at low cost and provides efficient and good-quality care, it is likely eventually to reach the intended groups, regardless of their socioeconomic characteristics. Here again, the empirical analysis matches what has been observed in studies of other countries, and what is often observed in the field.

Cultural Factors

Cultural factors have a major impact on the level of education and on fertility levels and trends, the analysis showed. In this respect, Islam appears to have a large impact on lower levels of education, as it has on early marriage and high fertility, and contributes significantly to the correlation between education and fertility at country level. Countries with the highest proportion of Muslims have the lowest level of female education, the lowest age at marriage, and the highest fertility, and this association seems to be largely independent of income and other factors.

The culture of colonization also has a relatively large impact on the level of education. In the analysis, the countries influenced by British colonization showed higher levels of education and, on average, also were more advanced in the fertility transition. Countries influenced by Belgian colonization were doing somewhat better in level of education than countries influenced by French colonization, although the differences tended to be due partly to other factors. The main characteristics of the group of countries influenced by France was a marked stagnation in level of education for cohorts born after 1970, a topic that remains to be analyzed further. However, this stagnation did not hamper rapid fertility decline in some francophone countries, such as urban Burkina Faso, for instance. Countries influenced by Portuguese colonization were catching up rapidly in level of education. Finally, Ethiopia started from very low levels of education, but increased rapidly for cohorts born after 1950. This handicap did not hamper a very rapid fertility decline in urban areas, which are now well below replacement fertility. (Lindstrom and Woubalem 2003)

Minor Biases

In this study, the estimation of the cohort level of education suffers from two minor biases: one due to mortality, the other to migration. With respect to the first bias, the level of education of a given cohort born at time (t) is measured by its level at time (t+a) when women were interviewed during the demographic survey at age (a). Ideally, one would like to have the level of education for the same cohorts when they had their children, or at least when they were age 20. But women who were interviewed in the surveys were only a subset of the entire cohort, since they were still alive at the time of the survey, while

others had died earlier. Given the fact that more educated women tend to have lower mortality rates, the estimate of the level of education measured at time of survey is likely to be somewhat higher than the true level at age 20. This bias would likely increase with age at survey, since women would have had a longer exposure to mortality.

The bias, however, seems of little importance for this study. First, the trends in increasing level of education can only be underestimated, and they already are very marked. Second, the magnitude of the bias seems to be small and negligible for the study. Let us assume that the population is composed of two groups of equal importance: one with no education (AYS= 0), the other with complete primary schooling (AYS= 6), and that the mortality differential between the two groups is a ratio of 2 to 1. Let us also assume a mortality level corresponding to a life expectancy of 55 years in the no-education group. At age 20, the AYS in the population will be 3.0 years. The AYS in the surviving population will then be 3.03 at age 30 (the mean age at childbearing), 3.15 at age 50, and 3.56 at age 70. Altogether, for the fertile women the average bias will only 2% of the mean value, which is very small compared with the magnitude of the changes over time, and probably even smaller than the measurement error or the sampling error.

The other bias is misclassification due to urban-rural migration. When women are interviewed, they are classified in their current place of residence (urban or rural), but they might have had their schooling and their births in the other residential category. For instance a woman who migrated to a city at age 49 and was interviewed there would have all her characteristics classified as urban whereas her education and fertility would actually pertain to rural areas. This bias is likely to be small for the purpose of this study. First, most migration from urban to rural areas occurs in childhood with parents, or in early adulthood at marriage. If a young woman moved to the city to marry, her fertility would be properly classified, and her level of education would not be affected. The percentage of rural women becoming urban immediately after childbearing is likely to be small. Second, let us assume that urbanization is increasing in a country, so that 30% of adult women are urban at baseline (when the women are age 20), 40% are urban 30 years later (when these women are age 50), and 50% are urban 60 years later (when they are age 80), and that all the increase in proportion urban is due to rural-to-urban migration. Let us also assume that over the same period the average years of schooling increase from 2.0 (baseline) to 4.0 (after 30 years) and 6.0 (after 60 years) in rural areas and, and, similarly, increase from 4.0 at baseline to 6.0 after 30 years and 8.0 after 60 years in urban areas. In this case, the average years of schooling in urban areas would be 4.0 at baseline, 5.5 years 30 years later (instead of 6.0), and 7.2 years 60 years later (instead of 8.0), while the level of education would remain constant in rural areas. As a result, the relative bias in urban areas is only 8% after 30 years, and 10% after 60 years, which are small relative values compared with the major changes observed for the continent as a whole. Note that in this case there is no bias in rural areas, so that the urban-rural differentials can only be underestimated.

Another bias could also be selection for rural-urban migration associated with level of education. This selection bias implies that more educated women in rural areas are more likely to move to urban areas. However, migration from rural to urban areas usually happens in early adulthood, right after school, either before or at time of first marriage. In this case there would be no real bias for urban women, since the fertility and the level of education of migrant women would pertain to the urban areas, unless one argues that education in rural areas differs in quality from that in urban areas. This selection would tend to lower the level of education of women born in rural areas, but the level of education of women who stayed would still be correctly assigned to those who had their babies in rural areas.

Conclusion

This study has presented an analysis of trends in level of education and trends in fertility in a long-term longitudinal perspective. This longitudinal approach has led to very different conclusions than those

drawn from the more common cross-sectional approach. The analysis should be completed with more detailed case studies at the country level, as well as at regional or ethnic levels in large countries, to better grasp the complex relationships between education and fertility transition. Most African countries have experienced rapid changes in both level of education and level of fertility over the past 50 years, and despite some minor stalls in both education and fertility, these changes seem to be accelerating. These dynamics call for continued detailed monitoring and further research from social scientists.

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Annex A: List of Surveys Included

Table A-1. List of DHS and related surveys included in the study

Code	Country	DHS-II	DHS-III	DHS-IV	DHS-V	DHS-VI
BJ	Benin		1996	2001	2006	
BF	Burkina Faso	1993	1999	2003		
CM	Cameroon	1991	1998	2004		
CF	Central African Rep.		1994			
TD	Chad		1996		2004	
KM	Comoros		1996			
CD	Congo-Kinshasa				2007	
CG	Congo-Brazza				2005	2009
CI	Cote d'Ivoire		1994	1999	2005	
ET	Ethiopia			2000	2005	
GA	Gabon			2000		
GH	Ghana	1993	1999	2003	2008	
GN	Guinea		1999		2005	
KE	Kenya	1993	1998	2003	2008	
LE	Lesotho			2004	2009	
LB	Liberia				2007	
MD	Madagascar	1992	1997	2003	2008	
MW	Malawi	1992		2000	2004	
ML	Mali		1996	2001	2006	
MZ	Mozambique		1997		2003	2009
NM	Namibia	1992		2000	2007	
NI	Niger	1992	1997		2006	
NG	Nigeria	1990	1999	2003	2008	
RW	Rwanda	1992		2000	2005	
ST	Sao-Tome & Principe					2009
SN	Senegal	1993			2005	
SL	Sierra-Leone				2008	
SA	South Africa		1998			
SZ	Swaziland				2006	
TZ	Tanzania	1991	1996	1999	2003, 2004	2007
TG	Togo		1998			
UG	Uganda		1995	2001	2006	
ZM	Zambia	1992	1996	2001	2007	
ZW	Zimbabwe		1994	1999	2005	

Note: Includes four AIDS Indicator Surveys (AIS) (Cote d'Ivoire, 2005; Mozambique 2009; Tanzania 2003 and 2007), and one Service Provision Assessment (SPA) survey (Congo-Brazza, 2009).

Annex B: Country Studies

Data and Methods for the Country Studies

This annex details the calculations for each individual country selected for the study. For the cohort study, men and women are presented separately at country level, because of their different dynamics of level of education. For the period study of fertile women, urban and rural areas are considered separately, because trends in fertility differ markedly between the two areas of residence.

Definition of Level of Education

The level of education was used as defined in DHS and related surveys (AIS, MIS) in the household membership files (PR files). Because of the differences of levels of education (primary, secondary, higher) among countries, the Average Years of Schooling (AYS) was taken as the main indicator. It is found under the code HV108: 'Education in single years' in PR files. The main report provides all the necessary details on this variable as well as the relationship between proportions of persons who achieved a given level and the average years of schooling.

Methods

Calculations for reconstructing trends in level of education were done in two steps: reconstructing cohort trends, and applying an age pattern of fertility for calculating the period trends of level of education for fertile women.

Cohort trends

The average years of schooling of the adult population age 20 and older was first computed for each yearly birth cohort, from 1890 to last date available (e.g. 1985). Erratic patterns due to age misreporting were smoothed by taking for cohorts born in year (t) the weighted average of the number of years schooling for persons in years (t-2, t-1, t, t+1, t+2), the weights being (0.1, 0.2, 0.4, 0.2, 0.1). Erratic patterns due to small sample size were then smoothed by taking a five-year moving average of yearly birth cohorts.

Period trends, fertile women

Period trends in level of education of fertile women were calculated by applying an age pattern of fertility to the cohort trends. This can be expressed by the following formula:

$$EDUC(t) = \sum_{a=15}^{49} Educ(a,t) \times f(a)$$

Where f(a) is the age pattern of fertile women, with $\sum f(a) = 1$, and Educ(a,t) is the level of education of cohort age (a) at time (t). Period estimates were calculated for each year between 1950 and 2005, separately for urban and rural areas.

The age patterns of fertility were calculated from the same DHS data (Individual Recode file, or 'IR' file). An average pattern was first calculated for each survey in the five years preceding the survey, by single year of age. These were merged by country, by single year of age, and for urban and rural areas separately. Country data were smoothed by quadratic splines, following the method developed by Schmertmann (2003), and for urban and rural areas separately.

Country Results

This annex details the calculations for each country. Each country study is organized the same way: a first section describes the surveys selected, with sample size. A second section comments on cohort trends in level of education for men and women, which are displayed in Figure B-n.1, 'n' being the country number. This figure shows the empirical values grouped by five-year periods (dots and triangles) before any smoothing, and the results of the yearly smoothing (solid lines). A third section describes period trends in level of education for fertile women in urban and rural areas, which are displayed in Figure B-n.2. The time at which the fertility transition started is indicated in the same figure with a triangle, unless it has not yet started. A short comment is made in each case to document erratic patterns or special issues.

1. Benin

Benin conducted three surveys with information on level of education, in 1996, 2001 and 2006. All three surveys were compatible in levels and trends of level of education. (Table B-1.1)

Table B-1.1. Basic characteristics of surveys, Benin

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1996	4,237	3.33	5,416	1.24
DHS	2001	4,909	3.88	6,277	1.68
DHS	2006	14,590	4.33	18,455	1.83

Cohort trends

The level of education remained very low for cohorts born before 1930, and was almost nil for those born before 1910. The mean level of education increased markedly afterwards, more so for men than for women. However, trends in level of education were not regular: the mean level stagnated, and even regressed for men, for cohorts born between 1965 and 1975, then it increased rapidly for the most recent cohorts. The stagnation in the level of education could be associated with the stagnation of the economy between 1961 and 1978, a period during which income per capita stayed around $1000: $987 in 1961 and $1013 in 1978. (Figure B-1.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, with a large and increasing gap between urban and rural areas (2.6 years in 2005). In 2005, the level of education of fertile women was still low in urban areas, and very low in rural areas, and was even lower when the fertility transition started (1982 in urban, 1988 in rural). (Figure B-1.2)

Figure B-1.1. Cohort trends in level of education, Benin

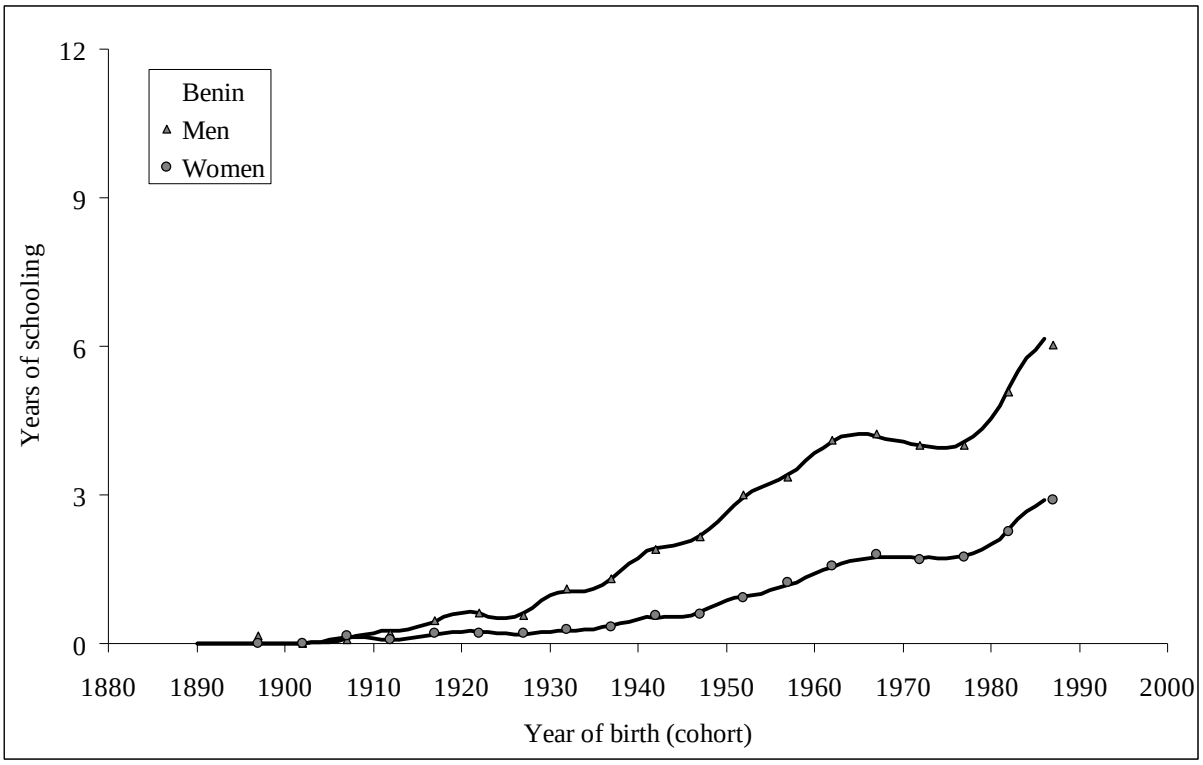
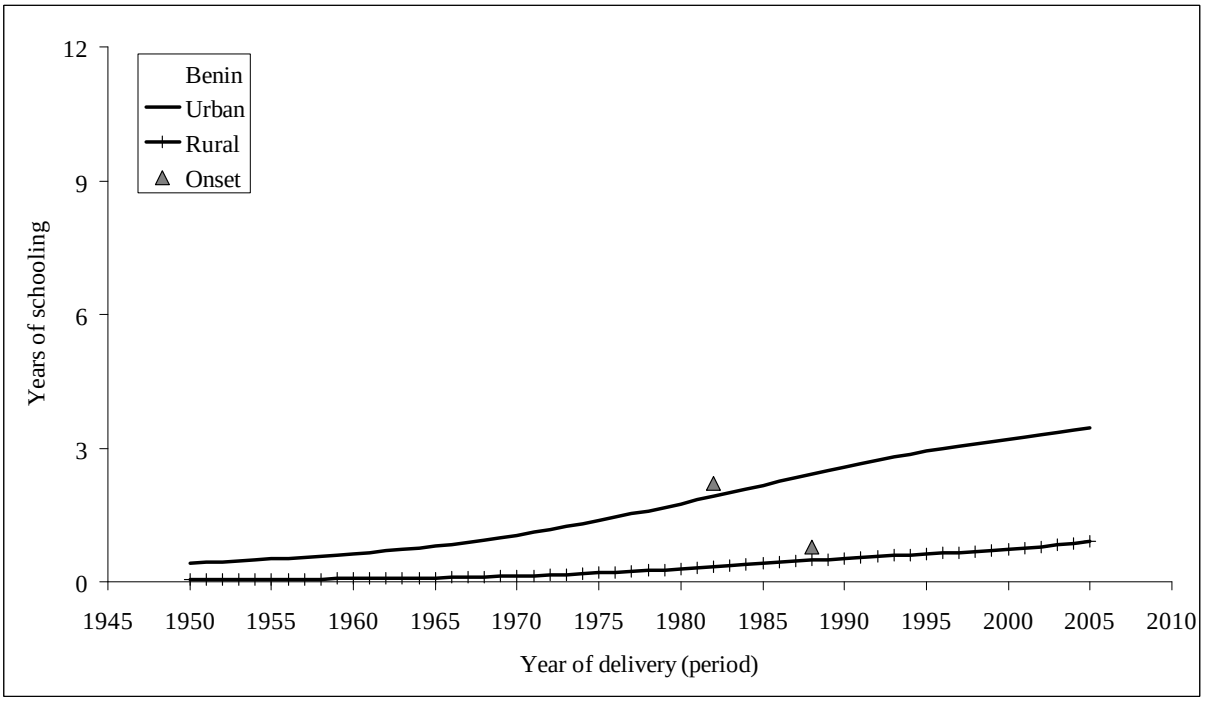


Figure B-1.2. Period trends in level of education, fertile women, Benin



2. Burkina Faso

Burkina Faso conducted three surveys with information on level of education, in 1993, 1999 and 2003. All three surveys were compatible in levels and trends of level of education, although the second survey indicated a somewhat lower level for both men and women. (Table B-2.1)

Table B-2.1. Basic characteristics of surveys, Burkina Faso

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1993	5,296	1.59	6,959	0.72
DHS	1999	4,613	1.57	6,410	0.65
DHS	2003	9,459	2.21	12,198	1.04

Cohort trends

The level of education remained very low for cohorts born before 1940, and was almost nil for those born before 1930. The mean level of education increased markedly afterwards, more so for men than for women. However, trends in level of education were not regular: the mean level stagnated, for men born between 1952 and 1962, then it increased for some 15 years, but stagnated again for the most recent cohorts born after 1977. For women the progression was more regular, with a gap of about 1 year in mean level compared with the men. The first period of stagnation could be associated with the period just following independence, where teachers might have left, although it was rather a period of steady economic growth, at least until 1972. (Figure B-2.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, with a large and increasing gap between urban and rural areas (3.8 years in 2005). In 2005, the level of education of fertile women was relatively low in urban areas, and remained extremely low in rural areas. It was very low when the fertility transition started (1976 in urban, 1983 in rural). (Figure B-2.2)

Figure B-2.1. Cohort trends in level of education, Burkina Faso

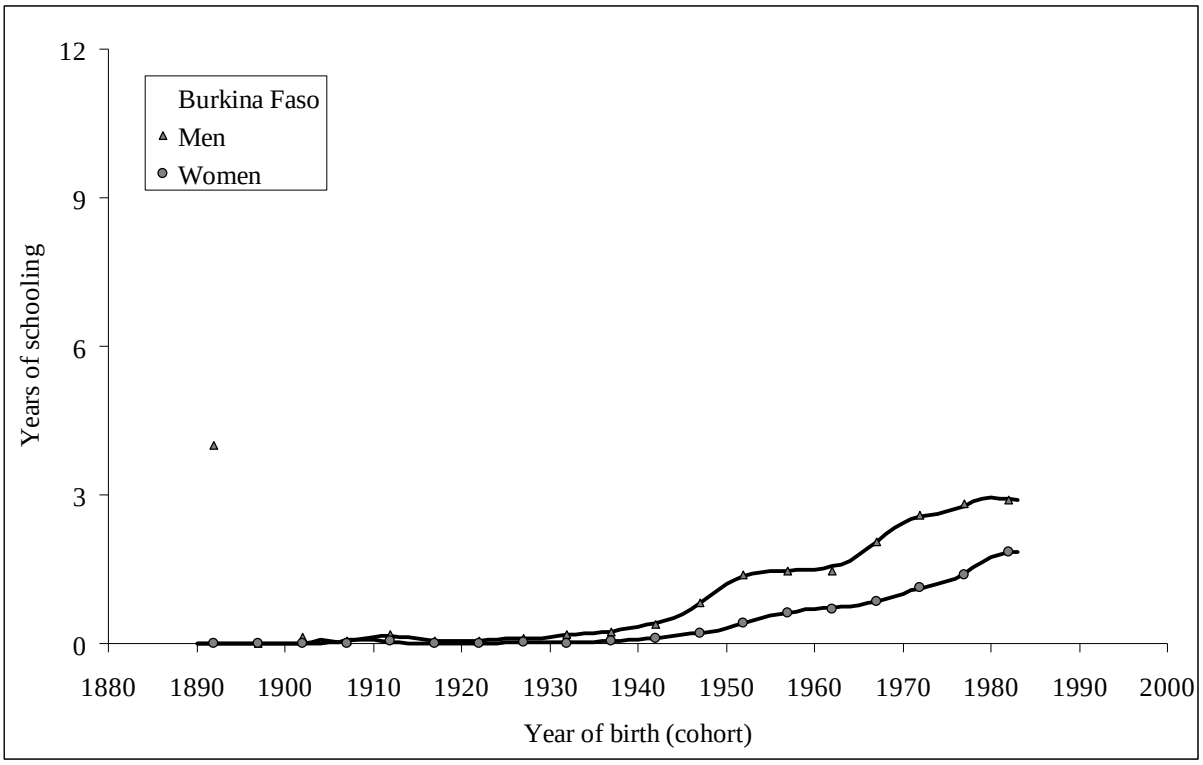
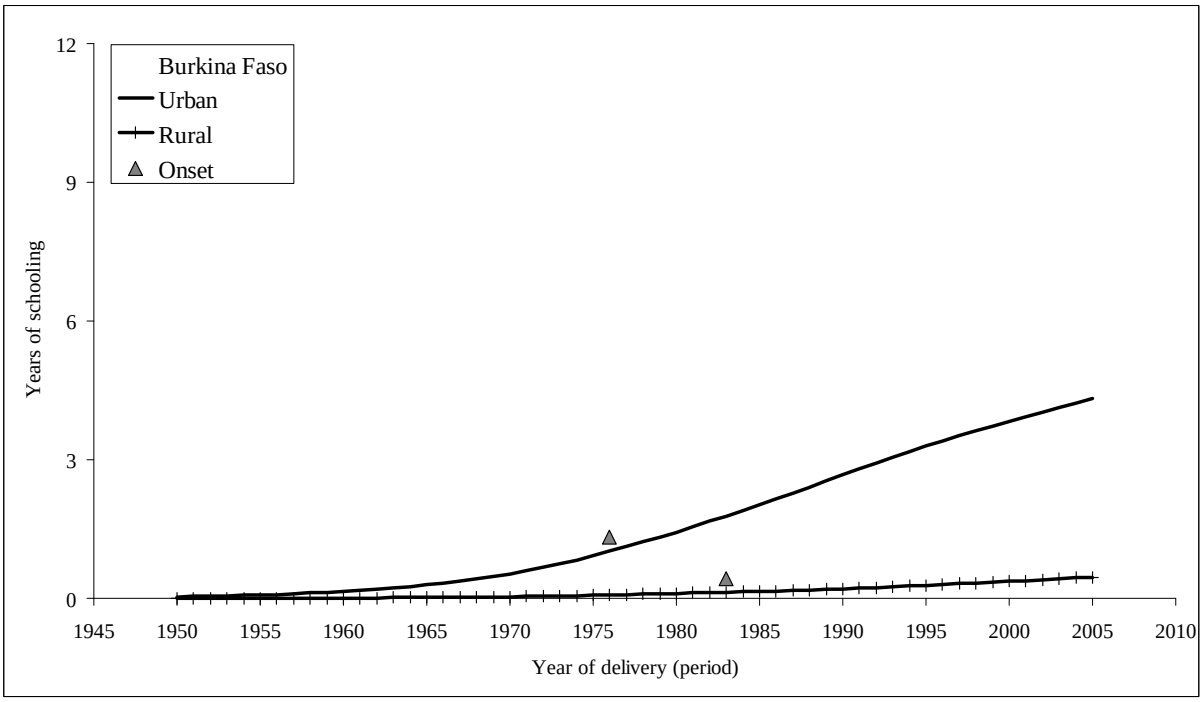


Figure B-2.2. Period trends in level of education, fertile women, Burkina Faso



3. Cameroon

Cameroon conducted three surveys with information on level of education, in 1991, 1998 and 2004. All three surveys were compatible in levels and trends of level of education, suggesting a steady increase in level of education of both men and women. (Table B-3.1)

Table B-3.1. Basic characteristics of surveys, Cameroon

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1991	3,603	5.03	4,112	2.96
DHS	1998	4,691	6.72	5,359	4.43
DHS	2004	9,598	7.01	10,551	5.04

Cohort trends

The level of education started to increase quite early in Cameroon, for cohorts born after 1900 for men and cohorts born after 1925 for women. The mean level of education increased steadily afterwards for a long period of time, up to cohorts born in 1972 for men and up to cohorts born in 1977 for women. For the most recent cohorts the level of education stagnated, and even declined somewhat for the men. The recent period of stagnation could be associated with the marked recession with lasted from 1986 to 1994 during which income per capita declined from $1683 to $955 (-43% in 8 years). (Figure B-3.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, with a large and increasing gap between urban and rural areas (3.3 years in 2005). This was due to the continuous increase in female level of education in urban areas, whereas it remained almost steady in rural areas over the 1995-2005 period. The mean level of education of fertile women was average and similar in both areas of residence when the fertility transition started (1982 in urban, 1983 in rural). (Figure B-3.2)

Figure B-3.1. Cohort trends in level of education, Cameroon

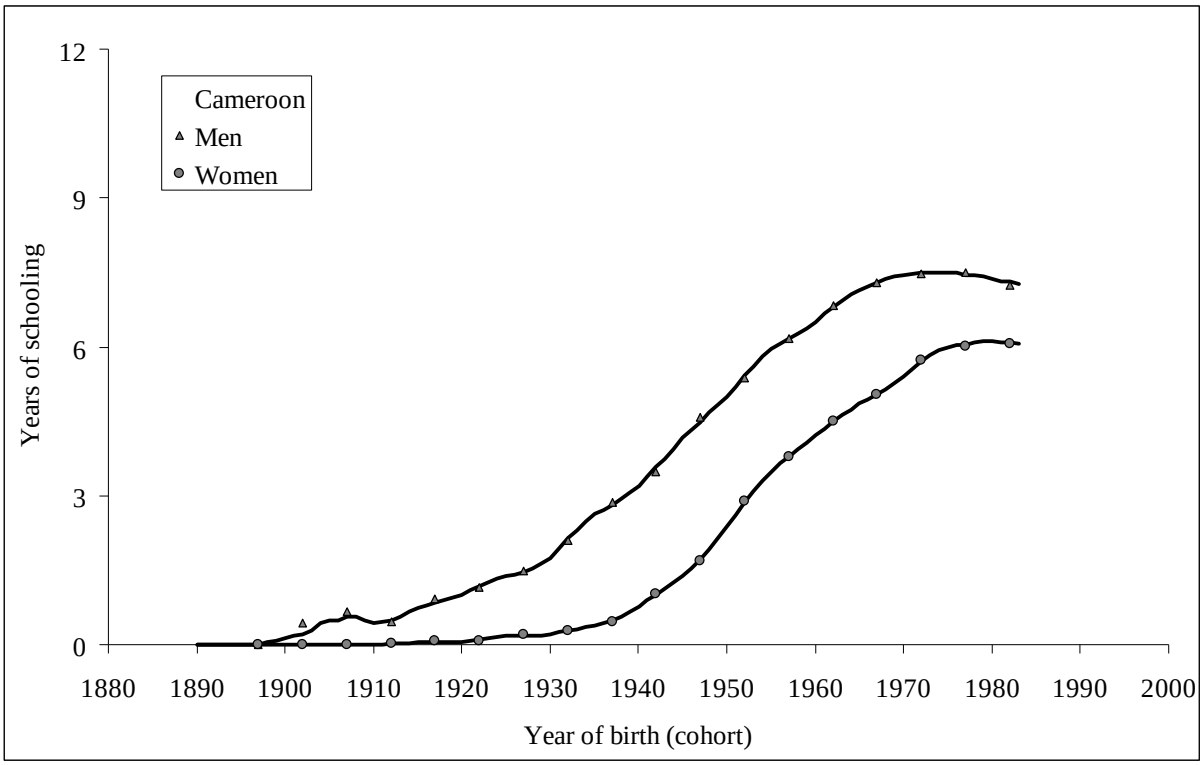
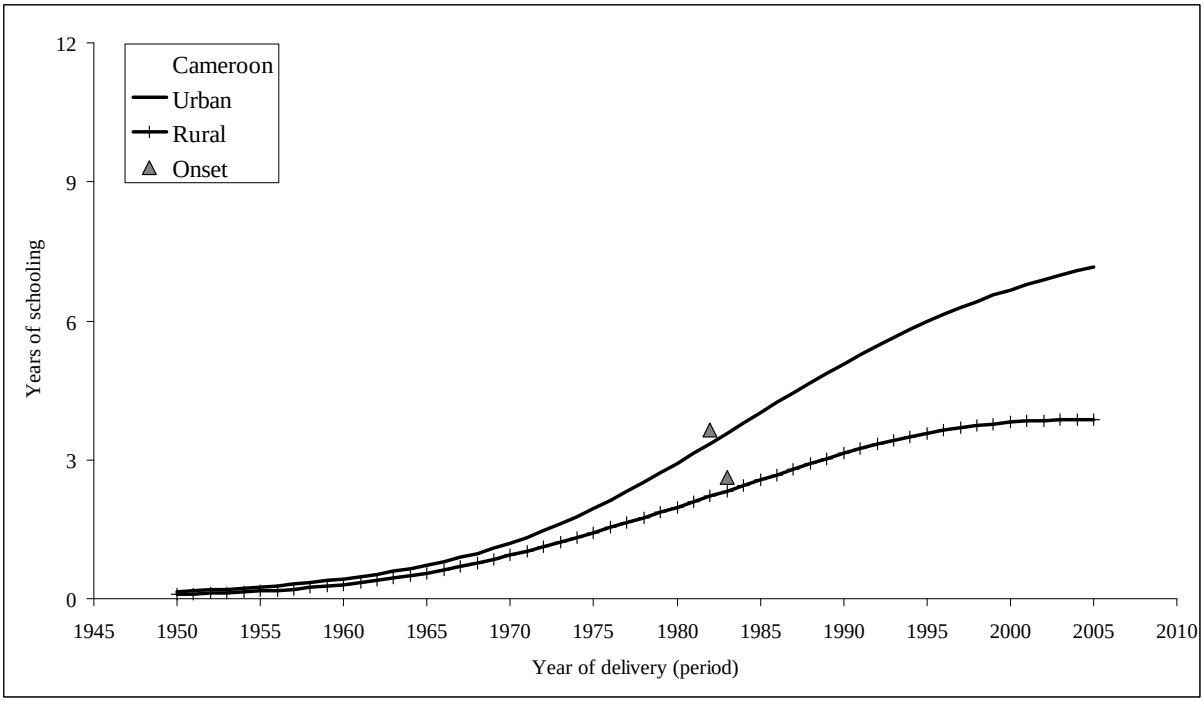


Figure B-3.2. Period trends in level of education, fertile women, Cameroon



4. Central African Republic

The Central African Republic (CAR) conducted only one survey with information on level of education, in 1994. (Table B-4.1)

Table B-4.1. Basic characteristics of surveys, Central African Republic

		Men 20-59		Women 20-59	
Survey	**Year**	**Number**	**Years of schooling**	**Number**	**Years of schooling**
DHS	1994	5,280	4.24	5,861	1.80

Cohort trends

The level of education started to increase for men born after 1915 and women born after 1945 in the Central African Republic. The mean level of education increased steadily afterwards for a long period of time, up to cohorts born in 1960 for men and up to cohorts born in 1962 for women. For the most recent cohorts the level of education stagnated, and even declined somewhat for the men, whereas it continued to increase slowly for women up to cohort 1974. The period of stagnation could be associated with the steady decline in income per capita with lasted for about 40 years, from a peak of $943 in 1961 to a bottom of $507 in 2003. (Figure B-4.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, with a large and increasing gap between urban and rural areas (3.0 years in 2005). This was due to the continuous increase in female level of education in urban areas, whereas it remained almost steady in rural areas since 1990. The mean level of education of fertile women was relatively low in both areas of residence when the fertility transition started (1987 in urban, 1988 in rural), although the onset of the fertility transition is poorly characterized for rural areas. (Figure B-4.2)

Figure B-4.1. Cohort trends in level of education, Central African Republic

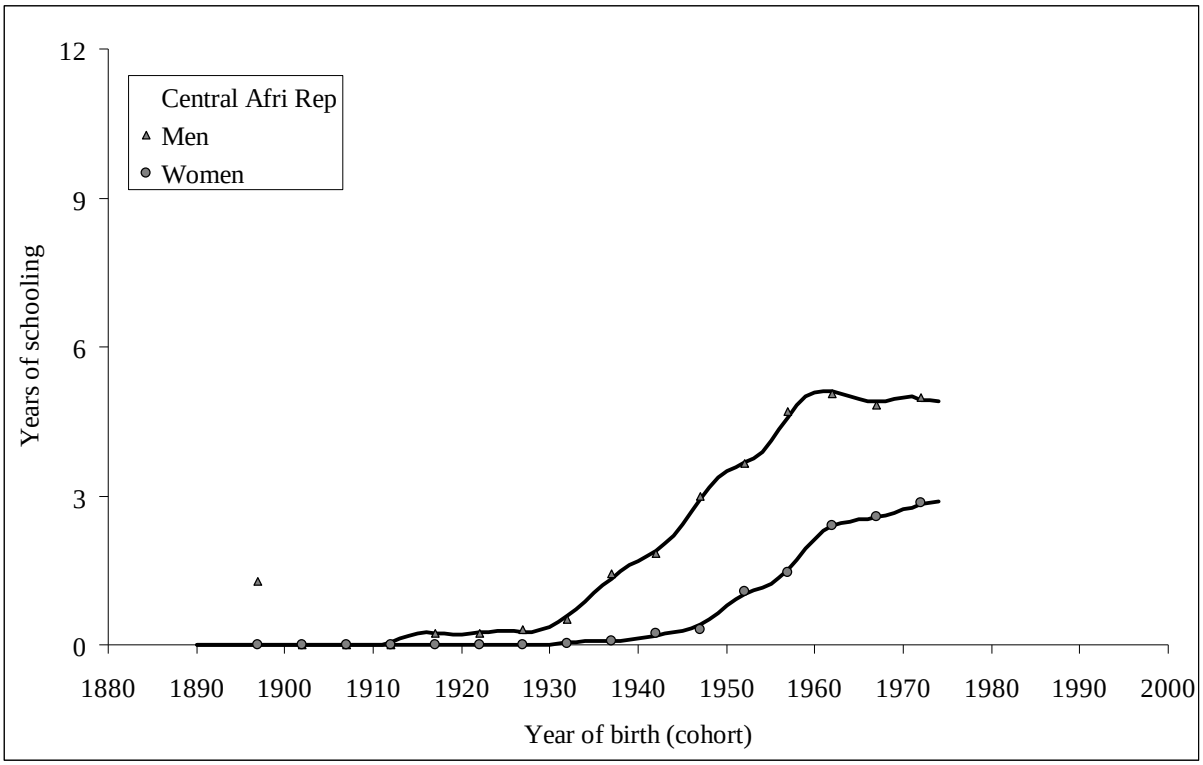
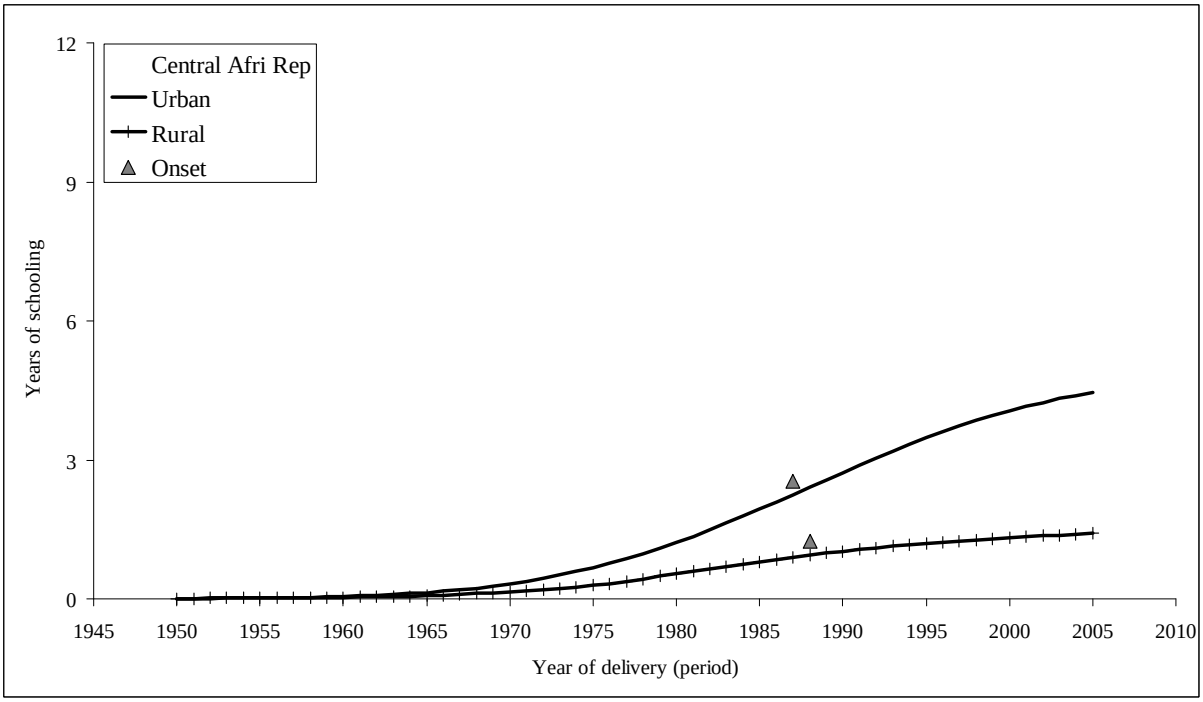


Figure B-4.2. Period trends in level of education, fertile women, Central African Republic



5. Chad

Chad conducted two surveys with information on level of education, in 1996 and 2004. Both are compatible for levels and trends in level of education. (Table B-5.1)

Table B-5.1. Basic characteristics of surveys, Chad

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1996	6,017	2.46	7,191	0.62
DHS	2004	4,748	2.97	5,577	0.91

Cohort trends

The level of education started to increase for men born after 1930 and women born after 1950 in Chad. The mean level of education increased steadily afterwards, with some irregularities for men. For the most recent cohorts the level of education was still below average, with a large gap between men and women (2.7 years). The increase in level of education occurred despite virtually no change in income per capita for about 50 years between 1950 ($476) and 2000 ($444), and despite some ups (in 1962) and downs (in 1980). (Figure B-5.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, with an average gap between urban and rural areas (2.0 years in 2005). This was due to the continuous increase in female level of education in urban areas, and a very slow increase in rural areas. The mean level of education of fertile women was very low in both areas of residence when the fertility transition started (1985 in urban, 2000 in rural), although the onset of the fertility transition is poorly characterized for rural areas. (Figure B-5.2)

Figure B-5.1. Cohort trends in level of education, Chad

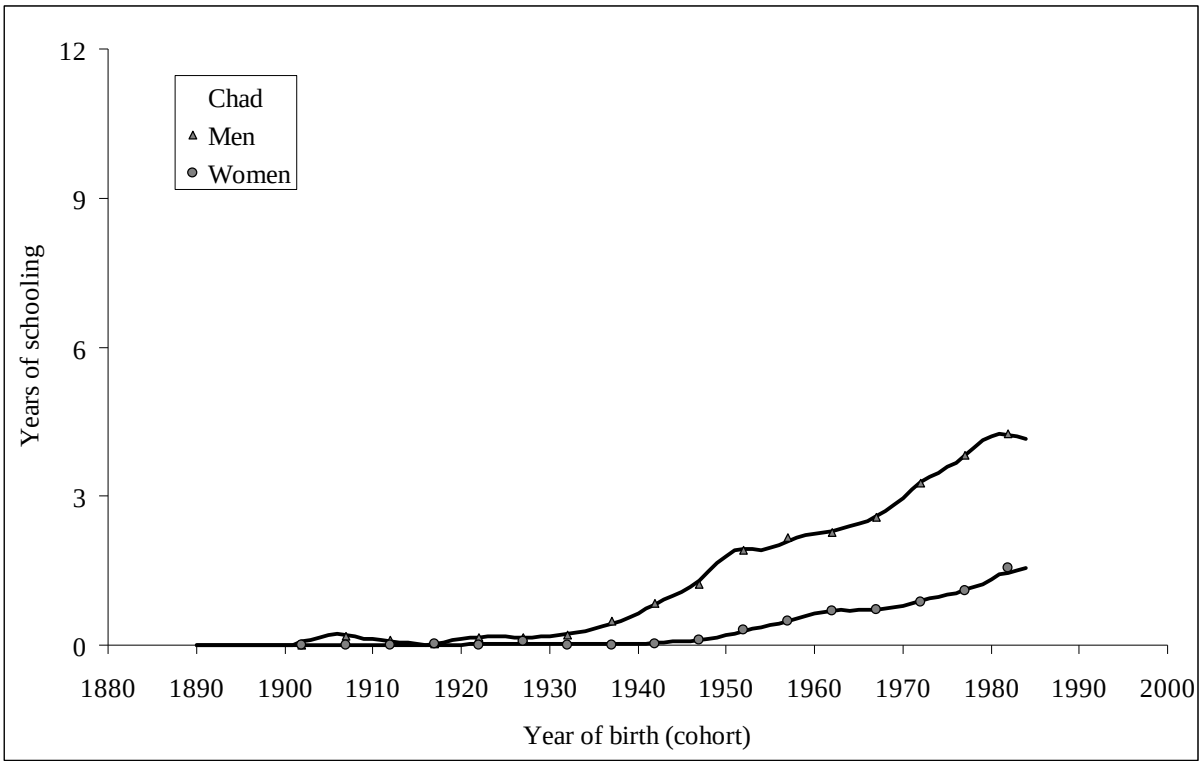
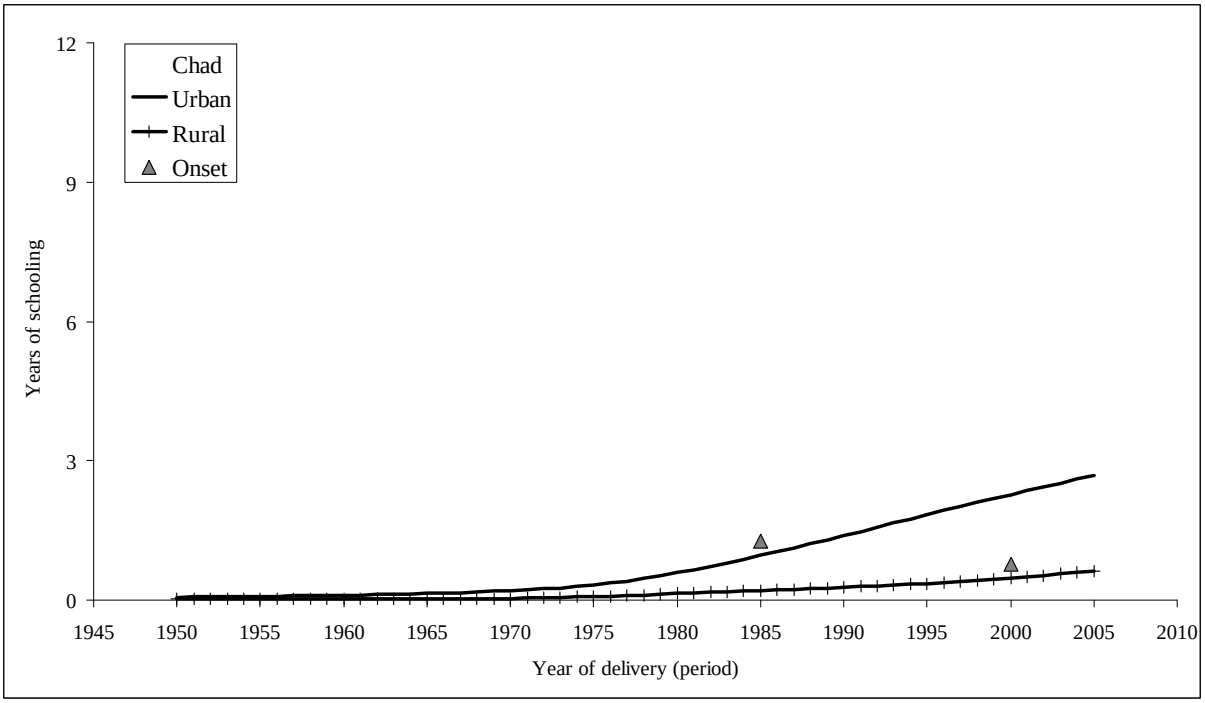


Figure B-5.2. Period trends in level of education, fertile women, Chad



6. Comoro Islands

The Comoro Islands conducted only one survey with information on level of education, in 1996. (Table B-6.1)

Table B-6.1. Basic characteristics of surveys, Comoro Islands

		Men 20-59		Women 20-59	
Survey	**Year**	**Number**	**Years of schooling**	**Number**	**Years of schooling**
DHS	1996	2,415	3.95	2,802	2.26

Cohort trends

The level of education stayed for a long time at a low level for men born before 1925, suggesting a small minority of educated men. Then it increased steadily up to a plateau reached for men born in 1963. For the cohorts born afterwards, the mean level remained steady for about 10 years, then tended to decline, loosing 0.8 years for the most recent cohorts born in 1977. For women, trends were similar, but delayed in time. The peak was reached for cohorts born in 1972, and the decline from 1972 to 1977 was less pronounced. The stagnation and decline period could be associated with the major recession that occurred between 1971 ($1154) and 1977 ($624), although trends in level of education seem to have anticipated the economic trends. The economic growth that prevailed in the 1950's and early 1960's seems to have stopped as early as 1967, despite some good years in 1971 and in 1974. (Figure B-6.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, with an average gap between urban and rural areas (2.7 years in 2005). The stagnation for the recent cohorts had an impact on the period trends, and the mean level hardly increased between 2000 and 2005 in both areas of residence. The mean level of education of fertile women was similar in both areas of residence when the fertility transition started, despite the time lag between the two areas (1980 in urban, 1987 in rural). (Figure B-6.2)

Figure B-6.1. Cohort trends in level of education, Comoro Islands

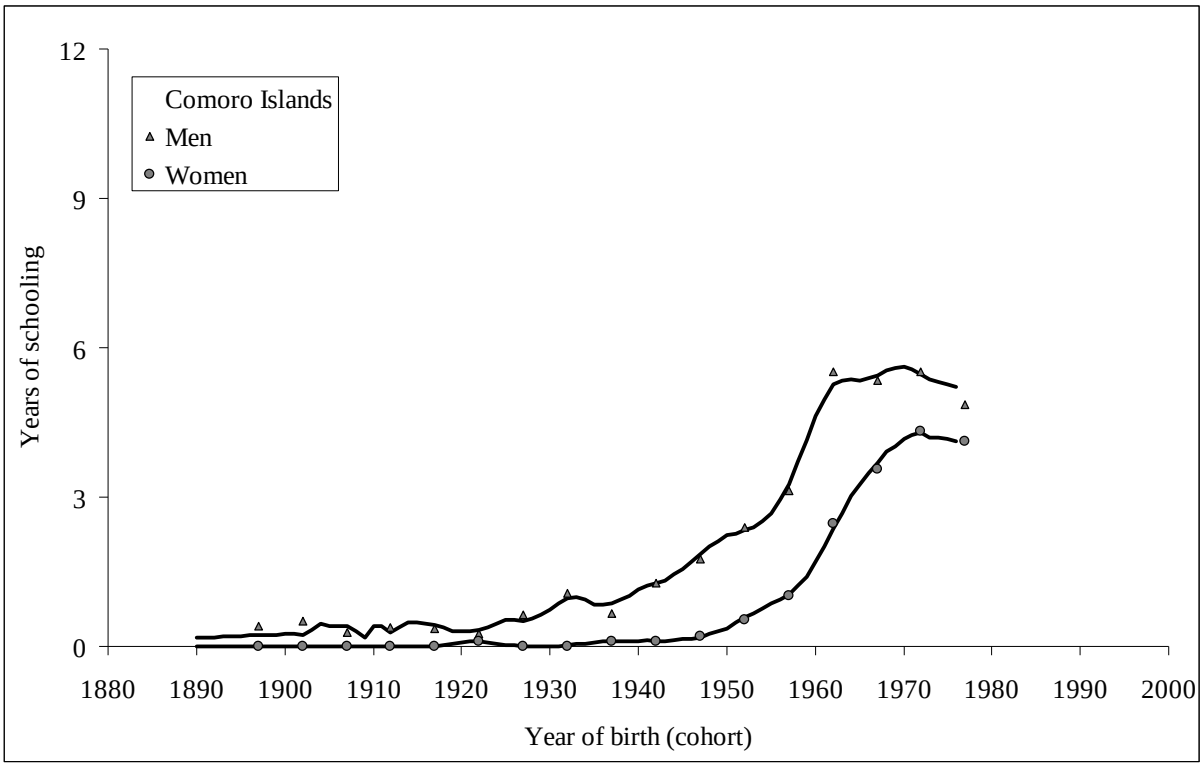
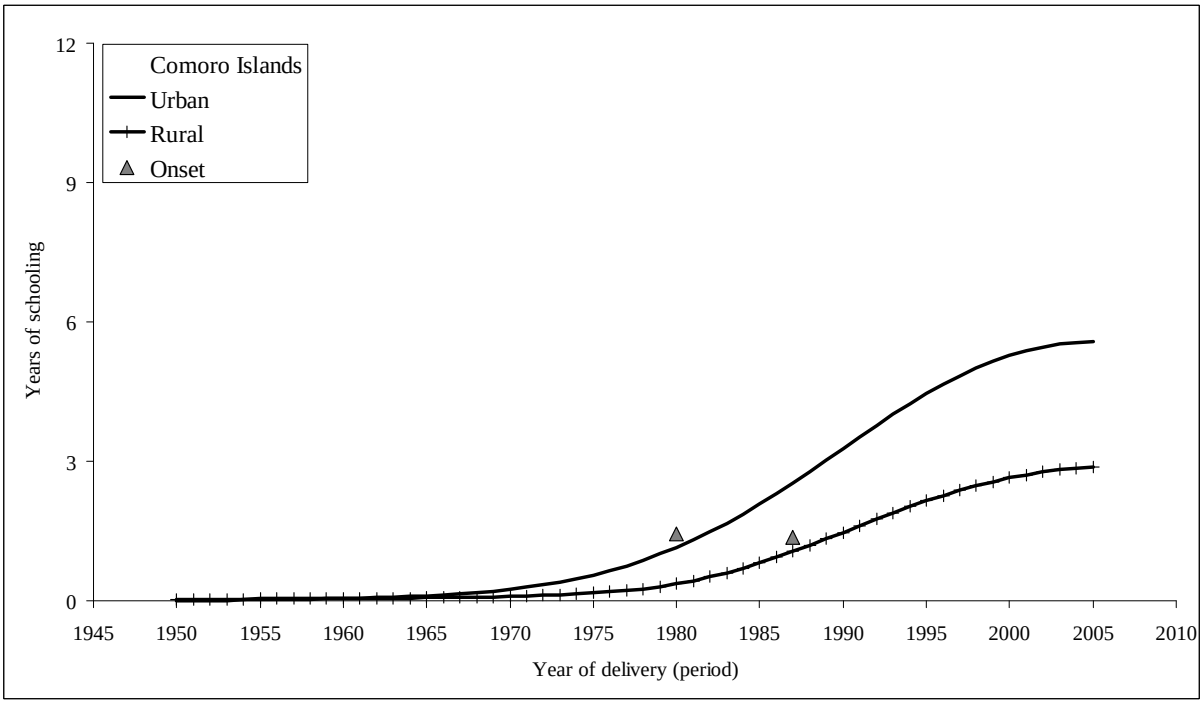


Figure B-6.2. Period trends in level of education, fertile women, Comoro Islands



7. Congo Kinshasa (RDC)

Congo Kinshasa (République Démocratique du Congo) conducted only one survey with information on level of education, in 2007. (Table B-7.1)

Table B-7.1. Basic characteristics of surveys, Congo Kinshasa

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	2007	9,133	8.19	9,906	4.91

Cohort trends

Because of the late date of the only survey, estimates of the level of education for the earliest cohort are unreliable. The mean level of education appears well above zero for men born around 1920 and women born around 1930. It increased rapidly for men up to cohort 1952, then slowly up to 1972, then declined up to the latest cohort available (1987). For women the mean level started to increase after cohort 1937, peaked around 1977, and remained rather steady for the next 10 cohorts. The gap between both sexes first increased, reached a maximum of 5.4 years for cohorts born in 1952, then tended to narrow (only 2.0 years in 1977). The halt in increasing level of education seems to be associated with the huge economic and political crisis that Congo went through since 1974, when income per capita declined from $823 in 1974 to $207 in 2001 (the Mobutu years). The magnitude of the recession is so large that one could anticipate long lasting effects on level of education, and only the most recent period (since 2001) gives some hope for later improvements. (Figure B-7.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, with a large gap between urban and rural areas (4.2 years in 2005). The period trends still benefit from the major improvements in the 1950's and 1960's and from the relatively high level in urban areas. Some slowing down is visible only in the recent years. The mean level of education of fertile women was relatively high in urban areas when the fertility transition started (1987), and fertility has not yet started to decline in rural areas by 2007. (Figure B-7.2)

Figure B-7.1. Cohort trends in level of education, Congo Kinshasa

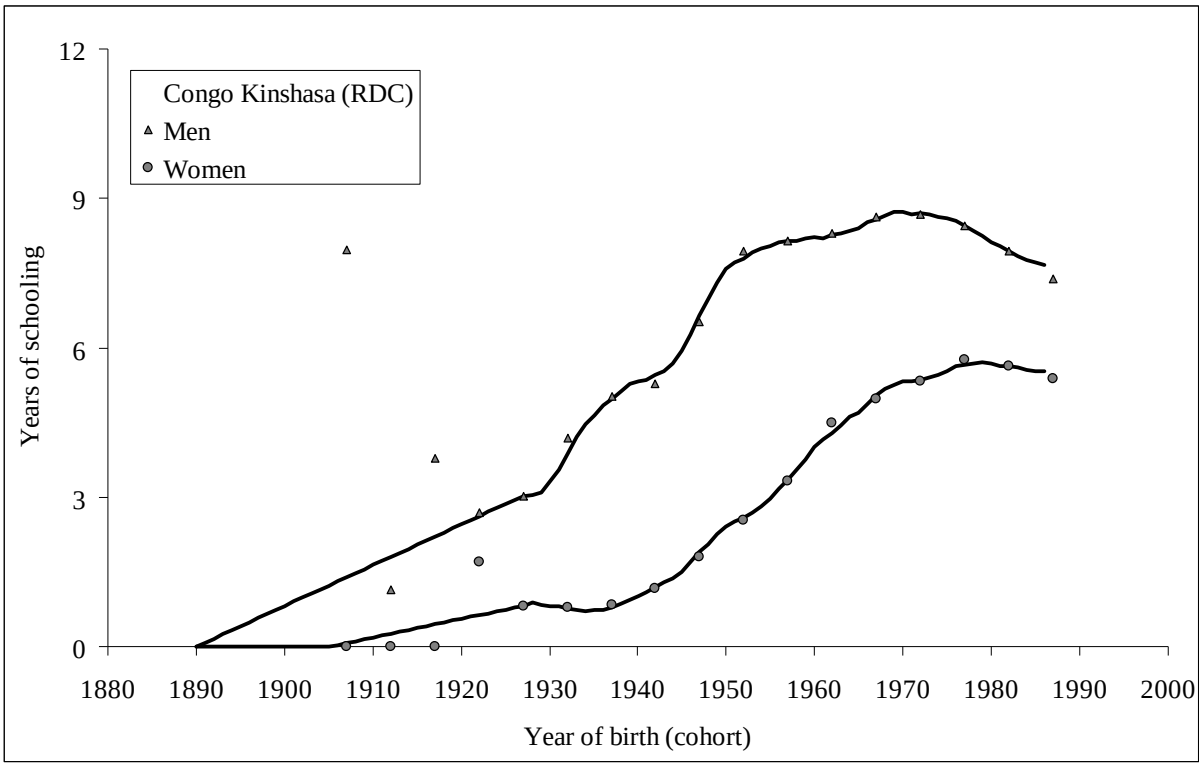
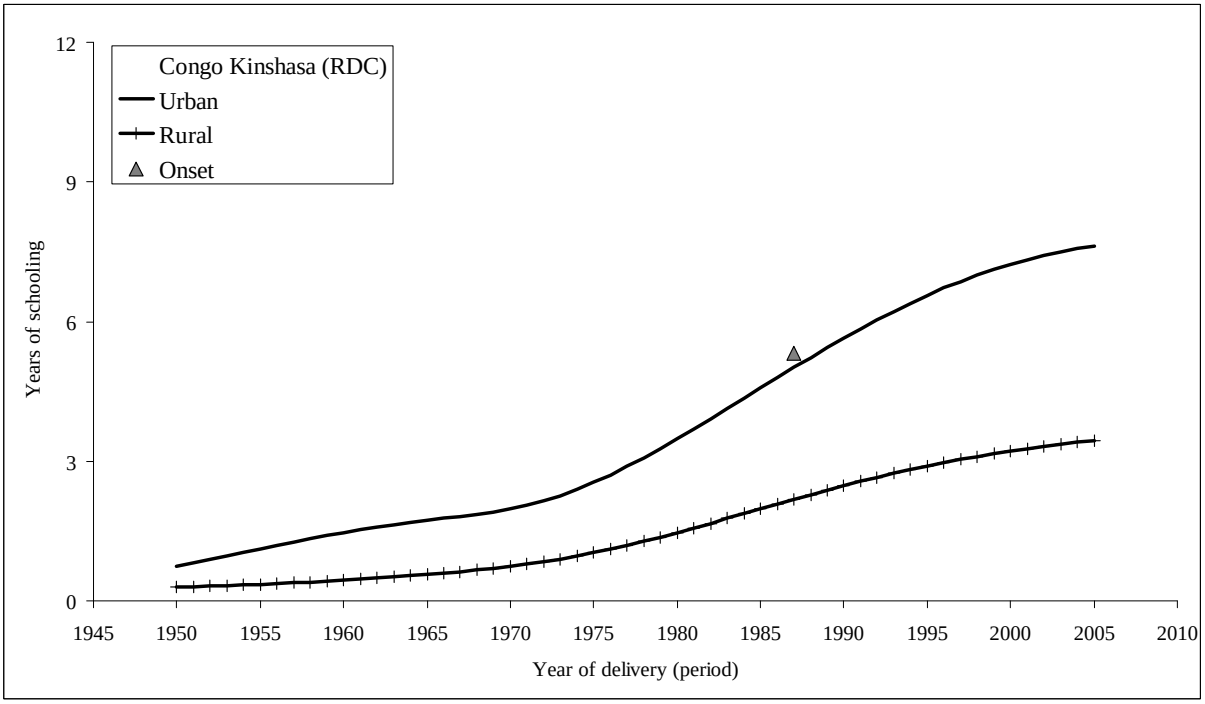


Figure B-7.2. Period trends in level of education, fertile women, Congo Kinshasa



8. Congo Brazza

Congo Brazza (République du Congo, formerly République Populaire du Congo) conducted two surveys with information on level of education, a DHS in 2005 and a SPA in 2009. Both are compatible in levels and trends in education. (Table B-8.1)

Table B-8.1. Basic characteristics of surveys, Congo Brazza

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	2005	5,943	8.99	7,201	6.71
SPA	2009	6,397	9.19	6,926	7.22

Cohort trends

Level of education in Congo Brazza increased very rapidly since 1915 for men and since 1925 for women, reaching high values by 1960 for men (10.1 years) and by 1980 for women (7.7 years). For men, the average level declined markedly from 1960 to 1985, reaching a value of 8.1 years, whereas for women the level stayed a about the same level up to the last point available. There are no obvious economic reasons for these trends in education. The high average levels were probably fueled by incomes higher than African average ($3000 in 1984), but trends do not match. The major increase for cohorts born before 1960 corresponds to a steady but slow economic growth, and the decline in education for men occurred during the period of highest income. The ups (1970-1984) and downs (1985-1995) of the economy did not translate into visible fluctuations for education. The country seems to have followed a very voluntary education policy, relatively independent from major economic trends. Only the stagnation for women after 1977 could be related with the recession that occurred after 1984. (Figure B-8.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, with high levels reached by 2005 (8.5 in urban and 5.7 in rural) despite a level close to zero in 1950. The period trends benefited from the fast increases in the 1950's and 1960's. Some slowing down is visible only in the recent years. The mean level of education of fertile women was low in urban areas when the fertility transition started (1967), and fertility has not yet started to decline in rural areas by 2005 despite a high level of education. (Figure B-8.2)

Figure B-8.1. Cohort trends in level of education, Congo Brazza

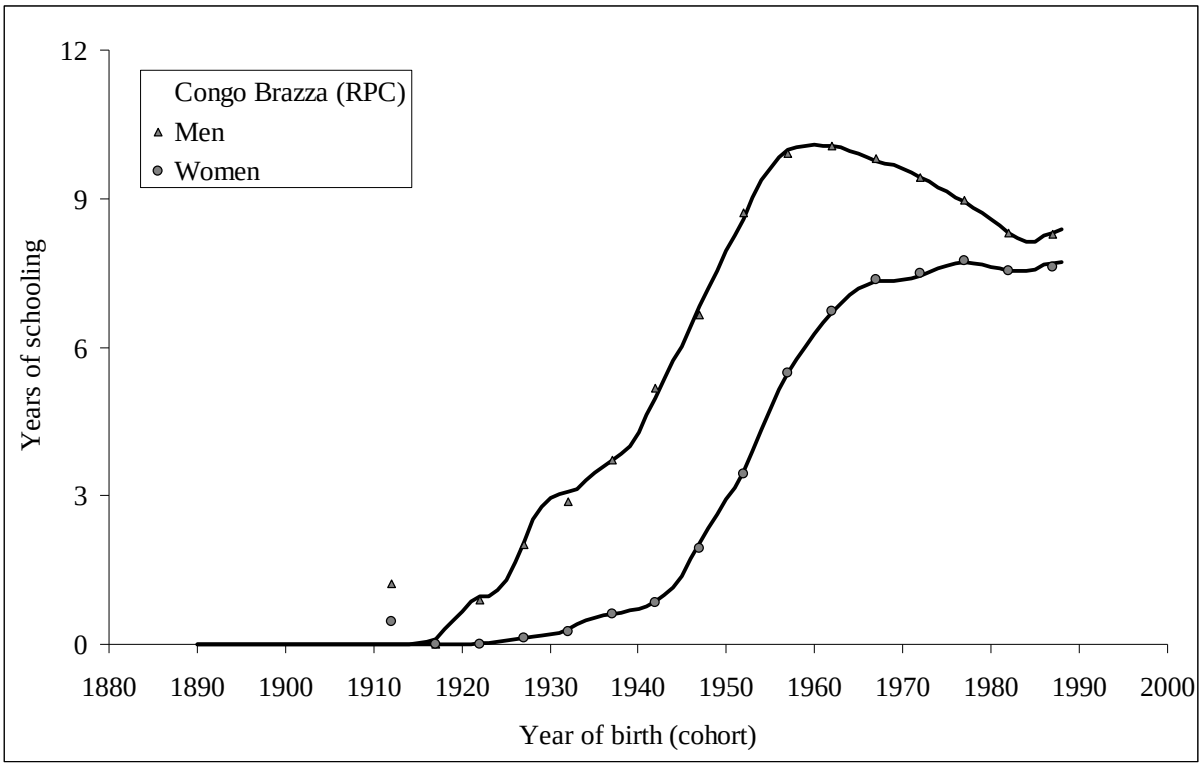
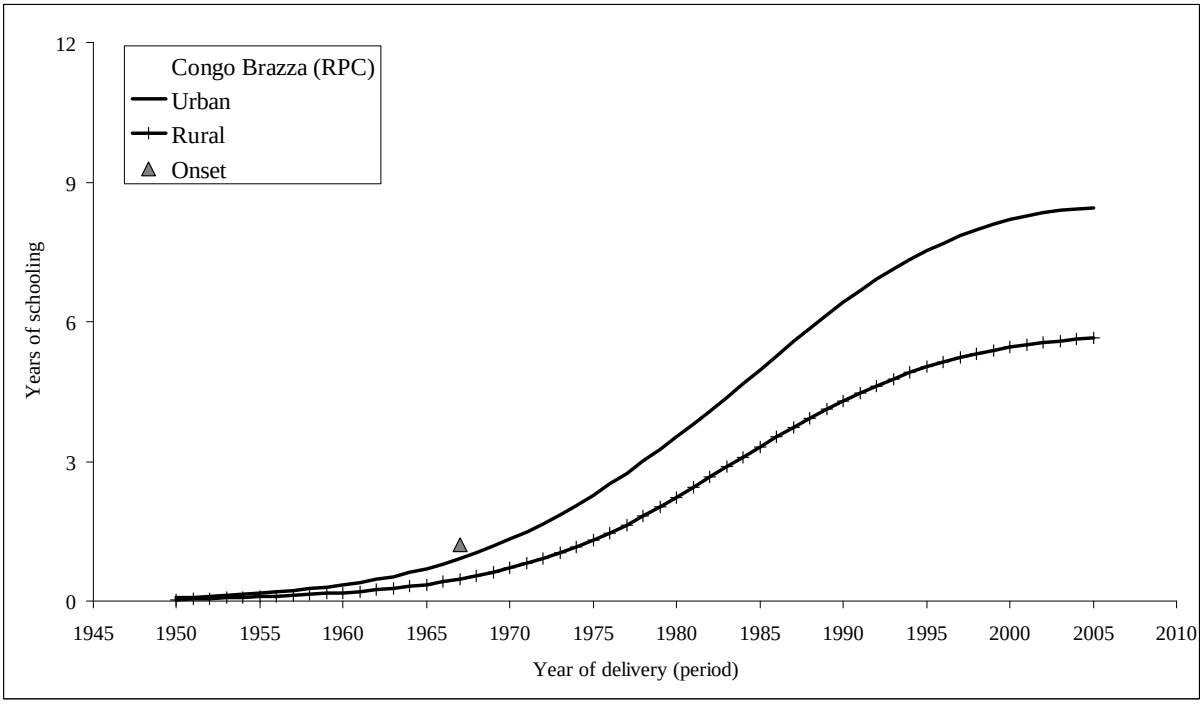


Figure B-8.2. Period trends in level of education, fertile women, Congo Brazza



9. Cote d'Ivoire

Cote d'Ivoire (Ivory Coast) conducted three surveys with information on level of education, two DHS in 1994 and 1999 and one AIS in 2005. All three are compatible in levels and trends in education. (Table B-9.1)

Table B-9.1. Basic characteristics of surveys, Cote d'Ivoire

		Men 20-59		Women 20-59	
Survey	**Year**	**Number**	**Years of schooling**	**Number**	**Years of schooling**
DHS	1994	7,421	4.11	7,617	1.90
DHS	1999	2,637	4.58	2,862	2.59
AIS	2005	5,290	4.98	5,588	2.66

Cohort trends

Level of education in Cote d'Ivoire started to increase for cohorts born after 1935 for men and those born after 1945 for women. The increase was moderate, and tended to stabilize in recent years, since 1980 for men (5.7 years) and since 1975 for women (3.3 years), with a probable drop for the most recent cohorts. The increase in level of education occurred during a long period in economic growth during which income per capita doubled ($1041 in 1950; $2041 in 1980), and the stagnation could be associated with the deep recession that stroke the country in the 15 years following (1980-1994). (Figure B-9.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, but slow and with only moderate levels reached by 2005 (4.0 in urban and 2.0 in rural). Some slowing down is visible only in the recent years. The mean level of education of fertile women was low and similar in urban and rural areas when the fertility transition started (1980 and 1986 respectively). (Figure B-9.2)

Figure B-9.1. Cohort trends in level of education, Cote d'Ivoire

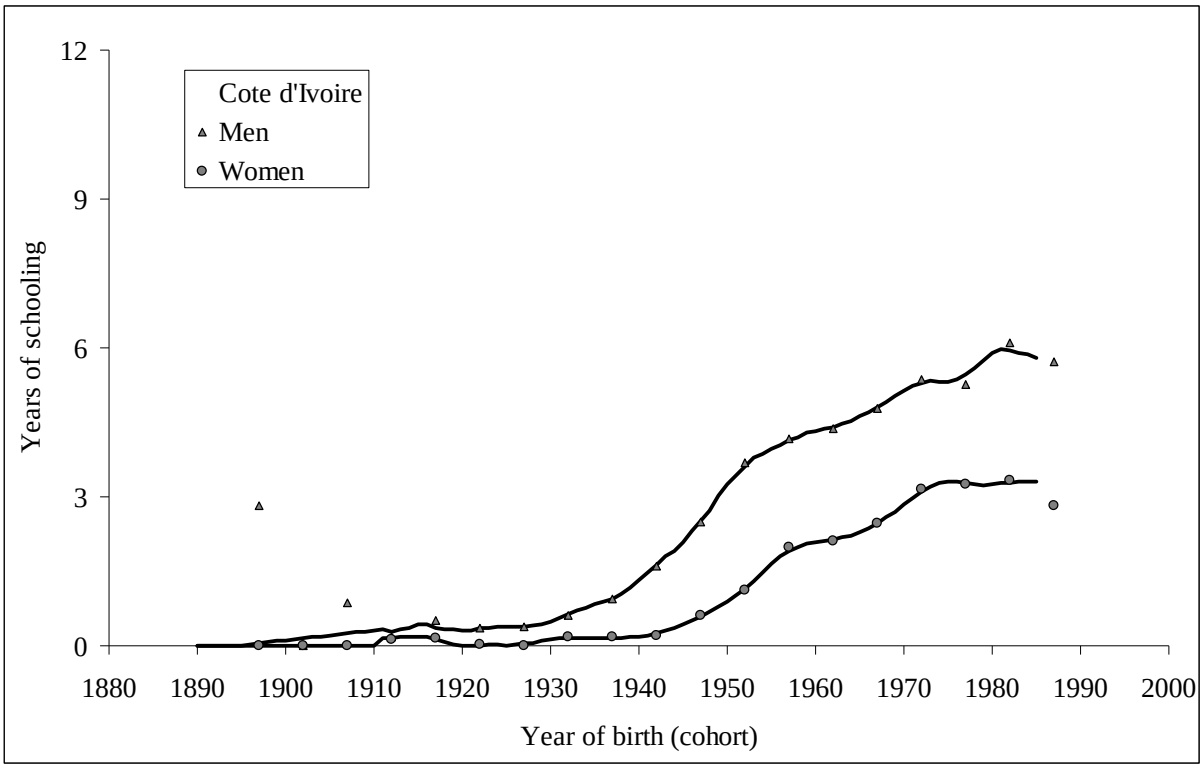
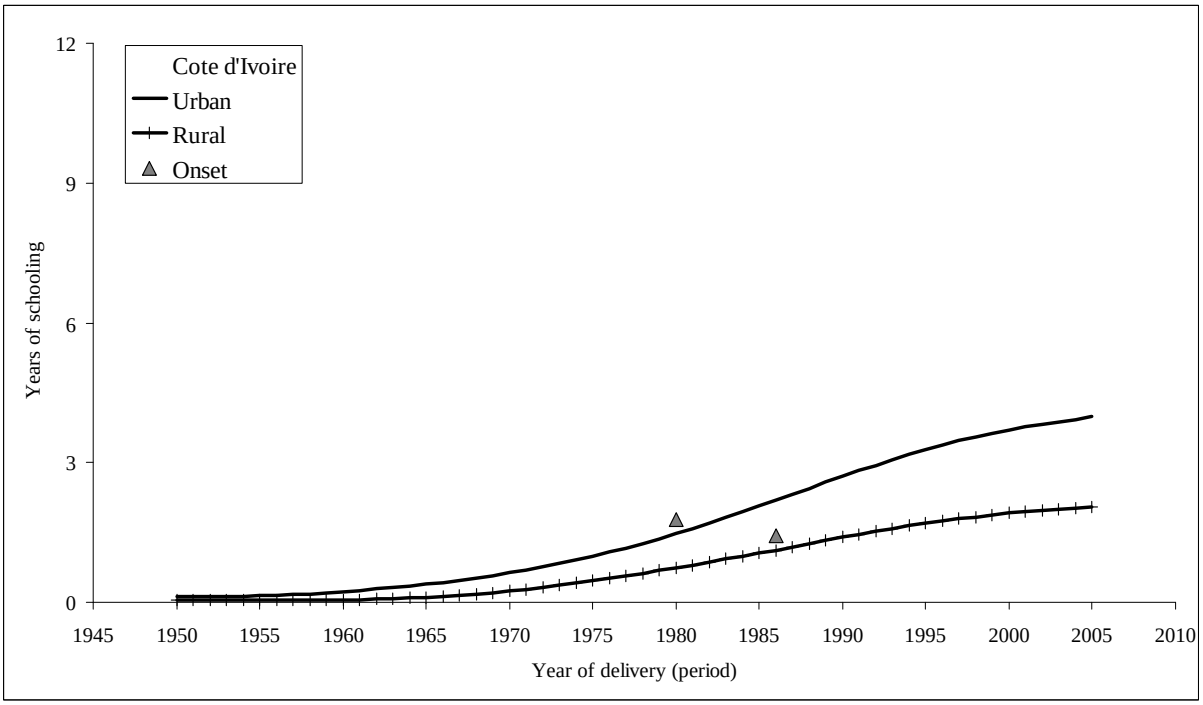


Figure B-9.2. Period trends in level of education, fertile women, Cote d'Ivoire



10. Ethiopia

Ethiopia conducted two DHS surveys with information on level of education, in 2000 and in 2005. Both are compatible in levels and trends in education. (Table B-10.1)

Table B-10.1. Basic characteristics of surveys, Ethiopia

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	2000	13,046	2.36	13,996	1.03
DHS	2005	12,281	2.96	13,308	1.41

Cohort trends

Level of education in Ethiopia started to increase for cohorts born after 1935 for men and those born after 1955 for women, and was virtually nil for those born before 1920. The increase was moderate and steady, with the exception of the 1970-1977 male cohorts whose level declined somewhat. These were likely to start school at the time of the revolution (1974). The increase in level of education occurred despite very low levels of income per capita, with only moderate increase in income from 1950 to 1974, and virtually no change in income for 30 years thereafter, from 1974 to 2004. (Figure B-10.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular. They were fast in urban areas given the level of income per capital, reaching 5.8 years in 2005, but very slow in rural areas, reaching only 0.8 years in 2005, creating a huge gap between the two areas. The mean level of education of fertile women was low in both urban and rural areas when the fertility transition started (1979 and 1990 respectively). (Figure B-10.2)

Figure B-10.1. Cohort trends in level of education, Ethiopia

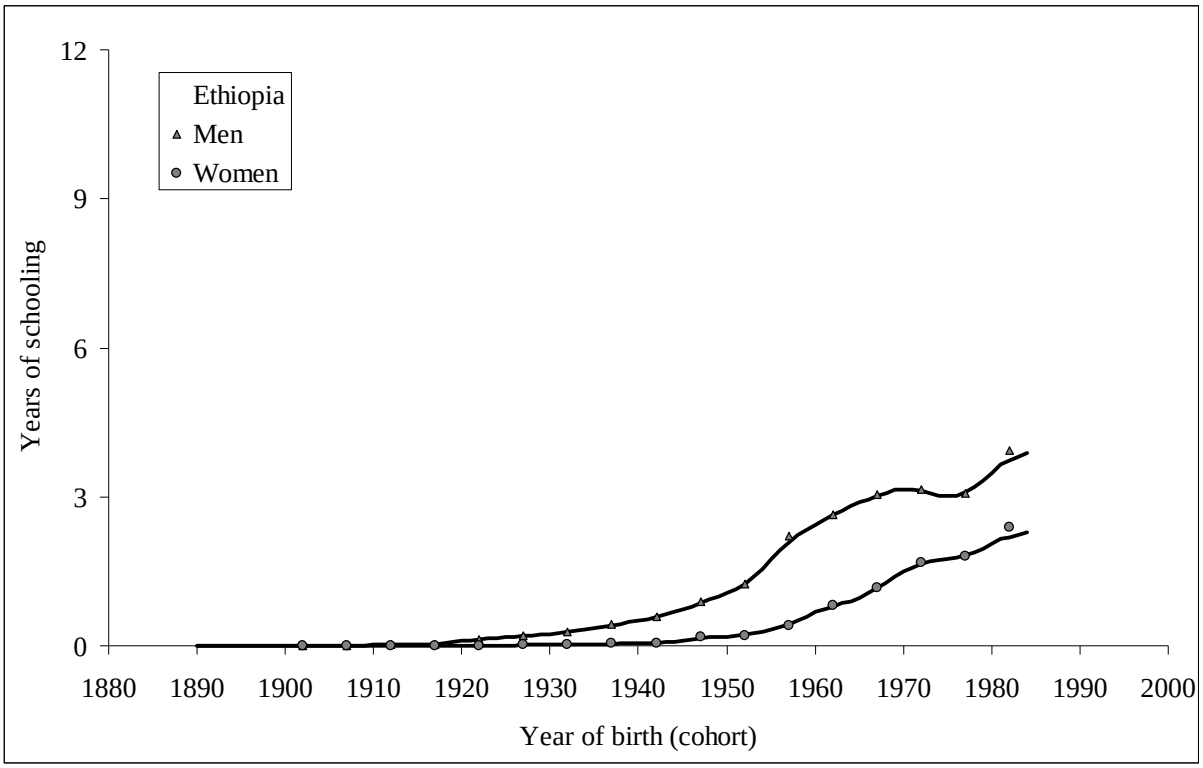
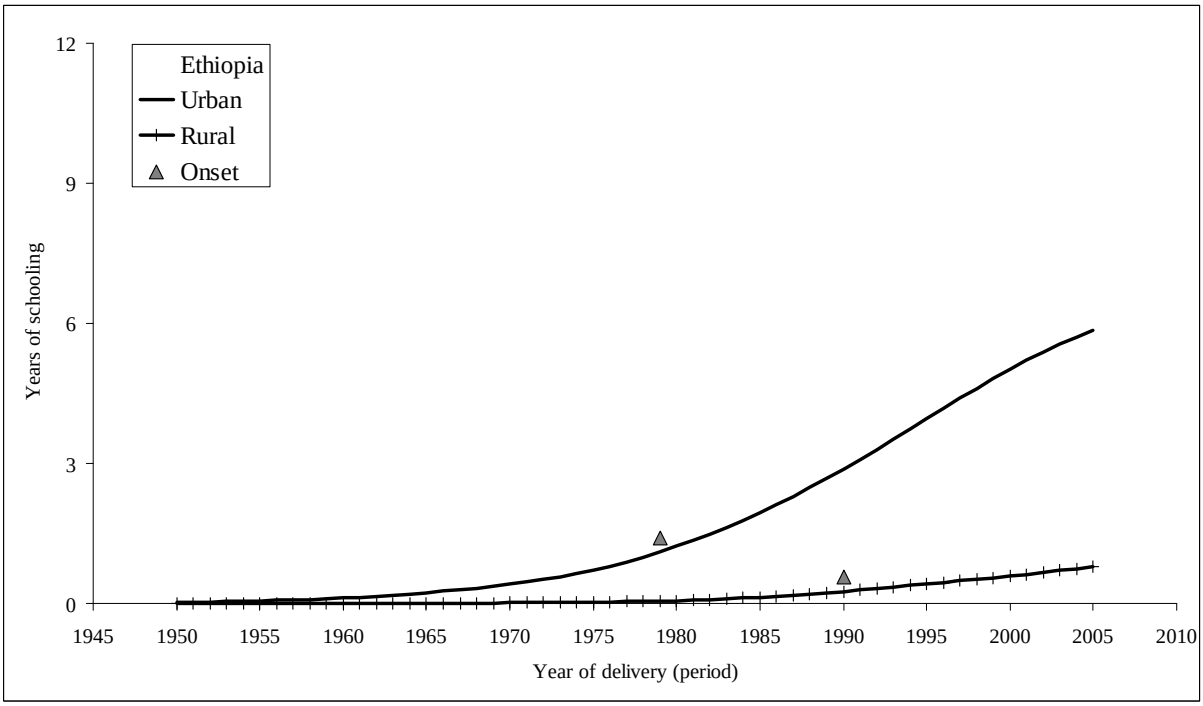


Figure B-10.2. Period trends in level of education, fertile women, Ethiopia



11. Gabon

Gabon conducted only one DHS survey with information on level of education, in 2000. (Table B-11.1)

Table B-11.1. Basic characteristics of surveys, Gabon

		Men 20-59		Women 20-59	
Survey	**Year**	**Number**	**Years of schooling**	**Number**	**Years of schooling**
DHS	2000	6,625	7.92	6,488	6.28

Cohort trends

Like in nearby Congo Brazza, the level of education in Gabon increased very rapidly for about one generation: for male cohorts born between 1930 and 1960 and for female cohorts born between 1940 and 1970. Afterwards, the mean level stagnated or slightly declined, both sexes evolving in parallel with a gap of about 10 years. The stagnation and decline could be associated with the long lasting recession that struck the country since 1978, which was still going on in 2008, after the very good years of 1974-1977 during which income per capita was very high by African standards, exceeding $10000. (Figure B-11.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular and benefited from the fast increase of the 1950's and 1960's. An outstanding feature of trends in education in Gabon was the lack of difference between urban and rural areas from 1965 to 1985. This is probably due to the small proportion of the population living in rural areas (mostly in the forest) and the huge effort of the Christian missions in these remote places. However, the gap between urban and rural increased afterwards, reaching 2.1 years in 2005. The fertility transition started at about the same time in urban and rural areas (in 1984), and at about the same level of education. (Figure B-11.2)

Figure B-11.1. Cohort trends in level of education, Gabon

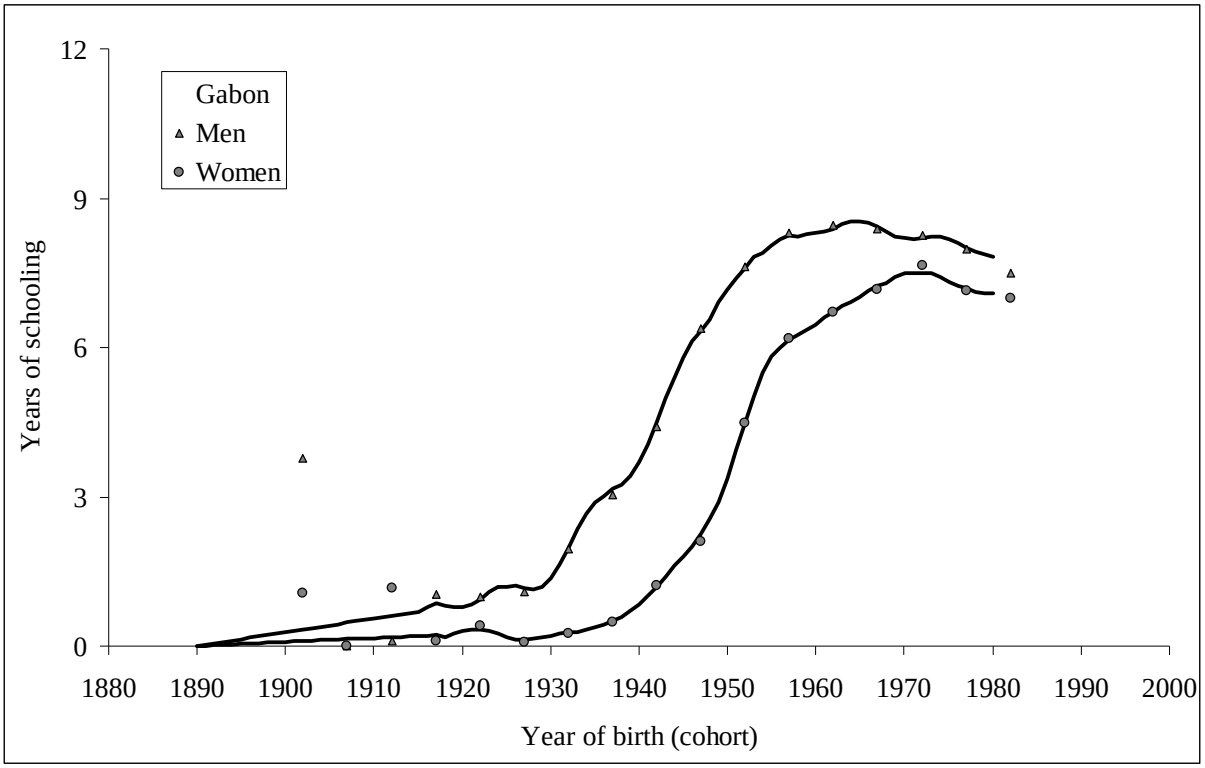
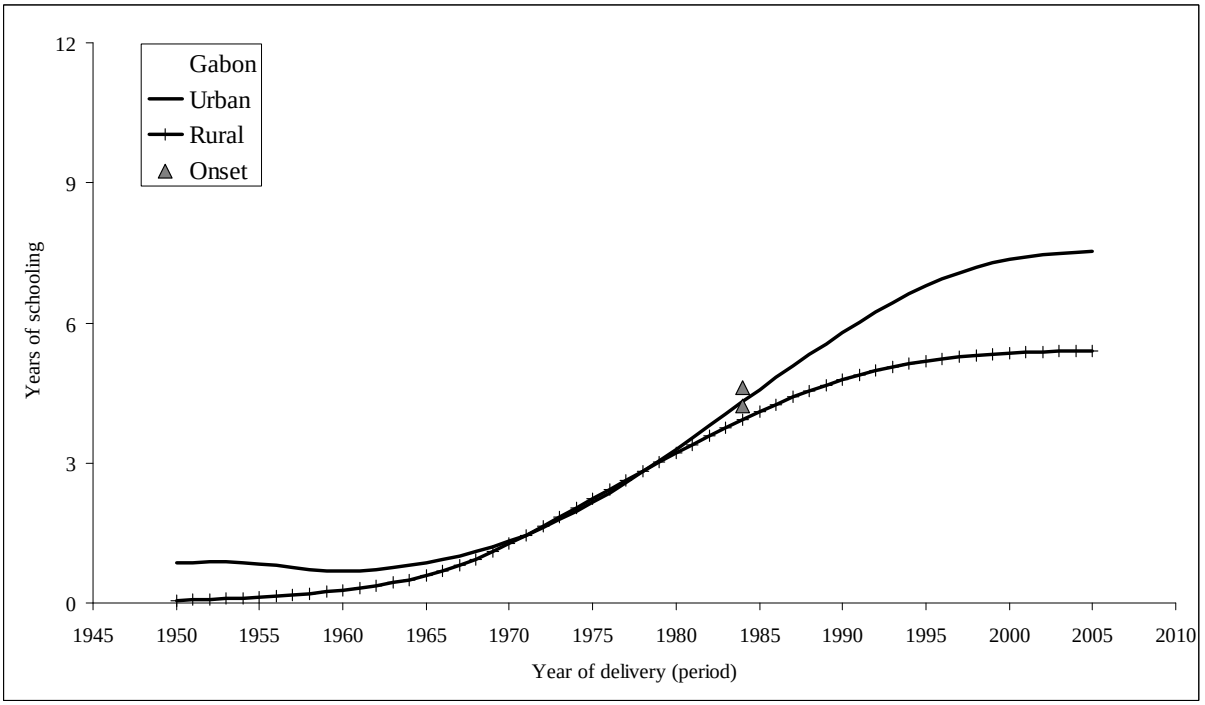


Figure B-11.2. Period trends in level of education, fertile women, Gabon



12. Ghana

Four DHS surveys are available in Ghana with information on level of education, conducted in 1993, 1999, 2003 and 2008. The surveys are not fully compatible, and in particular the 1999 survey reveals abnormally high levels compared with the others, especially for the men. However, discrepancies were relatively small and were smoothed out in the cohort study. (Table B-12.1)

Table B-12.1. Basic characteristics of surveys, Ghana

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1993	3,674	7.11	4,762	4.56
DHS	1999	3,984	8.49	4,832	5.37
DHS	2003	4,299	7.99	5,705	5.29
DHS	2008	8,369	8.32	10,338	6.10

Cohort trends

In Ghana, trends in level of education are rather complex. For men, the level increased slowly from cohort 1900 to 1920, then rapidly from cohort 1920 to 1950, then stagnated for a about 20 years, then increased slowly among the most recent cohorts (1967-1987) reaching a high value (8.7 years). For women, the level increased slowly from cohort 1900 to 1930, then rapidly from 1930 to 1960, then slowly again up to 1977, then more rapidly in the next 10 cohorts, catching up with the men. For cohort 1987, the gap between men and women was reduced to 1.2 years, whereas it was 3.7 years for cohort 1952. Trends in level of education do not appear to be related with economic growth. The 1950's and 1960's period was rather that of a slow but steady economic growth; the 1974-1983 was marked by a strong recession, but cohorts who entered school at that time did rather better that those born before. (Figure B-12.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular and benefited from the fast increase of the 1950's and 1960's. Urban and rural areas evolved in parallel, with some faster increase in urban areas in the 1960's and 1970's and some slower increase afterwards. The gap between urban and rural areas was still high in 2005 (3.2 years). The fertility transition started at average level of education both in urban and in rural areas, in 1977 and in 1986 respectively. (Figure B-12.2)

Figure B-12.1. Cohort trends in level of education, Ghana

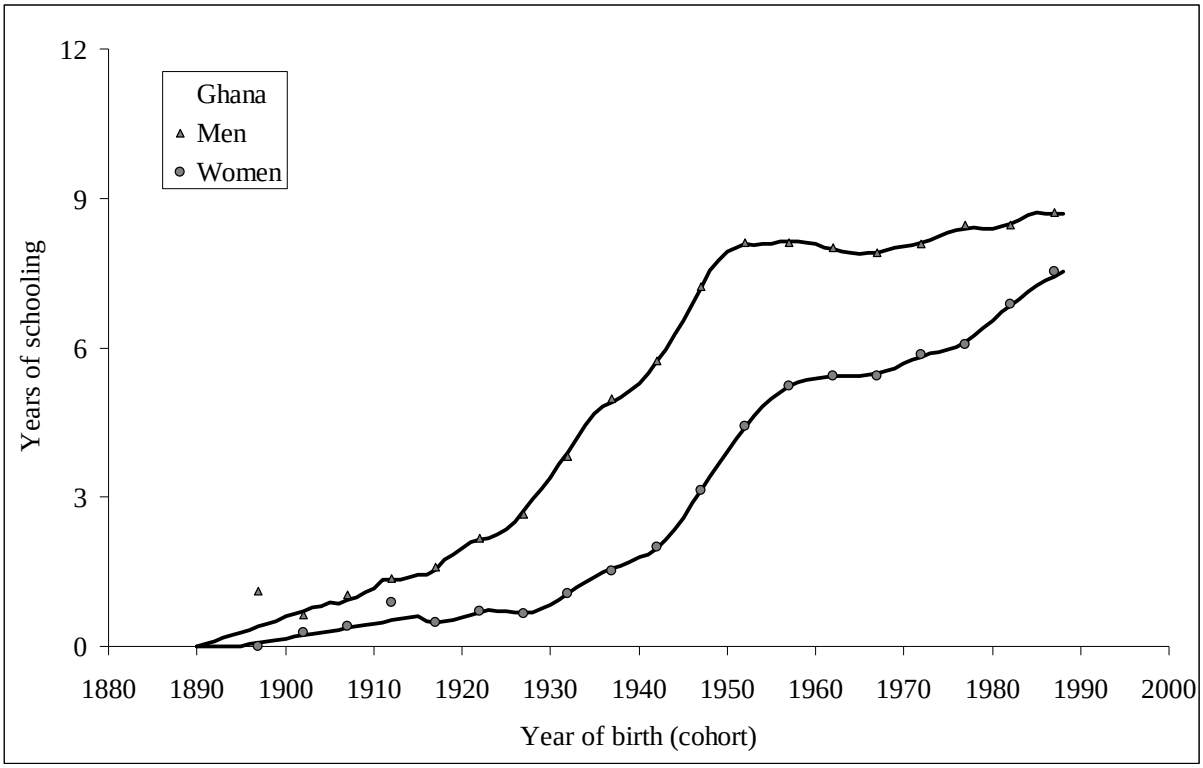
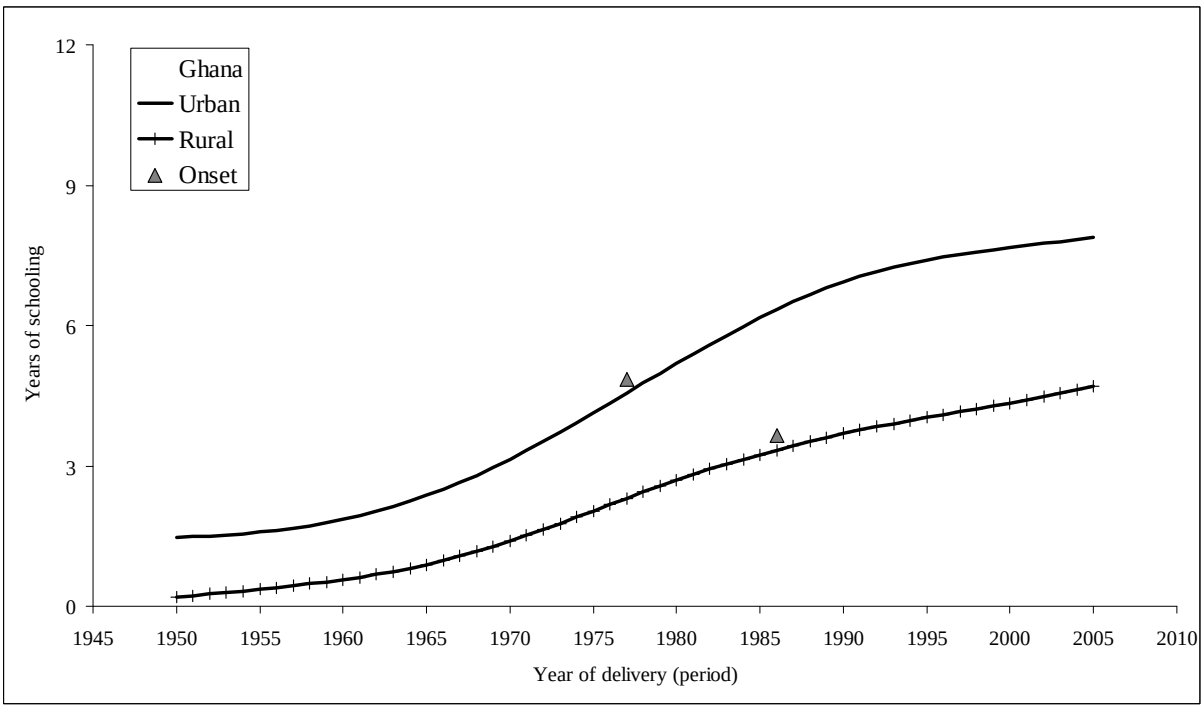


Figure B-12.2. Period trends in level of education, fertile women, Ghana



13. Guinea

Two DHS surveys are available in Guinea with information on level of education, conducted in 1999 and 2005. The surveys are not compatible, although the second survey shows a lower level for women. (Table B-13.1)

Table B-13.1. Basic characteristics of surveys, Guinea

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1999	5,481	3.25	6,788	1.15
DHS	2005	6,018	3.59	8,135	1.03

Cohort trends

In Guinea, trends in level of education are erratic, reflecting the complex political history of the past 50 years. For men, the level took off around cohort 1935 but leveled off 20 years later, to stay at a medium low level for about 20 years and increased again after cohort 1972, especially for those born after the death of Sekou Touré. For women, the levels were much lower, trends were similar, although somewhat delayed, with some leveling off among cohorts born from 1962 to 1972. trends in level of education seem to be more closely related with the political changes than with economic growth, which was quite steady in Guinea from 1950 to 2005, although at low levels of income ($303 in 1950; $614 in 2005). The period of economic stagnation (1978-1991) did not seem to have any major effect on levels of education. (Figure B-13.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, but stayed at low levels in urban areas (3.2 years in 2005) and very low levels in rural areas (0.5 years in 2005). The level of education hardly changed between 1995 and 2005. Despite low levels and slow trends, the fertility transition started in Guinea around 1986 in urban areas and around 1995 in rural areas. (Figure B-13.2)

Figure B-13.1. Cohort trends in level of education, Guinea

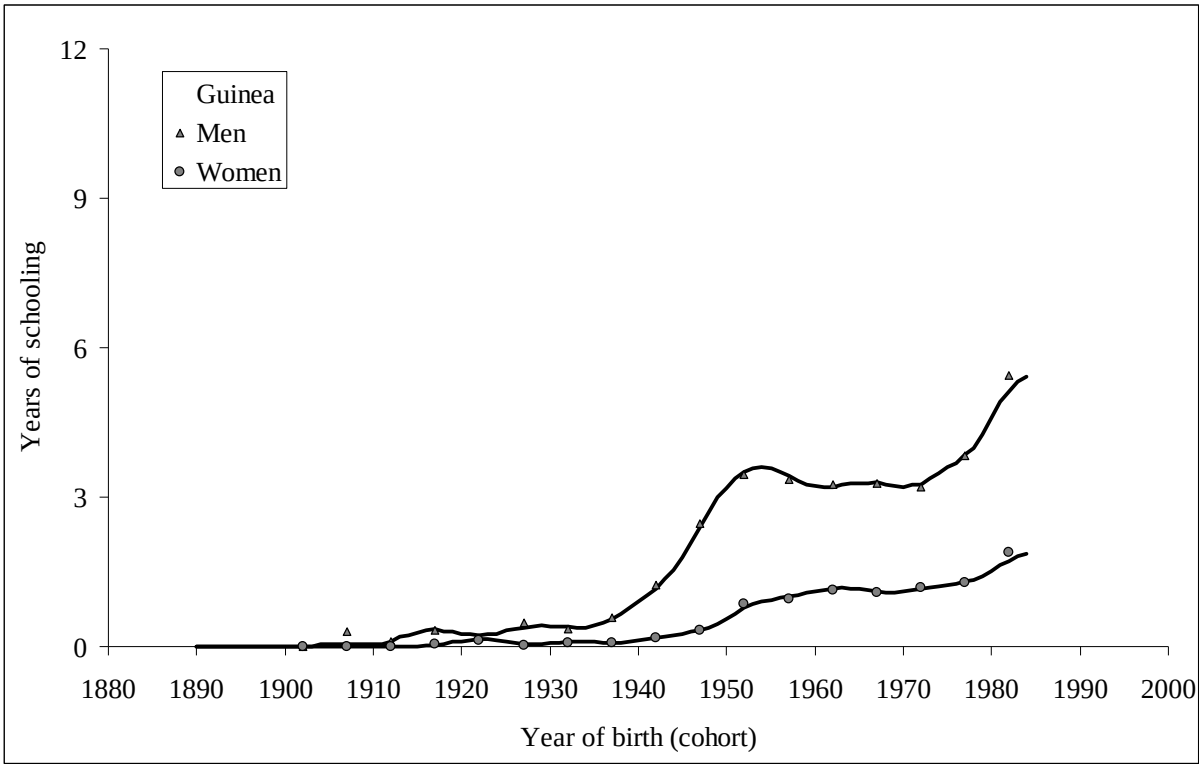
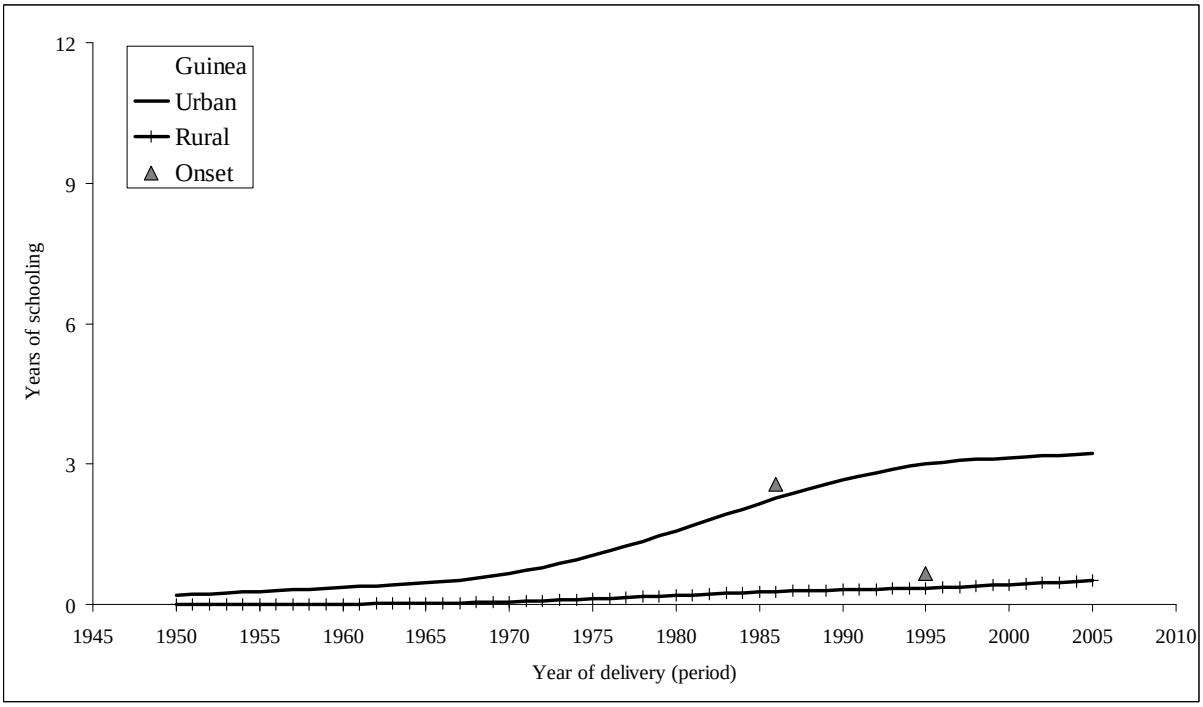


Figure B-13.2. Period trends in level of education, fertile women, Guinea



14. Kenya

Four DHS surveys are available in Kenya with information on level of education, conducted at 5-year intervals, in 1993, 1998, 2003 and 2008. The surveys are compatible in levels and trends in level of education. (Table B-14.1)

Table B-14.1. Basic characteristics of surveys, Kenya

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1993	6,246	7.18	7,412	5.01
DHS	1998	6,609	8.12	7,434	6.16
DHS	2003	7,199	8.14	7,868	6.65
DHS	2008	7,075	8.81	8,196	7.42

Cohort trends

In Kenya, trends in level of education were rather regular, and achieved high levels in the recent years, especially for women. For men, modern education seems to have started already in the last years of the 19th century, increased slowly for cohort born before 1925, faster for those born between 1925 and 1970, stagnated for some ten years, and increased again for the recent cohorts (1980-1988). For women, education took off some 10 years later, and increased rapidly for cohorts born between 1935 and 1975; it stagnated for a short period, then increased again for the recent cohorts. The gap between men and women was large for cohorts born in 1947 (3.7 years), but was reduced to a small value 40 years later (0.6 years). Economic growth was rather steady from 1950 to 1990, although the 1978-1985 period was one of stagnation of the economy, which could be related with that in the level of education of male cohorts born between 1972 and 1979. The larger recession that occurred later, from 1990 to 2002 was too recent to show an effect on the adult level of education. (Figure B-14.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular and impressive, both in urban and in rural areas, with a steady gap between the two areas (2.1 years in 2005). Most impressive was the high level reached by rural areas in 2005 (7.2 years), way above most other African countries. The fertility transition started early in Kenya, 1961 in urban areas and around 1966 in rural areas, although it started when the level of education was still moderate, and at comparable levels in both areas of residence. (Figure B-14.2)

Figure B-14.1. Cohort trends in level of education, Kenya

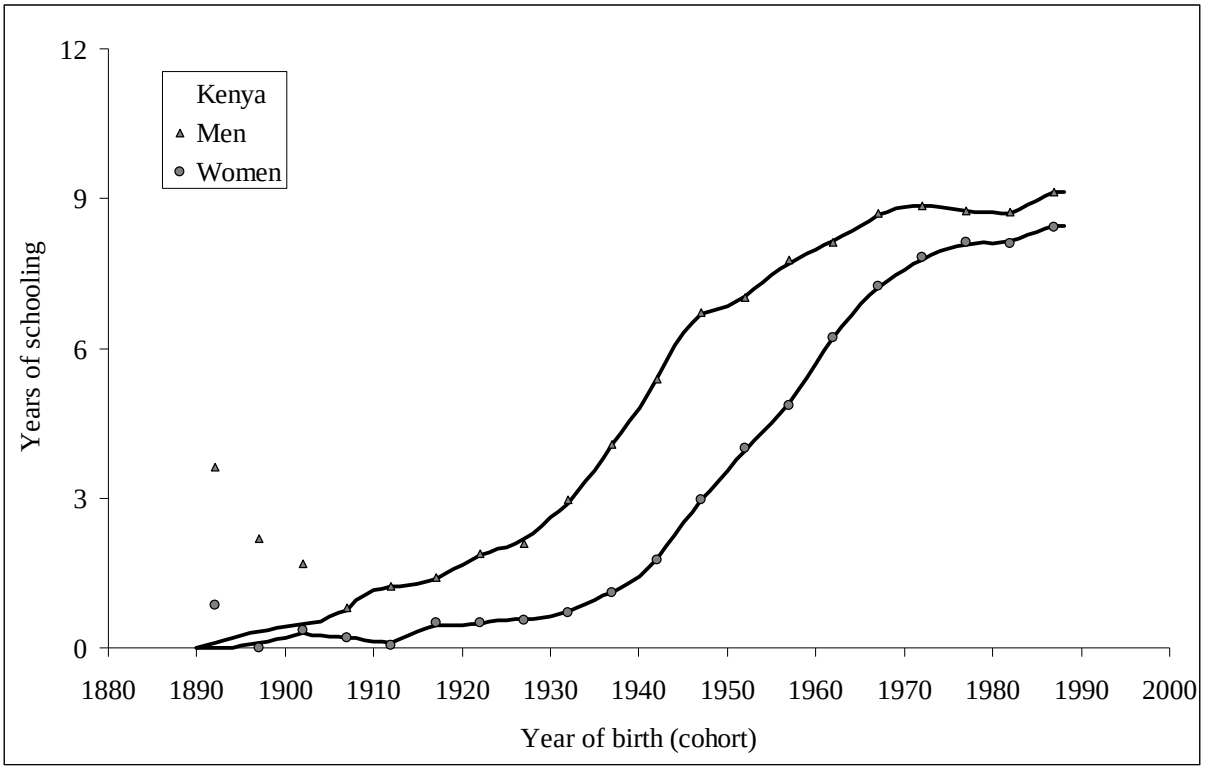
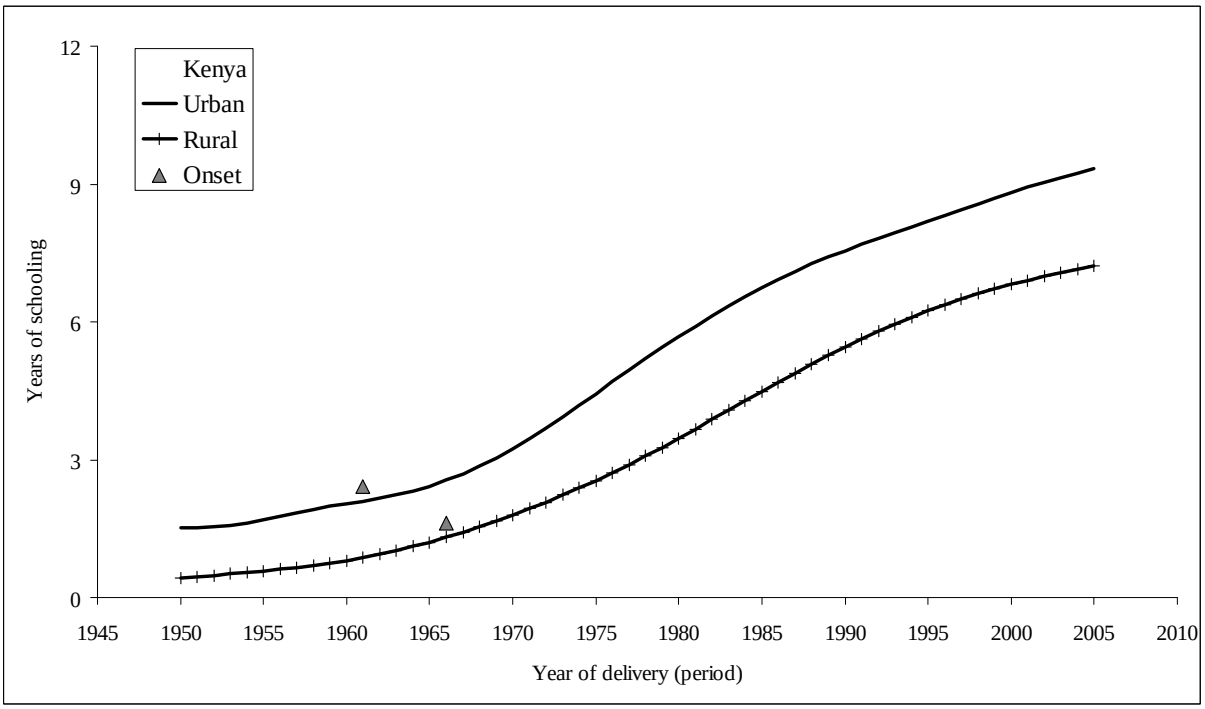


Figure B-14.2. Period trends in level of education, fertile women, Kenya



15. Lesotho

Two DHS surveys are available in Lesotho with information on level of education, conducted at 5-year intervals, in 2004 and 2009. The surveys are compatible in levels and trends in level of education. (Table B-15.1)

Table B-15.1. Basic characteristics of surveys, Lesotho

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	2004	8,050	5.49	8,625	7.14
DHS	2009	9,136	6.10	9,931	7.92

Cohort trends

In Lesotho, trends in level of education were rather regular, and achieved high levels in the recent years, for both men and women (8.7 years for men; 6.8 years for women). Data for the earlier cohorts are unreliable due to the late date of the first survey. The erratic values for the 1920-1930 cohorts are associated with small sample size, and might not be realistic. It should be noted that the gap between men and women tended rather to increase in the recent years than decrease as in most other African countries. Steady trends in education match steady trends in income per capita from 1950 to 2005. (Figure B-15.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, both in urban and in rural areas, as could be expected from the steady cohort trends. The gap between urban and rural was rather small in 1950 (0.9 years), but increased regularly to reach 2.0 years in 1977, then stayed at about the same level until 2005. The fertility transition started around 1976 in Lesotho, at the same time in urban and in rural areas, and at a relatively high level of education respectively in each area of residence. (Figure B-15.2)

Figure B-15.1. Cohort trends in level of education, Lesotho

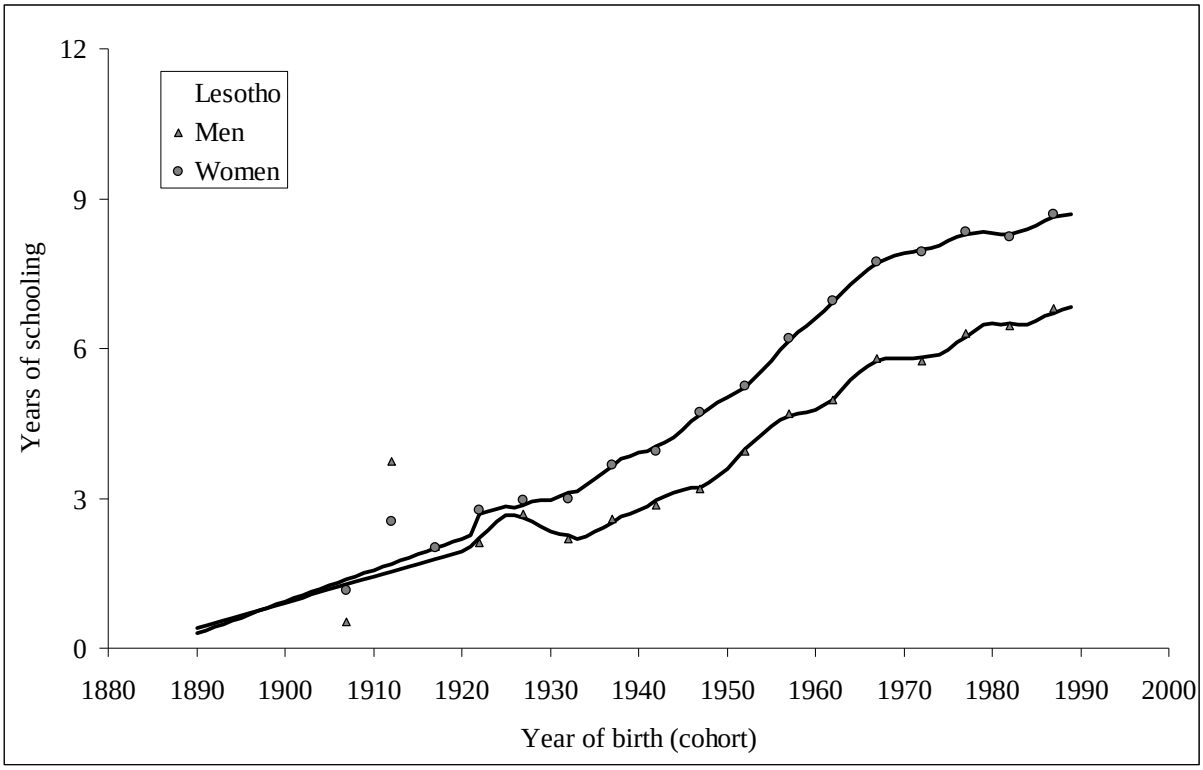
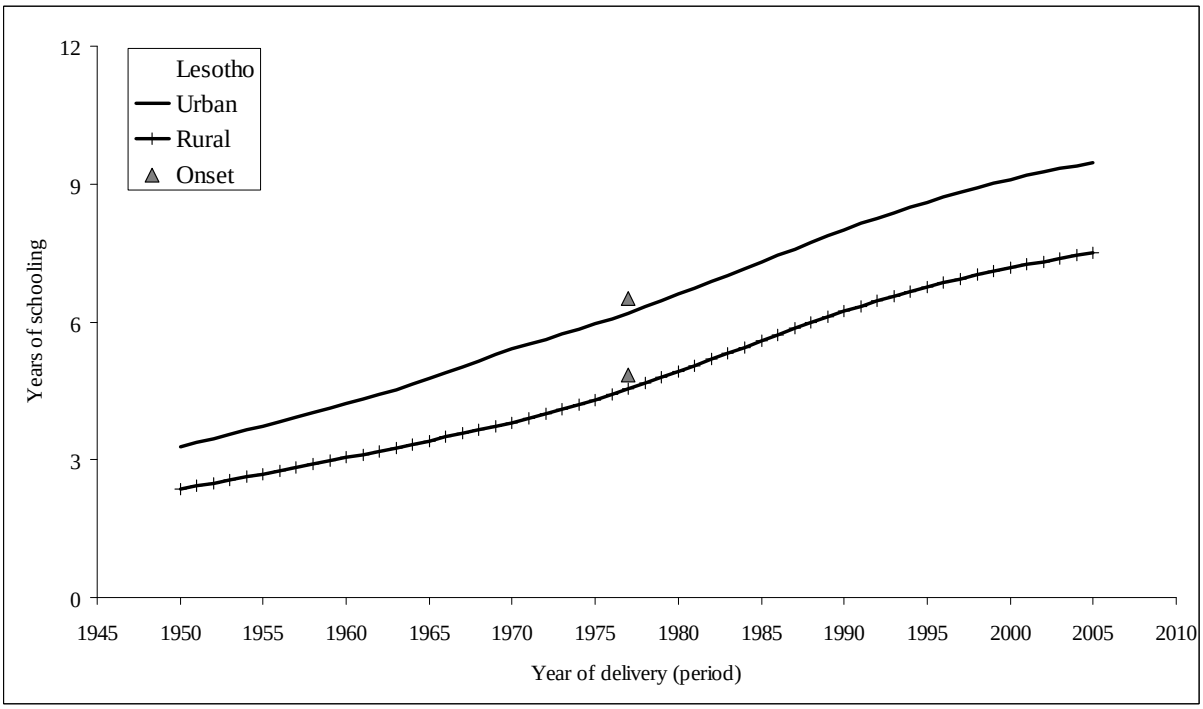


Figure B-15.2. Period trends in level of education, fertile women, Lesotho



16. Liberia

Only one DHS survey is available in Liberia with information on level of education, conducted in 2007. (Table B-16.1)

Table B-16.1. Basic characteristics of surveys, Liberia

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	2007	6,456	6.55	7,424	3.18

Cohort trends

In Liberia, trends in level of education of men are characterized by a fast increase from cohorts born between 1925 and 1962, reaching a high level (7.4 years in 1962), followed by a long period of regression covering 25 yearly cohorts with a small decline (6.7 years in 1987). Trends were different for women, with a steady increase from cohorts born in 1935 to the most recent cohorts available (4.4 years in 1987). The gap between men and women was very large for cohorts born in 1962 (almost 4 years), and was later reduced because of the different dynamics. The decline in level of education for men was probably associated with the strong recession of the 1972 to 1989 period, during which income per capita was divided by almost 3 ($1530 in 1972, $518 in 1989). It is striking to note that this recession did not seem to have an effect on the level of education of women. (Figure B-16.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, both in urban and in rural areas, as could be expected from the steady cohort trends among women. The gap between urban and rural was very small in 1950 (0.1 years), but increased regularly to reach 3.6 years in 2005. The fertility transition started early in urban areas (1974) and much later in rural areas (1996), and at similar low levels of education: 1.8 years in urban and 1.5 years in rural. (Figure B-16.2)

Figure B-16.1. Cohort trends in level of education, Liberia

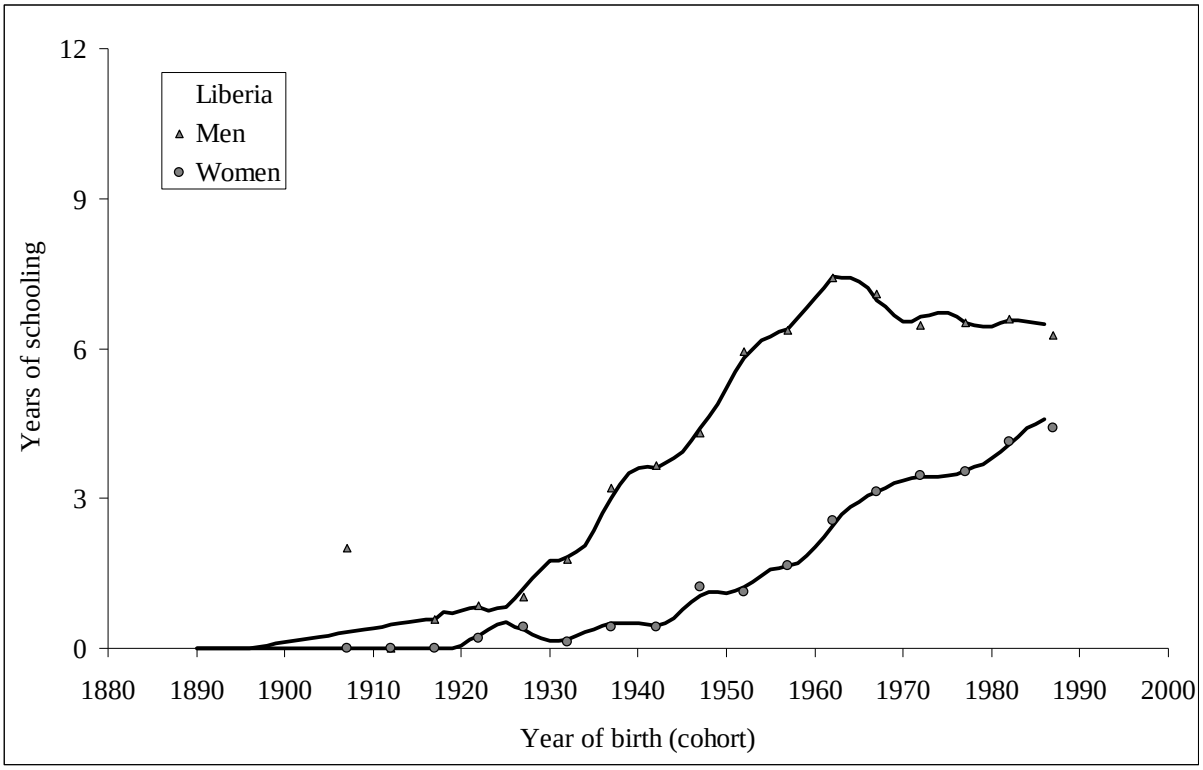
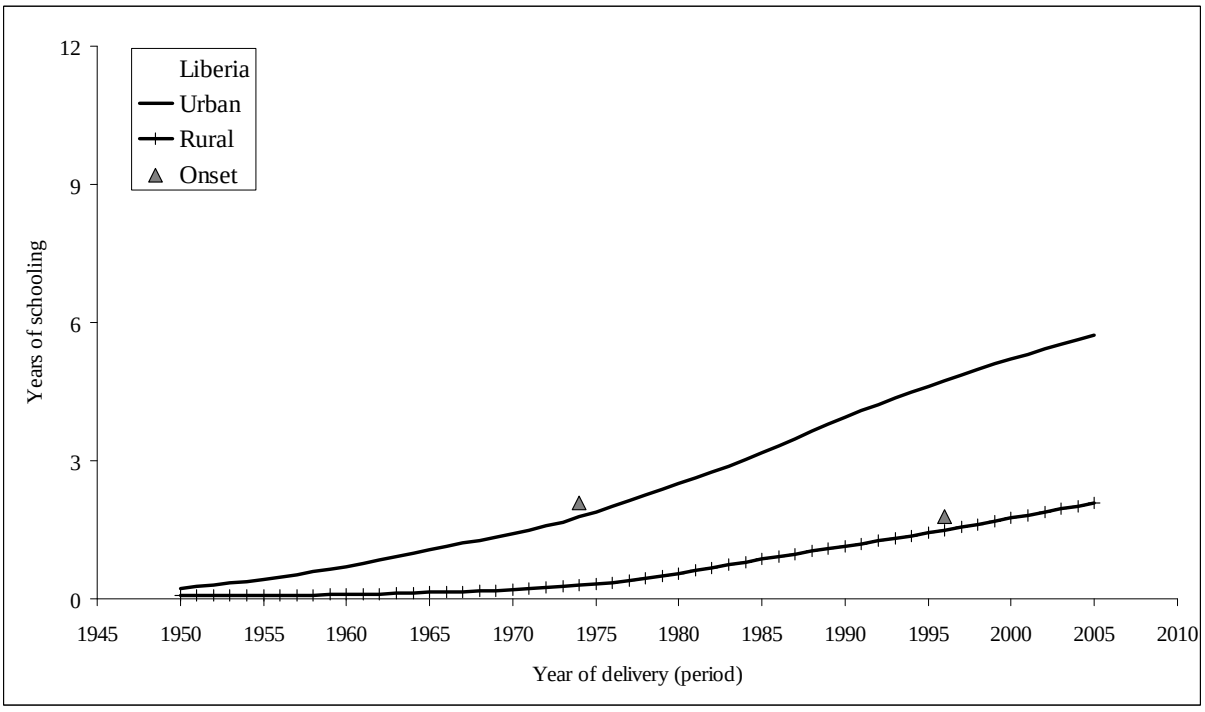


Figure B-16.2. Period trends in level of education, fertile women, Liberia



17. Madagascar

Four DHS surveys are available in Madagascar with information on level of education, conducted in 1992, 1997, 2003 and 2008. The coding of the number of years schooling (HV108) was inconsistent. In the 1992 survey it was erroneous, and was corrected using the level (HV106) and the number of years within each level (HV107). In the 2003 survey, level 10-11 years was grouped with level 9 years, and was inconsistent with HV106 and HV107; it was also corrected. In both the 2003 and the 2008 surveys, levels 17 years and above (more than 5 years in tertiary education) were grouped together. Therefore, the average years of schooling might not be fully compatible within the four surveys. However, discrepancies were small when cohorts were grouped together, and trends appeared reliable. In particular the lower level in the 2008 survey seems realistic. (Table B-17.1)

Table B-17.1. Basic characteristics of surveys, Madagascar

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1992	5,141	4.09	5,953	3.30
DHS	1997	6,329	4.20	6,856	3.53
DHS	2003	7,423	5.04	7,901	4.35
DHS	2008	15,473	4.54	16,519	3.97

Cohort trends

The increase in the level of education in Madagascar was early, slow and steady up to cohort 1967. Afterwards, for both men and women the average level tended to decline somewhat, then remained steady. The halt in the increase in average years of schooling seems to coincide with the Malagasy revolution of 1973, and the subsequent economic crisis which lasted for some 30 years: income per capita was $1246 in 1971 but only $606 in 2002. A feature of education in Madagascar is the small gap between men and women: a gap less that 0.5 years difference for cohorts born between 1970 and 1988, and which never exceeded 1.5 years for earlier cohorts, a small difference compared with most other African countries. Values for the earliest cohorts were erratic due to small sample size, but revealed a small minority of educated persons, both men and women, as early as the late 19th century. (Figure B-17.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, both in urban and in rural areas. The gap between urban and rural was very small in 1950, but increased regularly to reach 2.4 years in 2005. The fertility transition started early in urban areas (1971) and a few years later in rural areas (1978), and at similar medium-low levels of education: 1.9 years in urban and 2.0 years in rural. (Figure B-17.2)

Figure B-17.1. Cohort trends in level of education, Madagascar

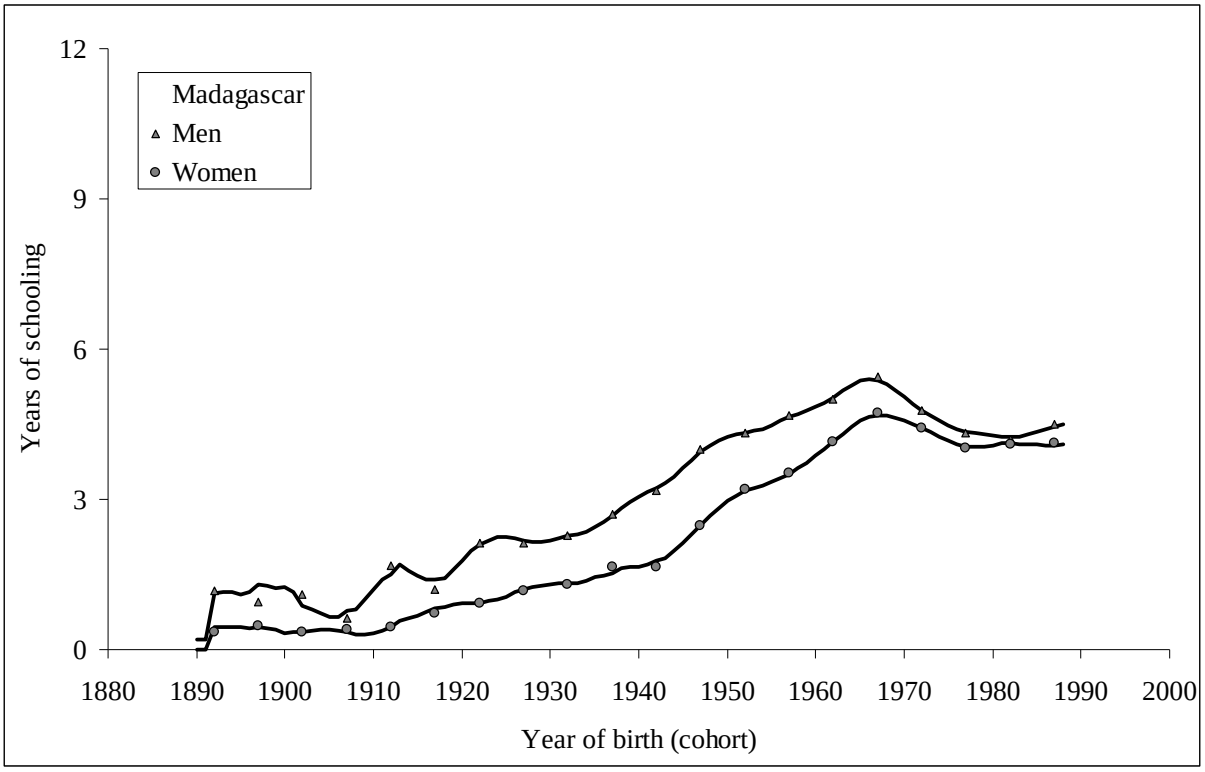
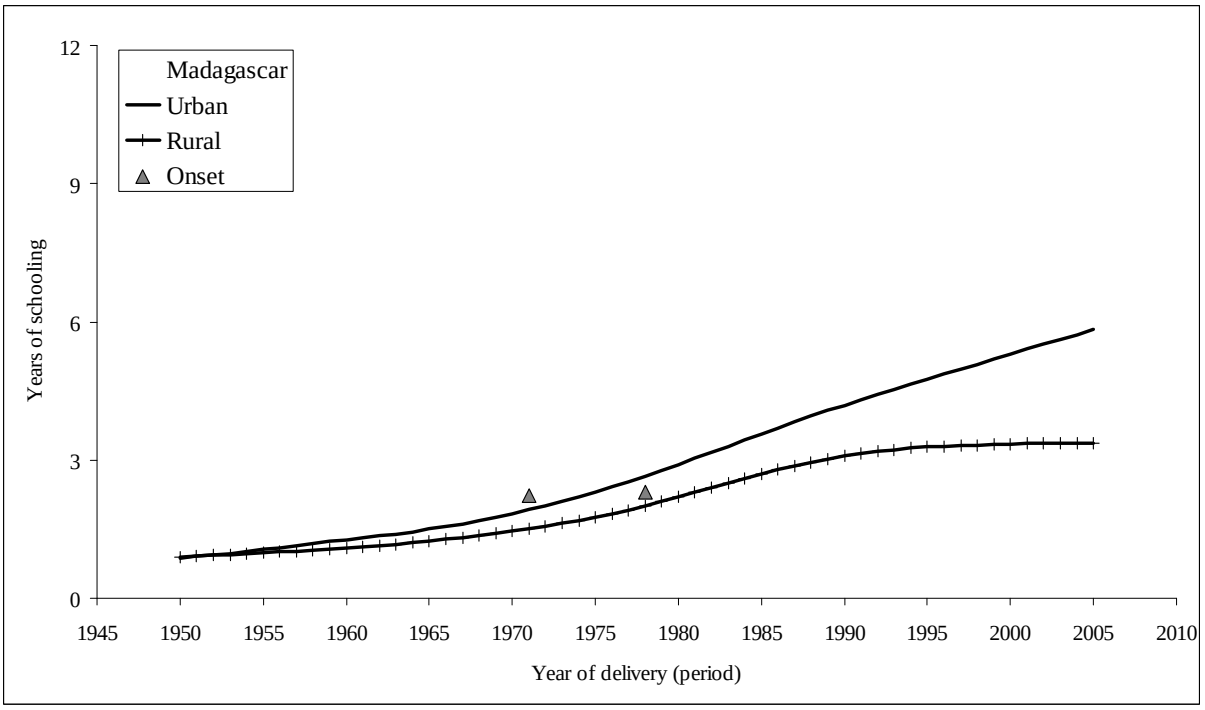


Figure B-17.2. Period trends in level of education, fertile women, Madagascar



18. Malawi

Three DHS surveys were available in Malawi with information on level of education, conducted in 1992, 2000 and 2004. Levels and trends appeared compatible in the three surveys. (Table B-18.1)

Table B-18.1. Basic characteristics of surveys, Malawi

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1992	4,307	4.75	4,693	2.23
DHS	2000	11,876	5.64	12,607	3.35
DHS	2004	10,991	6.24	11,686	4.02

Cohort trends

The increase in the level of education in Malawi was early and steady, with only some minor incidents. For men, the increase in level of education slowed down for those born in the early 1930's and those born in the 1960's, but this did not occur among women. For women, most of the increase occurred since 1940. The gap between men and women was large for those born in the 1950's (about 3 years), but narrowed markedly in the recent years, reaching 1.1 years for those born in 1988. The halt observed in the 1960's for men could not be explained by fluctuations in income per capita, and might simply be associated with the period just following independence. The recession that occurred between 1980 and 1994 could not affect the cohorts under study. (Figure B-18.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, both in urban and in rural areas. The gap between urban and rural was very small in 1950 (0.7 years), but increased regularly to reach 3.0 years in 2005. The fertility transition started at about the same time in urban areas (1977) and in rural areas (1978), at different levels of education: 3.3 years in urban and 1.5 years in rural. (Figure B-18.2)

Figure B-18.1. Cohort trends in level of education, Malawi

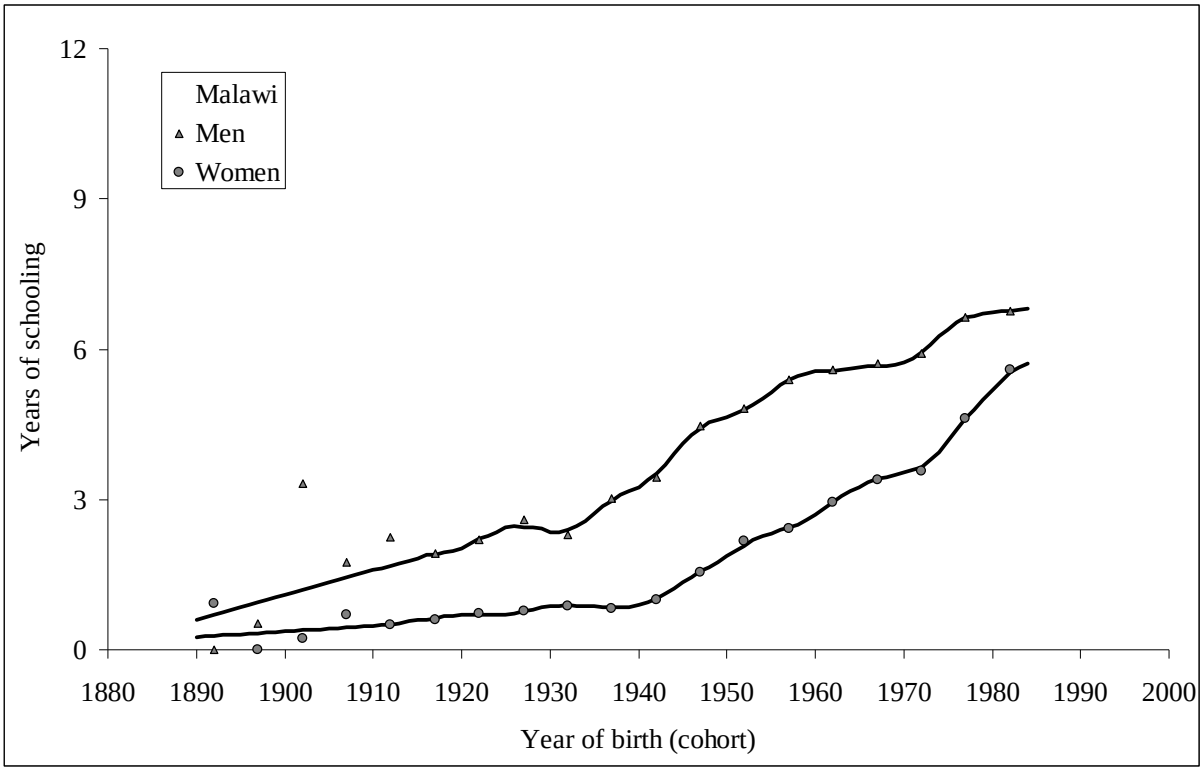
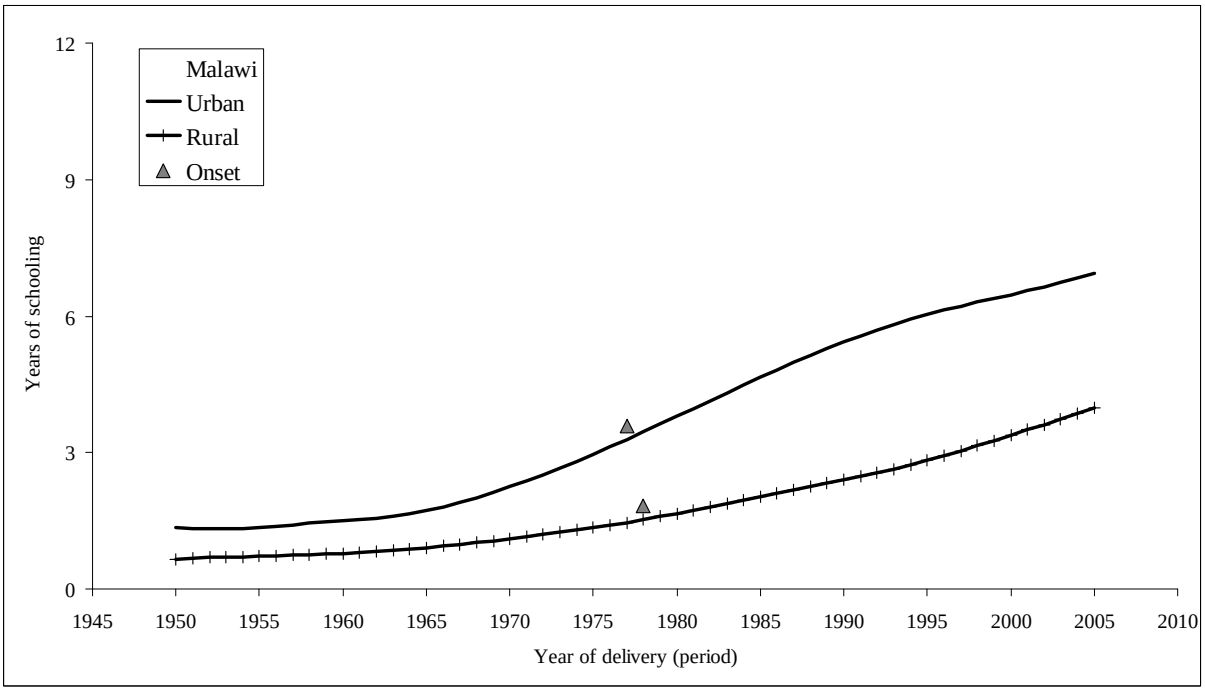


Figure B-18.2. Period trends in level of education, fertile women, Malawi



19. Mali

Three DHS surveys were available in Mali with information on level of education, conducted in 1996, 2001 and 2006. Levels and trends appeared compatible in the three surveys, and were very low with hardly any change. (Table B-19.1)

Table B-19.1. Basic characteristics of surveys, Mali

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1996	8,149	1.63	9,947	0.80
DHS	2001	10,923	2.22	13,158	1.04
DHS	2006	12,148	2.23	14,626	1.03

Cohort trends

The increase in the level of education in Mali remained overall very low. It increased somewhat before independence for cohorts born before 1955 (1960 for women), and again for cohorts born later, after 1970 for men and after 1980 for women. The gap between men and women remained similar, increasing somewhat from 1.0 (cohort 1950) to 1.5 years (cohort 1987). This occurred despite a slow but steady economic growth, ranging from $457 in 1950, $733 in 1980 and $1073 in 2005. (Figure B-19.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, both in urban and in rural areas and remained at very low levels. The gap between urban and rural was almost nil in 1950, and increased regularly to reach 1.8 years in 2005. The fertility transition started within a few years in urban areas (1982) and in rural areas (1989), despite the very low levels of education. (Figure B-19.2)

Figure B-19.1. Cohort trends in level of education, Mali

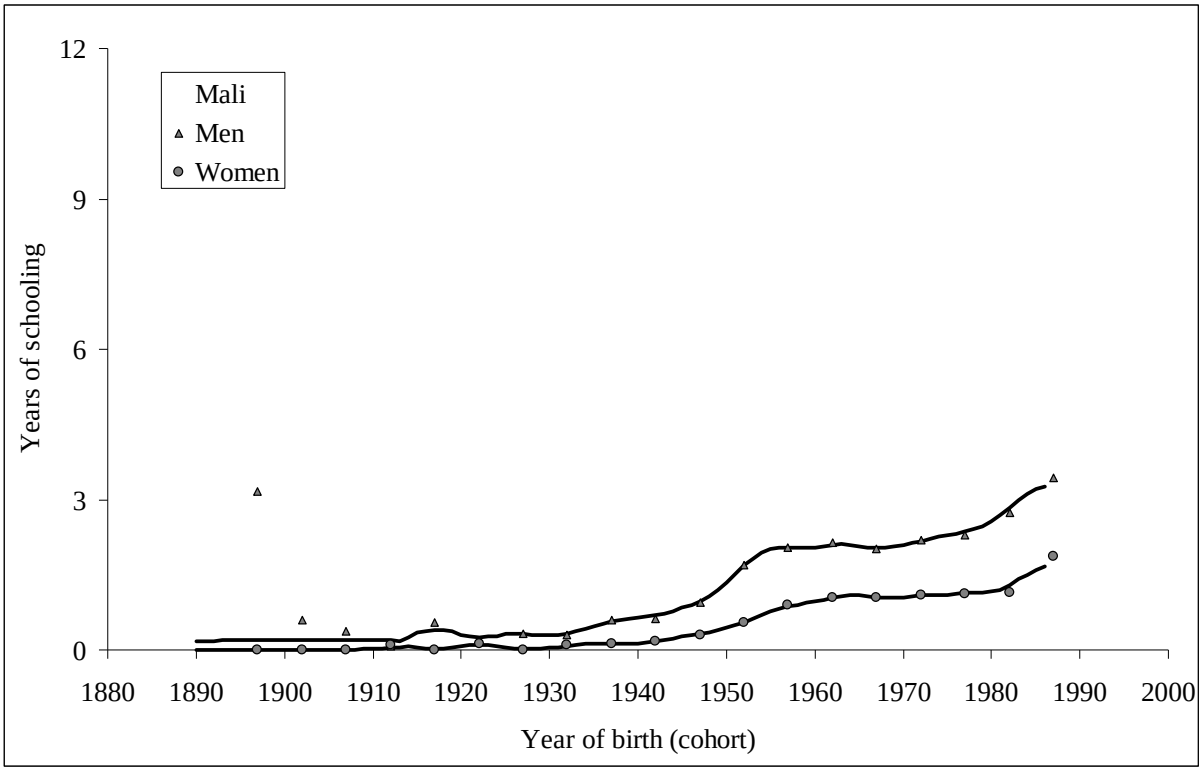
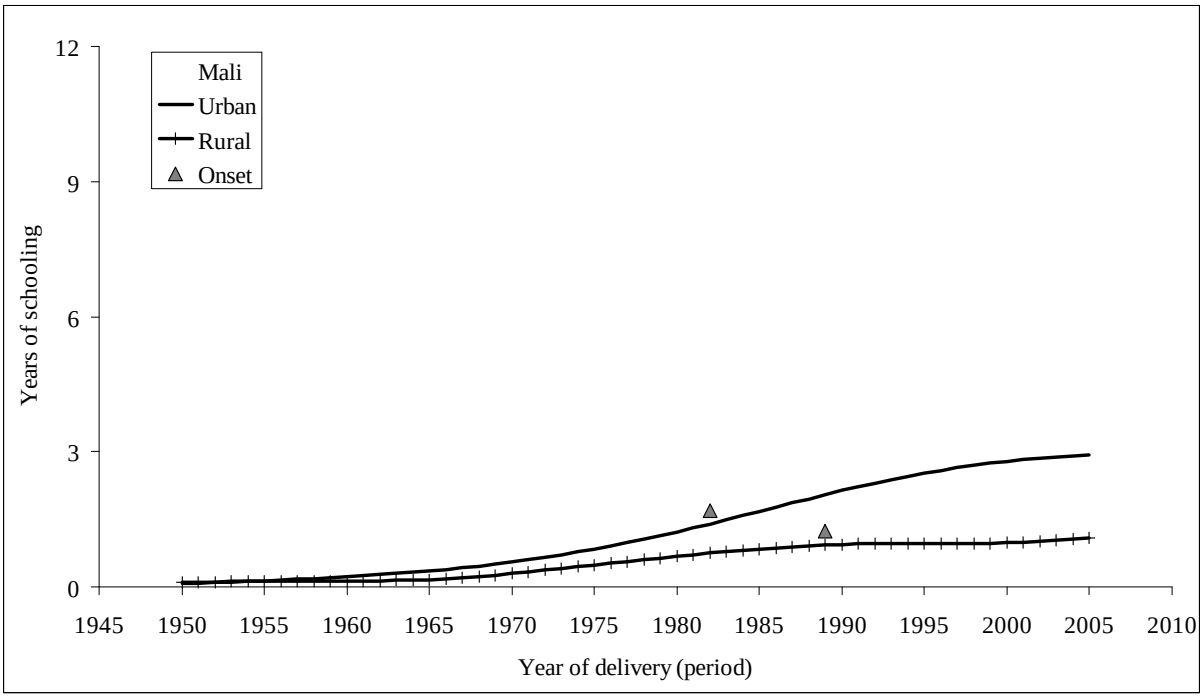


Figure B-19.2. Period trends in level of education, fertile women, Mali



20. Mozambique

Three surveys were available in Mozambique with information on level of education, conducted in 1997 (DHS), 2003 (DHS), and 2009 (AIS). Levels and trends appeared compatible in the three surveys, with a marked increase in the last survey. (Table B-20.1)

Table B-20.1. Basic characteristics of surveys, Mozambique

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1997	7,029	3.34	9,136	1.61
DHS	2003	10,438	3.77	12,750	1.87
AIS	2009	3,749	5.37	3,543	3.93

Cohort trends

The increase in the level of education in Mozambique was irregular: it was slow at the beginning of the 20th century, faster for cohorts born between 1930 and 1965, almost stopped or even reversed for men between 1965 and 1975, then increased rapidly for cohorts born after 1975. The difficult years (1965-1975) seem to be correlated with the difficult period of independence, and the civil war that followed (1975-1992), a period associated with a deep economic depression (1973-1985) during which income per capita was halved ($1873 in 1973; $920 in 1985). However, the cohorts do not fully match the economic recession, and obviously a large effort was made for those born after 1975 despite the difficult times which lasted until 1995. (Figure B-20.1)

Period trends, fertile women

In contrast, period trends in level of education for fertile women were regular, both in urban and in rural areas. The gap between urban and rural was almost nil in 1950, at very low levels, and increased regularly to reach 1.3 years in 2005. The fertility transition started in 1984 in urban areas at low levels of education (2.0 years), and had not started yet in rural areas at the time of the last DHS survey (2003), the 2009 AIS having no information on period fertility. (Figure B-20.2)

Figure B-20.1. Cohort trends in level of education, Mozambique

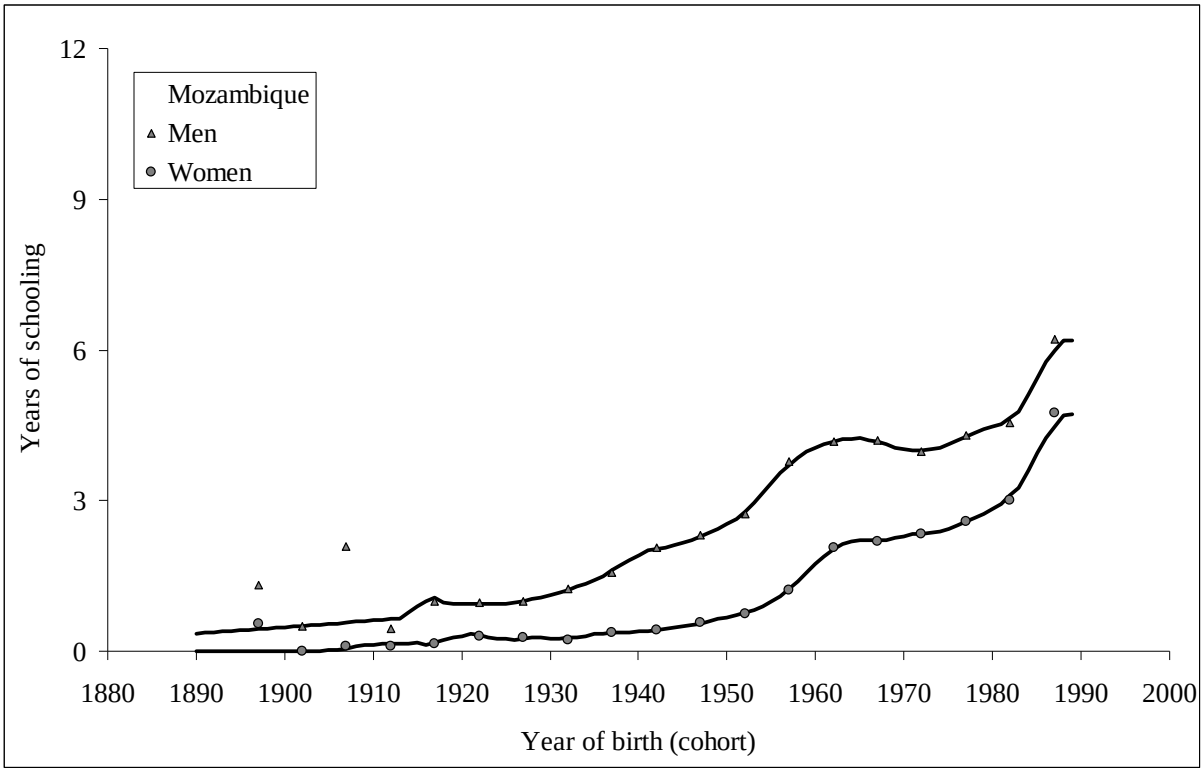
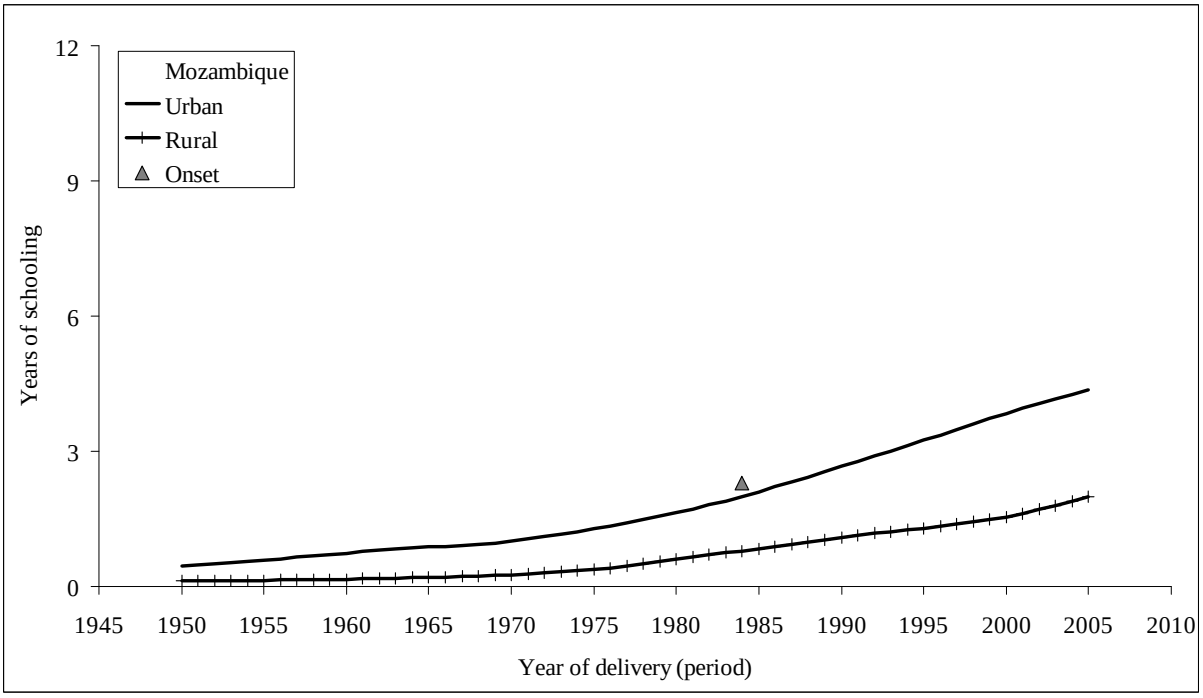


Figure B-20.2. Period trends in level of education, fertile women, Mozambique



21. Namibia

Three DHS surveys were available in Namibia with information on level of education, conducted in 1992, 2000, and 2007. Levels and trends were compatible in the three surveys. (Table B-21.1)

Table B-21.1. Basic characteristics of surveys, Namibia

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1992	4,244	5.63	5,199	5.49
DHS	2000	6,002	7.00	7,094	6.89
DHS	2007	8,635	7.80	9,685	8.00

Cohort trends

The increase in the level of education in Namibia was remarkable: it was early, fast, steady with minor differences between men and women. Already for those born in 1900 there was a minority of men and women educated. By 1950 the average level was already medium (5.4 years for men, 4.6 years for women), and by 1990 it was high for both sexes (9.2 years and 8.4 years respectively). The gap between men and women was always small, and less than one year most of the time. Namibia is one of the few countries for which female level of education exceeded that of males in recent cohorts, those born after 1965. The economic stagnation that prevailed between 1966 and 1990 did not seem to have any effect on trends in level of education. (Figure B-21.1)

Period trends, fertile women

Period trends in level of education for fertile women were also very regular and steep, both in urban and in rural areas. The gap between urban and rural was very large in 1950 (3.1 years), and tended to diminish over time, reaching 2.2 years in 2005. The fertility transition started early in urban areas (1958) at medium level of education (4.6 years), and somewhat later in rural areas (1975) at somewhat lower level of education (3.0 years). (Figure B-21.2)

Figure B-21.1. Cohort trends in level of education, Namibia

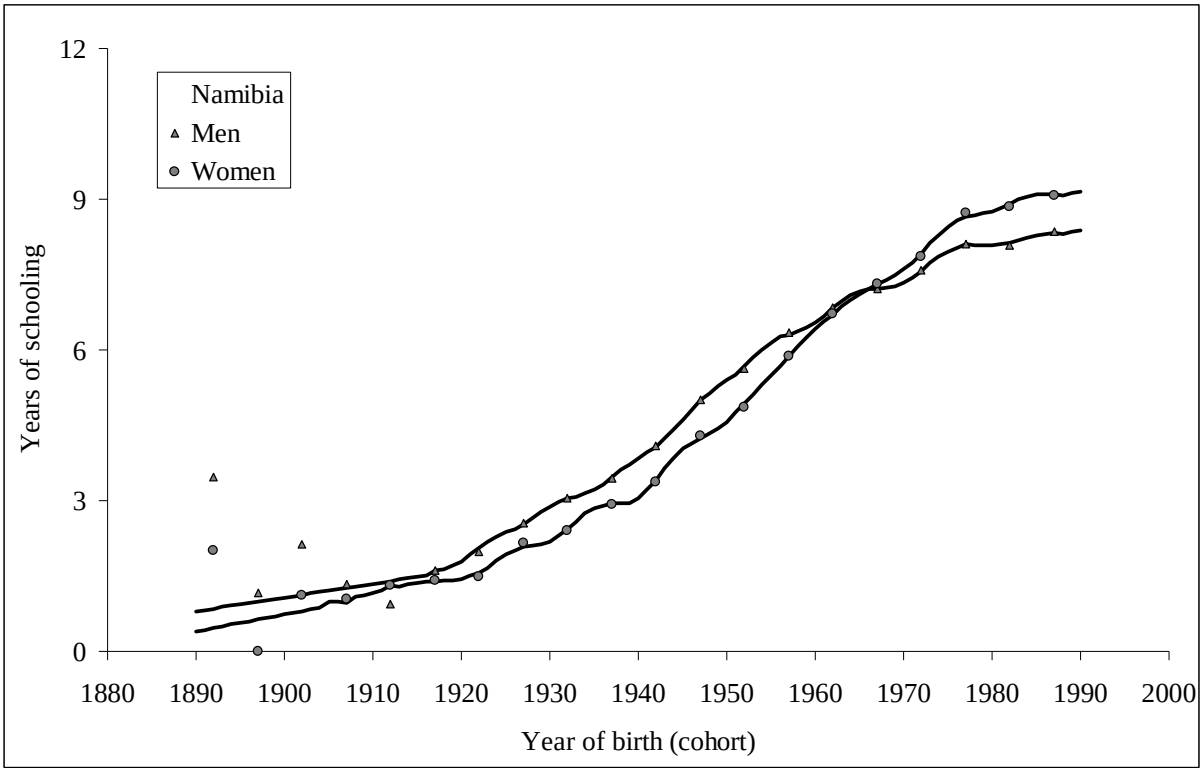
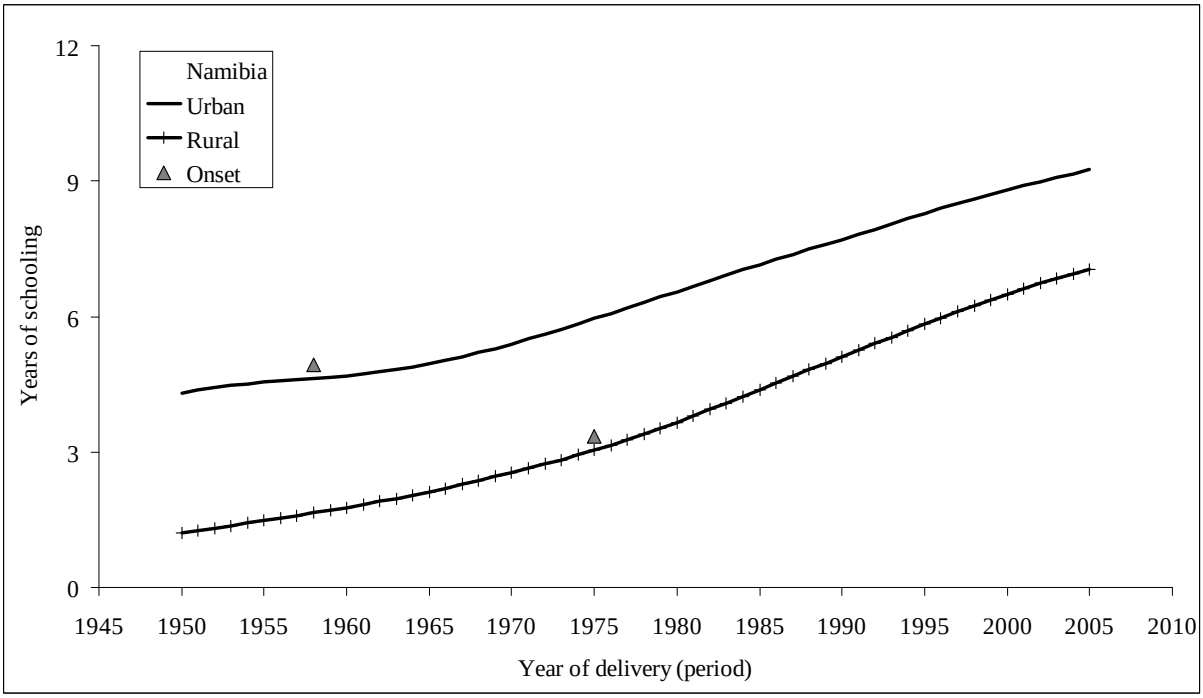


Figure B-21.2. Period trends in level of education, fertile women, Namibia



22. Niger

Three DHS surveys were available in Niger with information on level of education, conducted in 1992, 1997, and 2006. Levels and trends were compatible in the three surveys, and remained at very low levels. (Table B-22.1)

Table B-22.1. Basic characteristics of surveys, Niger

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1992	5,713	0.93	6,526	0.42
DHS	1997	5,643	1.61	6,994	0.75
DHS	2006	6,565	1.66	9,218	0.76

Cohort trends

Level of education remained very low in Niger despite some improvements for cohorts born between 1950 and 1970. It stagnated, and even somewhat declined for cohorts born between 1972 and 1987, both for men and for women. The gap between men and women remained around 1 year among the recent cohorts. The major recession that occurred between 1965 and 1995 could explain the stagnation of the level of education for those born after 1972. Over this period income per capital was about halved ($935 in 1965, $483 in 1995). Niger remains one of the poorest countries in Africa, with very low income, very high fertility and mortality, and very low level of education. (Figure B-22.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular. The level remained close to zero in rural areas, but increased markedly in urban areas, reaching 3.2 years in 2005. As a consequence, the gap between urban and rural increased markedly over the years. The fertility transition started already in urban areas (1972), at very low level of education. It was unclear whether it had started in rural areas, although fertility was lower at the time of the last DHS survey than at the previous one. (Figure B-22.2)

Figure B-22.1. Cohort trends in level of education, Niger

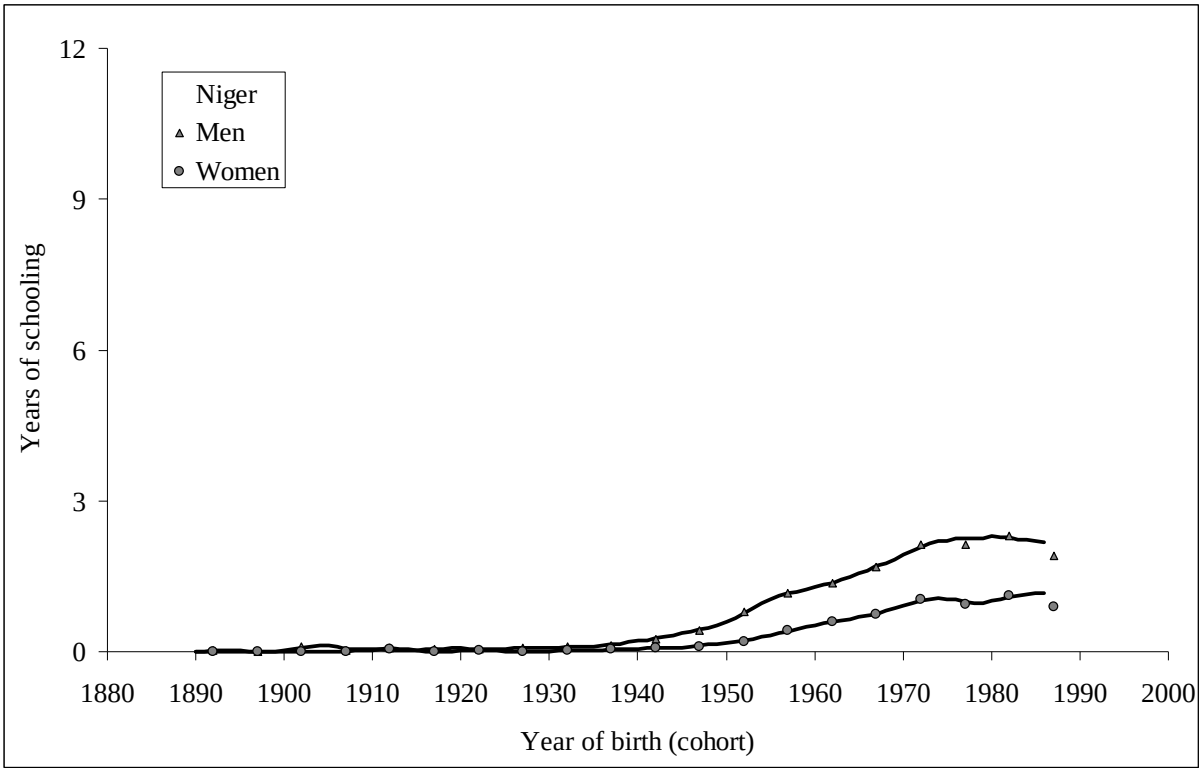
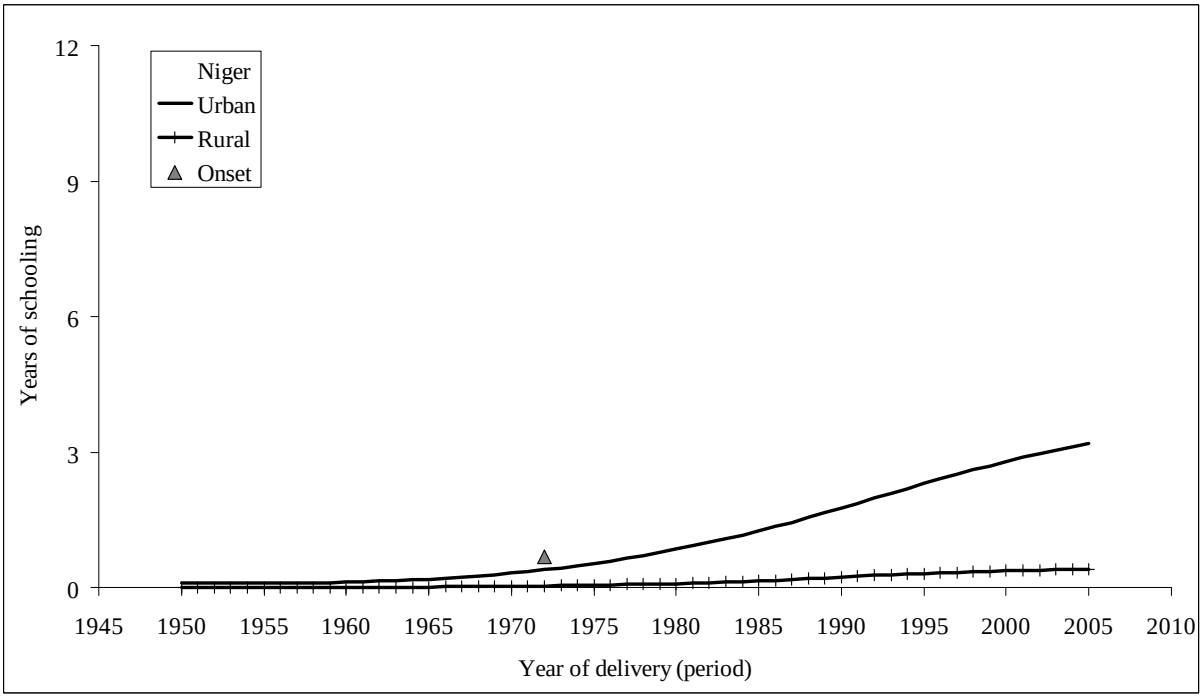


Figure B-22.2. Period trends in level of education, fertile women, Niger



23. Nigeria

Four DHS surveys were available in Nigeria with information on level of education, conducted in 1990, 1999, 2003 and 2008. Levels and trends were roughly compatible in the three surveys, although the second survey (1999) showed higher levels than expected. This survey had numerous other problems (fertility levels, mortality levels, etc). However, differences were small, and almost disappeared when cohorts were grouped together. (Table B-23.1)

Table B-23.1. Basic characteristics of surveys, Nigeria

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1990	8,371	4.74	9,792	2.42
DHS	1999	6,855	7.30	7,451	4.83
DHS	2003	7,019	7.10	7,586	4.43
DHS	2008	28,943	8.01	31,613	5.59

Cohort trends

Level of education increased rapidly and steadily in Nigeria, for both men and women. For men, education took off for cohorts born after 1920, and there was a minority of men already educated by the end of the 19th century. For women, education started about 10 years later (cohorts born after 1930), and increased in parallel with that of men. The gap between men and women stayed about constant around 2.0 years since cohorts 1935. Recessions due to the Biafra war (1965-1968) and the later recession (1977-1984) did not seem to have any effect on trends in level of education. (Figure B-23.1)

Period trends, fertile women

Period trends in level of education for fertile women were also very regular, with a remarkable increase from 1950 to 2005, especially in urban areas, one of the fastest in Africa. For urban fertile women, the average years of schooling increased from 0.5 to 8.4 years, and that in rural areas from 0.2 to 4.5 years. As a consequence, the gap between urban and rural increased markedly over the years. The fertility transition started at about the same time in urban areas (1983) and in rural areas (1984), but at different levels of education (3.9 years in urban; 1.9 years in rural). (Figure B-23.2)

Figure B-23.1. Cohort trends in level of education, Nigeria

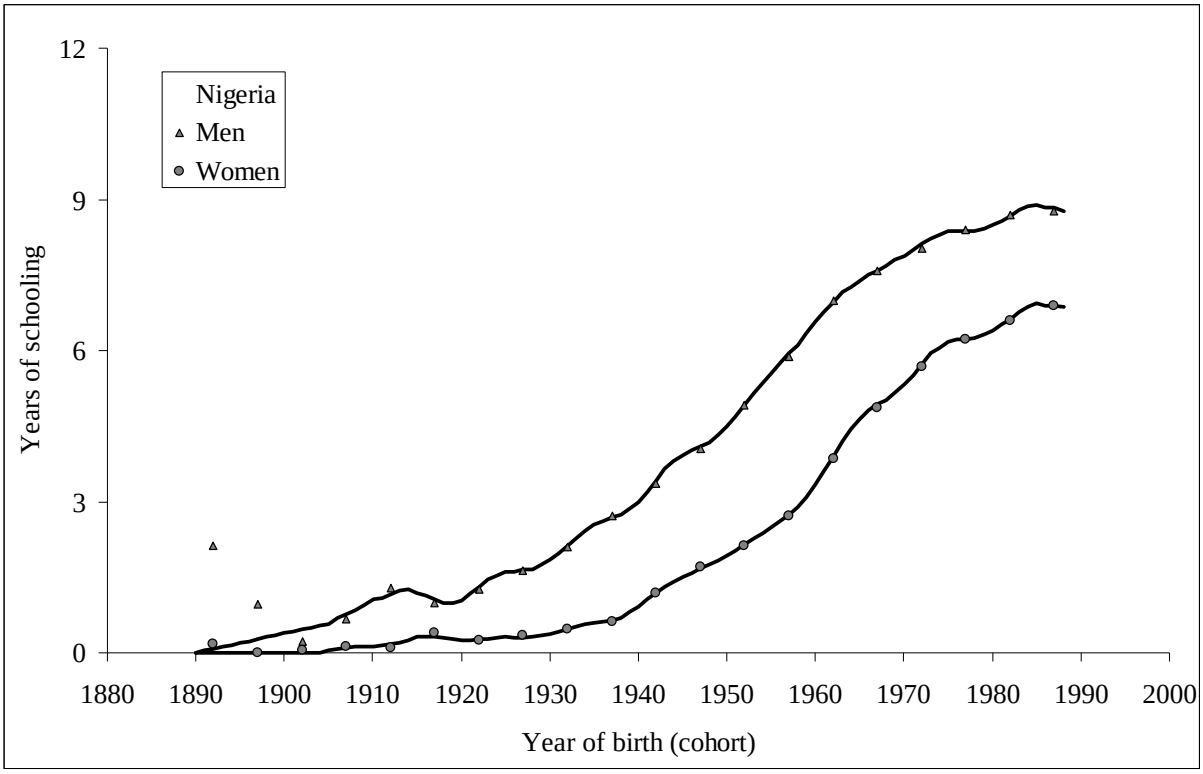
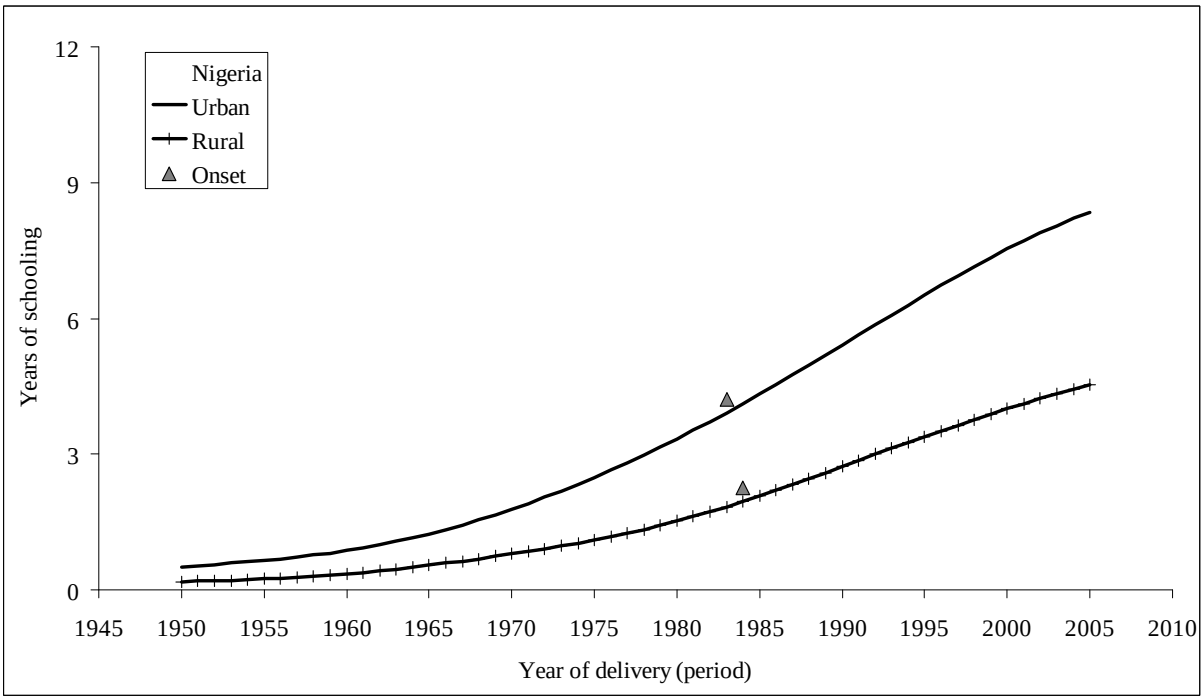


Figure B-23.2. Period trends in level of education, fertile women, Nigeria



24. Rwanda

Three DHS surveys were available in Rwanda with information on level of education, conducted in 1992, 2000 and 2005. Levels and trends were roughly compatible in the three surveys, given the fact that trends were erratic. (Table B-24.1)

Table B-24.1. Basic characteristics of surveys, Rwanda

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1992	5,577	3.88	6,079	2.73
DHS	2000	6,652	4.32	8,875	3.36
DHS	2005	8,028	4.30	10,127	3.51

Cohort trends

Rwanda is one of the few countries with a marked decline in level of education for the recent cohorts. Level of education increased rapidly in Rwanda for both men since cohort 1900 and for women since cohort 1930 and peaked for both sexes around cohort 1972 who should have been in school at the beginning of the 1980's. During this period the gap between men and women first increased to reach its maximum for cohorts 1940-1949, then decreased to become rather small in 1972. Thereafter, trends in level of education declined steadily, loosing more than a year for men and almost a year for women. This decline seems to be associated with the economic recession that stroke the country after 1983 (GDP= $1057), which lasted well after the civil war, until 1996 (GDP=$653). (Figure B-24.1)

Period trends, fertile women

Period trends in level of education for fertile women were far more regular, with a steady increase from 1950 to 2000, and some leveling off up to 2005. The gap between urban and rural areas was very small in 1950, but increased steadily over the years, to reach 1.8 years in 2005. (Figure B-24.2)

Figure B-24.1. Cohort trends in level of education, Rwanda

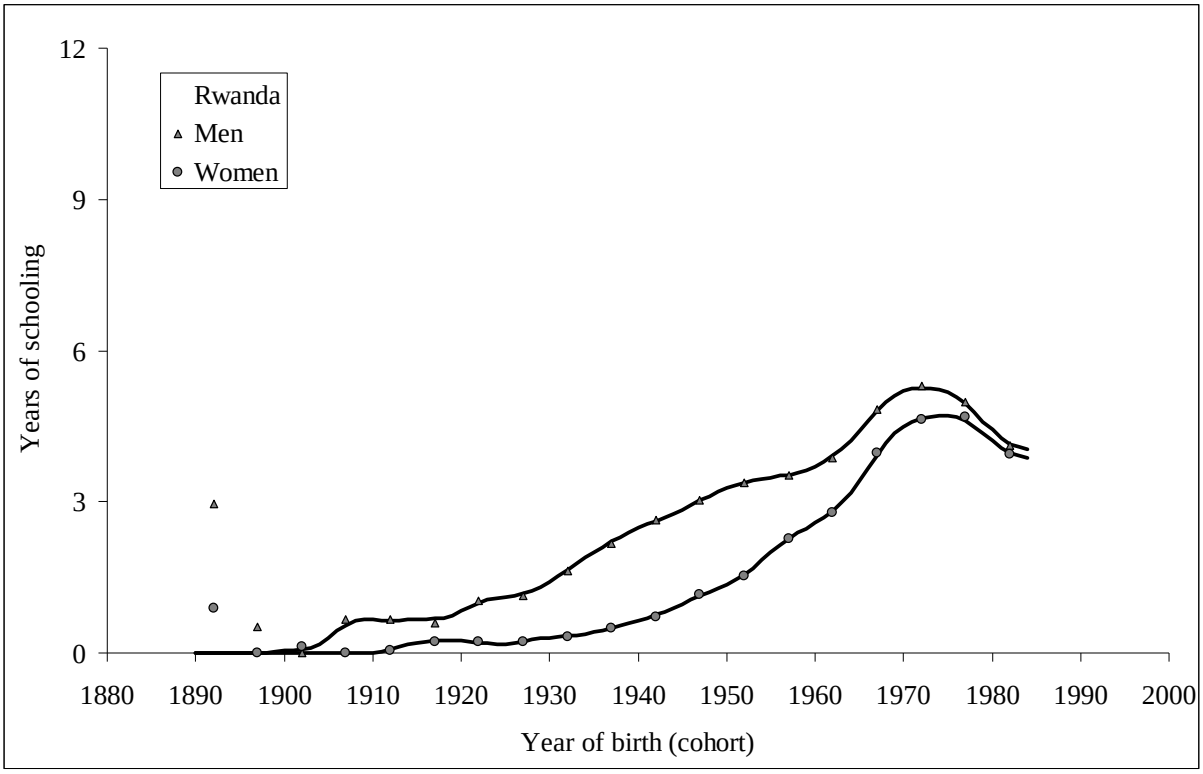
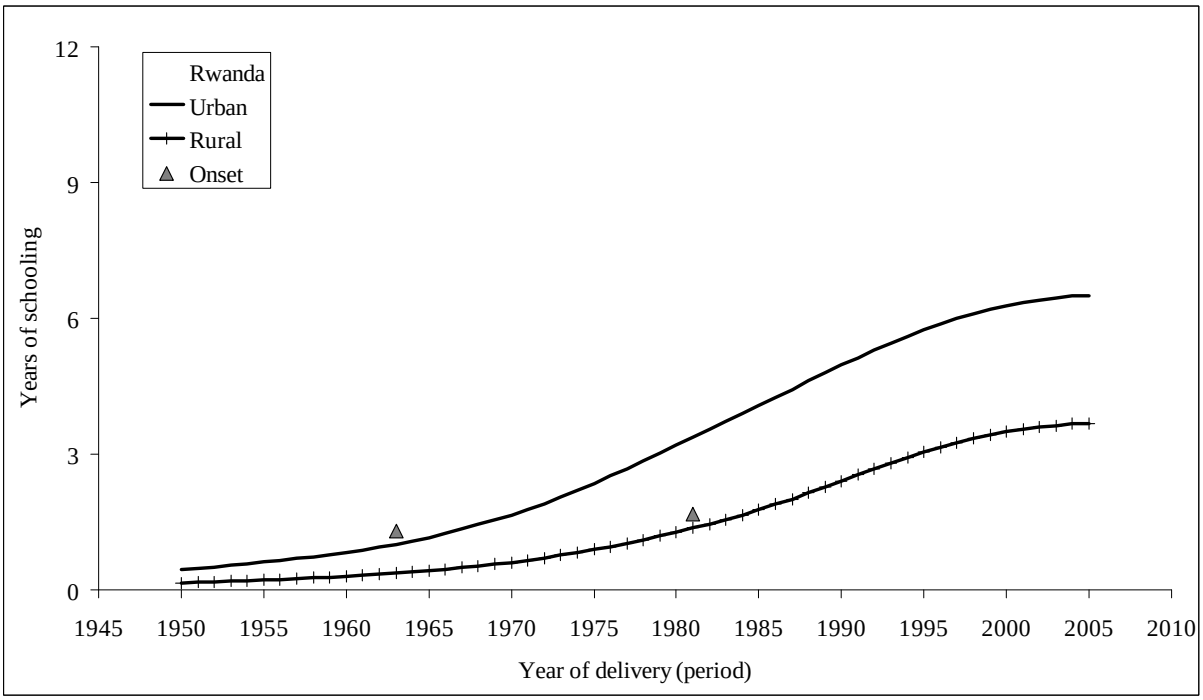


Figure B-24.2. Period trends in level of education, fertile women, Rwanda



25. Sao Tome & Principe

Only one DHS survey was available in Sao Tome & Principe with information on level of education, conducted in 2009. The sample size was small, but trends by cohort were realistic and consistent. (Table B-25.1)

Table B-25.1. Basic characteristics of surveys, Sao Tome & Principe

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	2009	2,375	6.14	2,862	4.95

Cohort trends

Cohort trends in level of education in Sao Tome & Principe were erratic. For men, level of education increased rapidly for cohorts 1900-1923, then dropped for a about 5 years, then increased steadily up to cohort 1962, then dropped again for some 15 years, then increased again, reaching 6.5 years for cohort born in 1988. Trends were similar for women, with a rapid increase (1912-1927), followed by a small decline for 5 years, followed by an increase reaching a peak around 1977, then a short plateau and a recent increase reaching a value close to that of men (6.2 years in 1988). The second decline or plateau seems to correspond to the beginning of the recession which started in 1980. However, the recession lasted for some 20 years, until year 2000, and this did not hamper the level of education to increase again for cohorts born after 1980. (Figure B-25.1)

Period trends, fertile women

Since erratic trends were recent and of small magnitude, period trends in level of education for fertile women remained regular, with a steady increase from 1950 to 2005. A typical feature of Sao Tome & Principe is the small gap between urban and rural areas, with a small difference which remained steady over the years, which never exceed 1 year, and remained lower than 0.5 years up to 1995. (Figure B-25.2)

Figure B-25.1. Cohort trends in level of education, Sao Tome & Principe

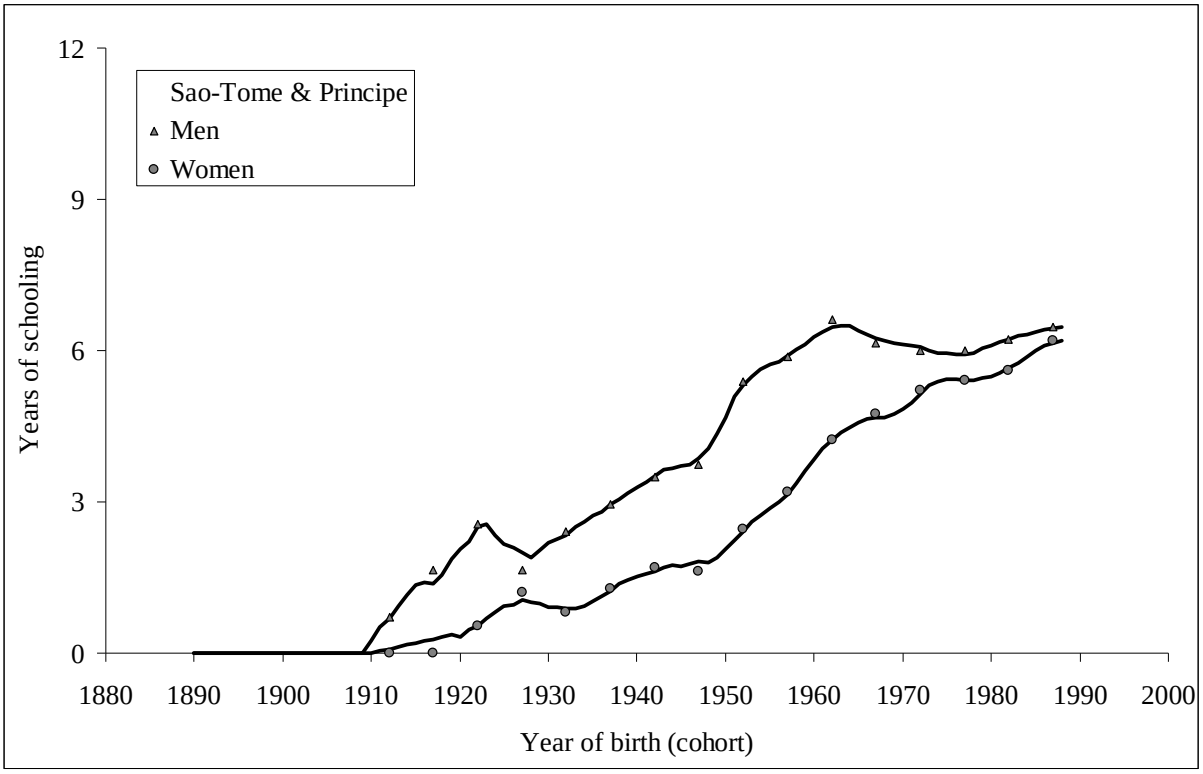
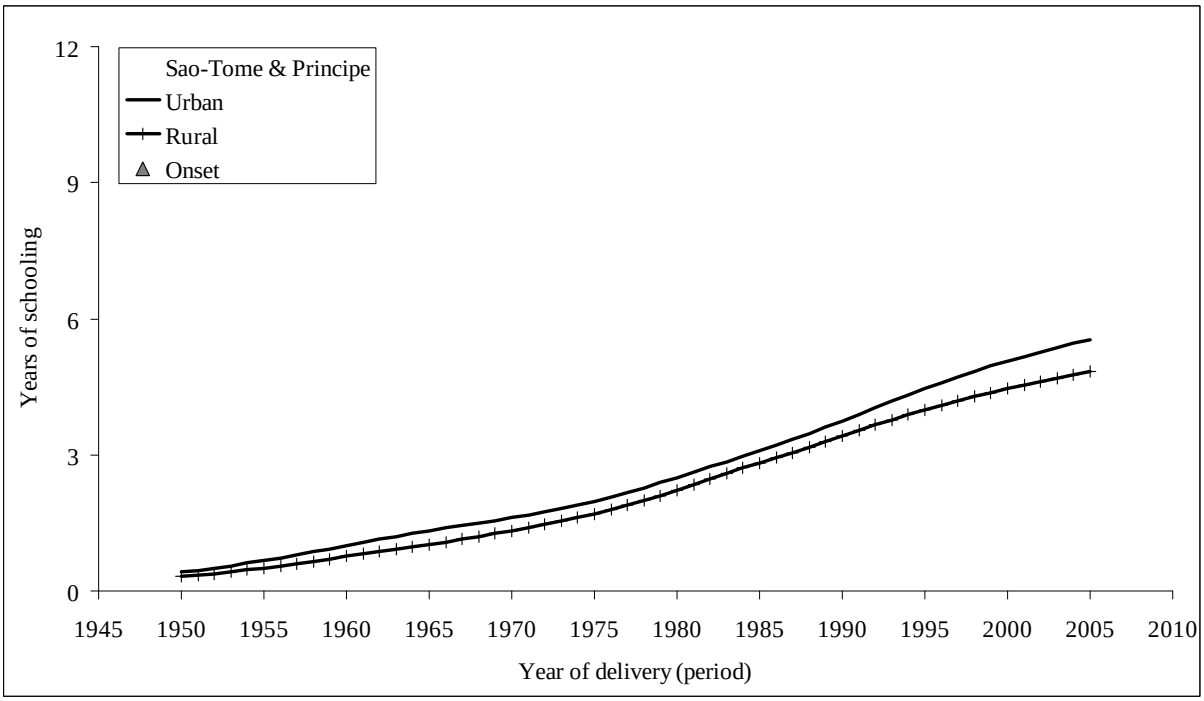


Figure B-25.2. Period trends in level of education, fertile women, Sao Tome & Principe



26. Senegal

Two DHS surveys were available in Senegal with information on level of education, conducted in 1993 and 2005. Both surveys were consistent for levels and trends. (Table B-26.1)

Table B-26.1. Basic characteristics of surveys, Senegal

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1993	4,954	2.79	6,379	1.34
DHS	2005	10,908	3.56	14,051	2.05

Cohort trends

Cohort trends in level of education in Senegal remained at low levels for both men and women. For men, level of education started to increase for cohorts born around 1905, stopped for a few years after 1920, the resume its increase until cohort 1980 (4.1 years), after which it remained roughly constant with a possible minor decline in most recent cohorts. For women, the level took off much later, for cohorts born after 1940, and also leveled off for the recent cohorts. The gap between men and women remained roughly constant over the years, at about 1.4 years. Senegal is one of the few countries with no long-term income growth for a long period of time (1950-2000), and with only minor fluctuations: some higher income in the mid-1960's and some lower income in the mid-1990's. (Figure B-26.1)

Period trends, fertile women

Period trends in level of education for fertile women remained regular, with a steady increase from 1950 to 2005 in urban areas, but hardly any increase in rural areas. As a result, the gap between urban and rural areas increased markedly over the years, reaching 3.3 years in 2005. Part of the issue is the rural to urban migration: as soon as rural women have some education they tend to move to urban places, so that by selection only uneducated women remain in rural areas. Fertility started to decline at rather low levels of education, in 1979 in urban areas and in 1982 in rural areas (Figure B-26.2)

Figure B-26.1. Cohort trends in level of education, Senegal

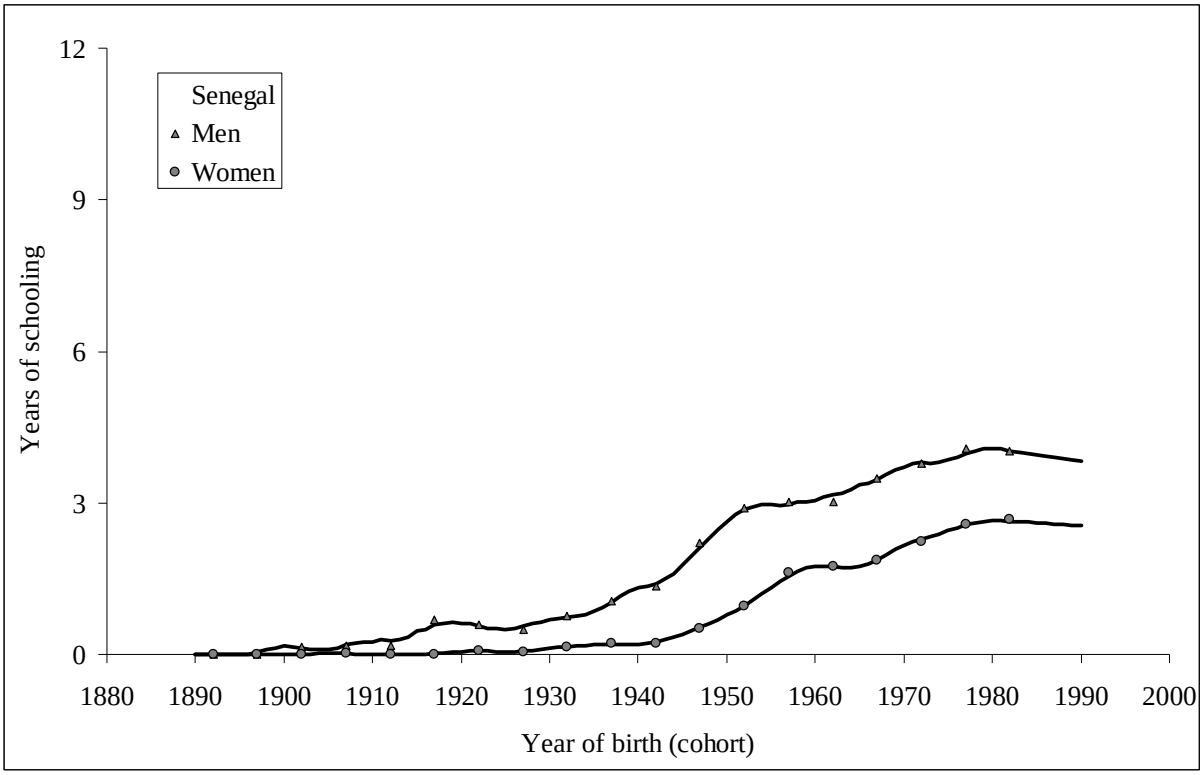
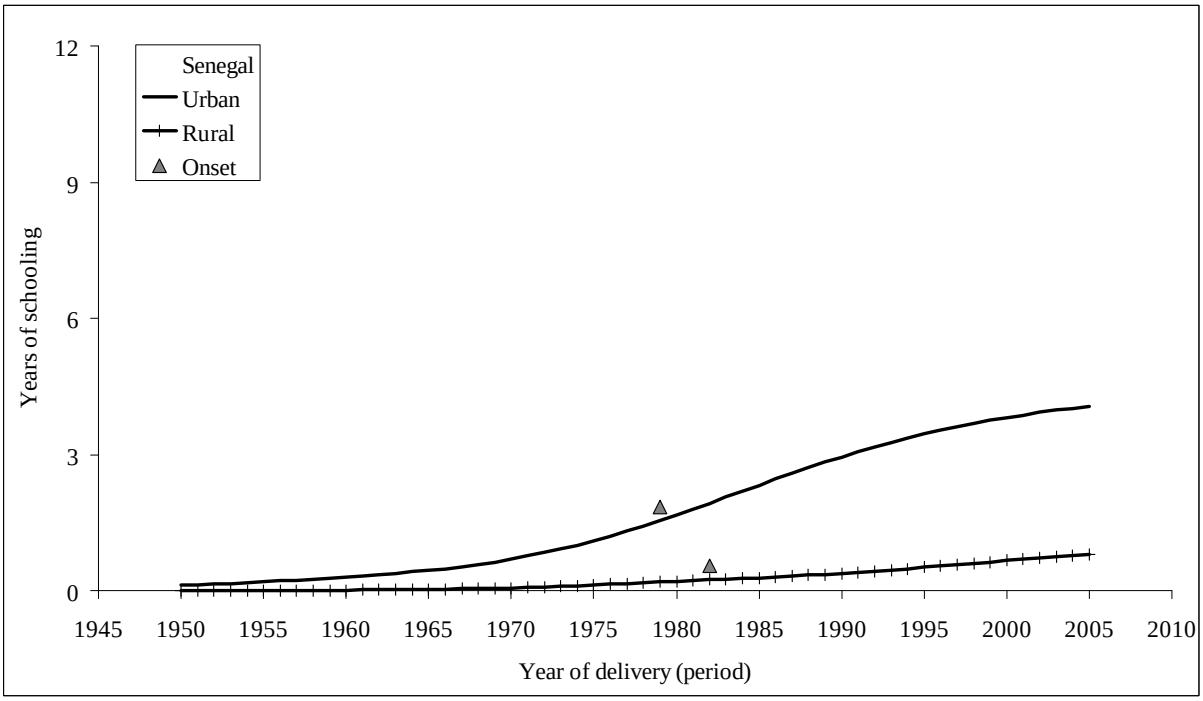


Figure B-26.2. Period trends in level of education, fertile women, Senegal



27. Sierra Leone

Only one DHS survey was available in Sierra Leone with information on level of education, conducted in 2008. Levels and sex differences appeared realistic. (Table B-27.1)

Table B-27.1. Basic characteristics of surveys, Sierra Leone

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	2008	6,830	4.18	8,727	1.93

Cohort trends

Cohort trends in level of education in Sierra Leone were particularly erratic, which might be due to real trends or to inaccuracies in the data. For men, level of education started to increase for cohorts born around 1910, increased rapidly up to cohort 1952, then stayed at roughly the same level for some 25 years with minor ups and downs, to resume steady increase thereafter. For women, the level took off later, for cohorts born after 1937, and also showed a leveling off for cohorts 1962-1980, then increased for the most recent cohorts. The gap between men and women first increased, then remained roughly constant with a gap of 2.3 years for cohort 1988. Sierra Leone had a steady economic growth from 1950 to 1981, followed by a severe recession up to year 2000. Strangely enough the period of economic growth corresponded to the period of stagnation of the level of education, whereas the period of recession was that of fast increase in level of education. (Figure B-27.1)

Period trends, fertile women

Period trends in level of education for fertile women remained regular, with a steady increase from 1950 to 2005 in urban areas, but hardly any increase in rural areas. As a result, the gap between urban and rural areas increased markedly over the years, reaching 3.8 years in 2005. Fertility started to decline at rather low levels of education, in 1976 in urban areas and in 1987 in rural areas. (Figure B-27.2)

Figure B-27.1. Cohort trends in level of education, Sierra Leone

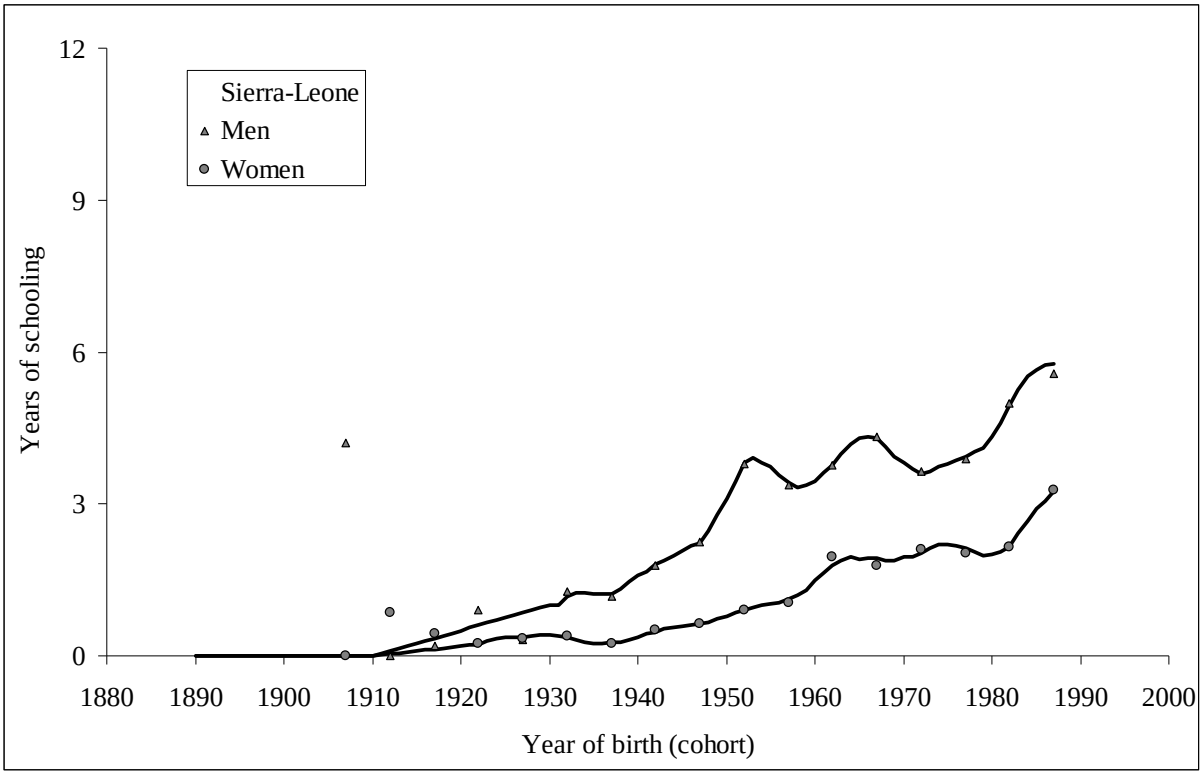
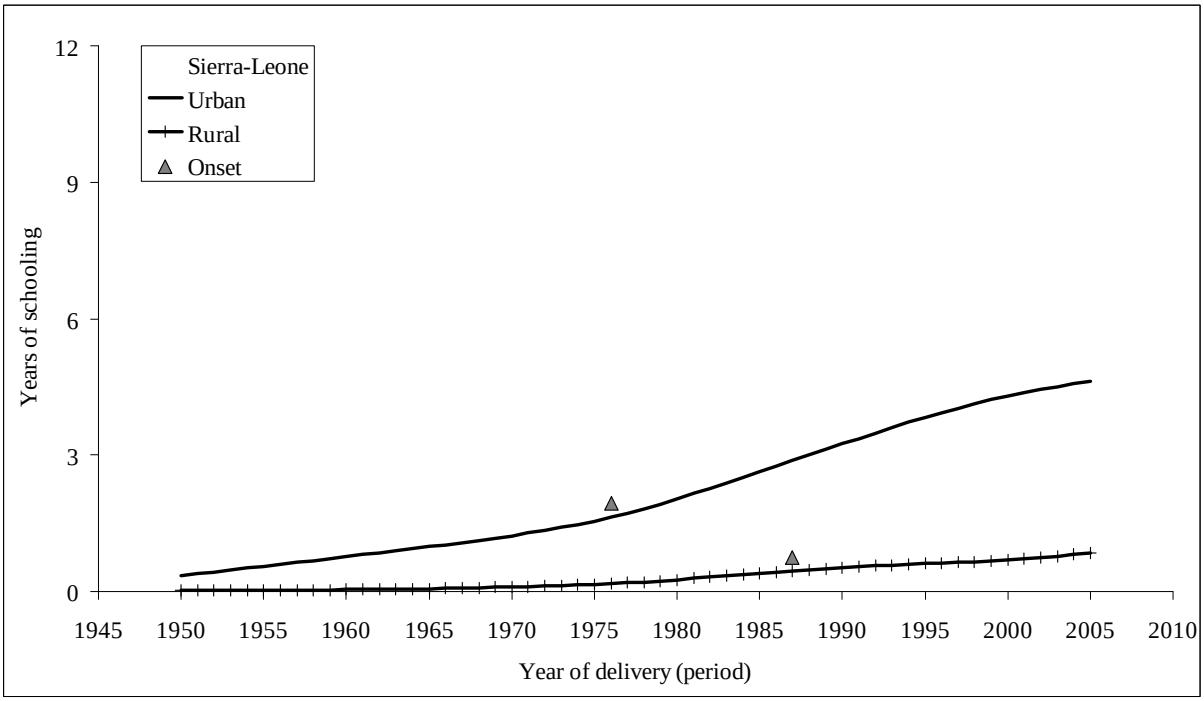


Figure B-27.2. Period trends in level of education, fertile women, Sierra Leone



28. South Africa

Only one DHS survey was available in South Africa with information on level of education, conducted in 1998. Another DHS was conducted in 2003, but data were not made available. The 1998 DHS survey had a rather large sample size. Other demographic surveys are also available in South Africa, but not with the same type of information on level of education. Levels and sex differences appeared realistic. (Table B-28.1)

Table B-28.1. Basic characteristics of surveys, South Africa

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1998	10,021	8.69	12,563	8.09

Cohort trends

South Africa is characterized by high levels of education, much higher than the average of African countries. Even for cohort 1900, the mean level of education for both men (3.0 years) and women (2.0 years) was relatively high, even higher than that of the least advanced countries a century later. Level of education increased over the years, but with an apparent regression for cohorts born in the 1920's. After 1930 level of education increased rapidly, from 5.0 for men and 4.0 for women to reach high levels (9.6 years) 40 years later. From 1900 to 1970, the gap between men and women was small, rarely exceeding 1.0 years, was nil for cohort 1970 and even reversed thereafter. South Africa is one of the few countries in which the mean level of education for women now exceeds that of men, although by a small margin of 0.4 years. The economic recession that stroke the country between 1981 and 1993, largely due to the sanctions imposed on the country, could not have any visible effect of cohorts born before 1978. (Figure B-28.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, with a steady increase from 1950 to 2005 in both urban areas and rural areas. The level of education of fertile women was already high in 1950 in urban areas (4.9 years), and exceeded 10 years in 2005. The level of education was lower in rural areas (2.3 years in 1950), but caught up to some extent, bridging the gap between urban and rural, and reaching 8.8 years in 2005, way above all other rural areas in sub-Saharan Africa. Fertility started to decline at rather high levels of education, 5.5 years in 1955 in urban areas and 3.6 years in 1973 in rural areas. (Figure B-28.2)

Figure B-28.1. Cohort trends in level of education, South Africa

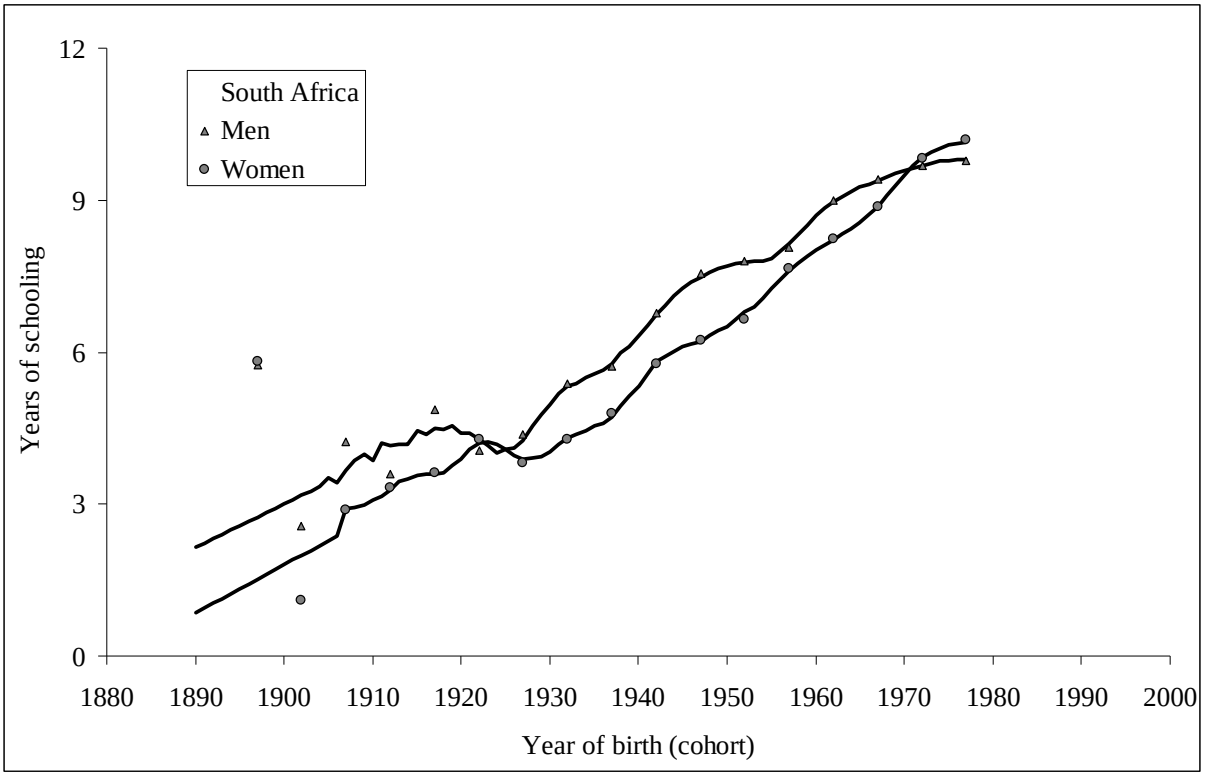
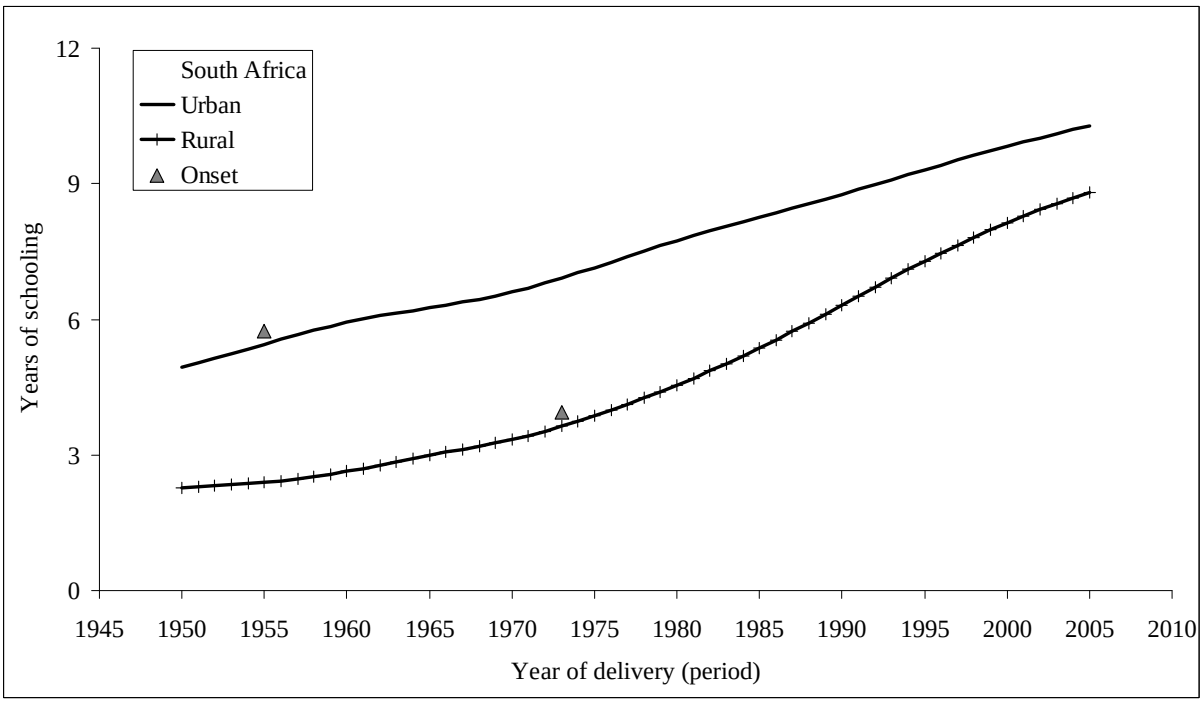


Figure B-28.2. Period trends in level of education, fertile women, South Africa



29. Swaziland

Only one DHS survey was available in Swaziland with information on level of education, conducted in 2006. Levels and sex differences appeared realistic. (Table B-29.1)

Table B-29.1. Basic characteristics of surveys, Swaziland

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	2006	3,778	8.19	4,814	7.82

Cohort trends

Swaziland is characterized by high levels of education, much higher than the average of African countries. For men, the level of education started to take off probably around cohort 1900, and increased almost steadily up to cohort 1975, with apparently a minor accident for cohorts 1931-1935. For women, the level of education took off about 10 years later, and showed a similar trend with a minor accident in the early 1930's and a peak for cohort 1979. Like in some nearby countries, female level of education is now equal or somewhat higher than that of males. However, for both sexes the level of education seems to have declined somewhat for the most recent cohorts, unless this is a bias for cohorts around age 20 who have not yet finished their schooling. This point deserves further investigation. This could also be the effect of the economic stagnation which characterized the country from 1974 to 1993. (Figure B-29.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, with a steady increase from 1950 to 2005 in both urban areas and rural areas. The level of education of fertile women was already high in 1950 in urban areas (3.4 years), and was close to 10 years in 2005. The level of education was lower in rural areas (1.0 years in 1950), but caught up to some extent, bridging the gap between urban and rural, and reaching 7.9 years in 2005, way above most other rural areas in sub-Saharan Africa. Fertility started to decline at rather high levels of education, 4.2 years in 1958 in urban areas and 4.6 years in 1981 in rural areas, in a pattern similar to that of South Africa. (Figure B-29.2)

Figure B-29.1. Cohort trends in level of education, Swaziland

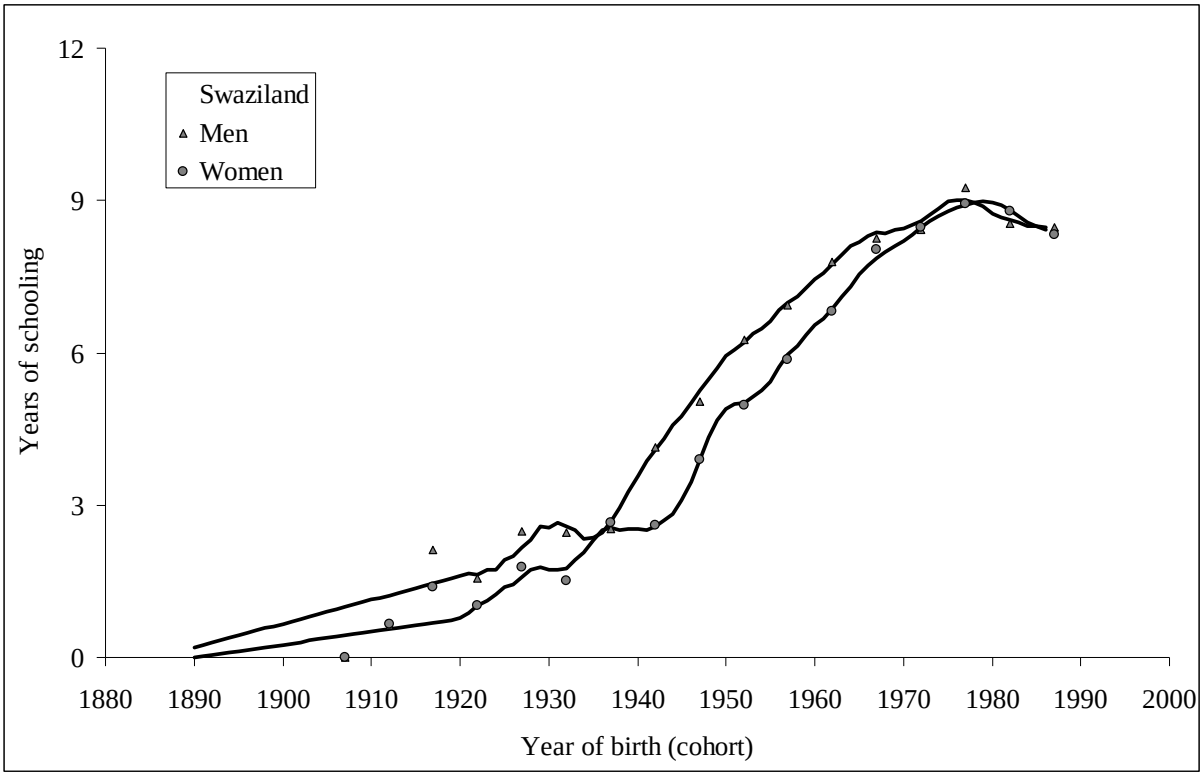
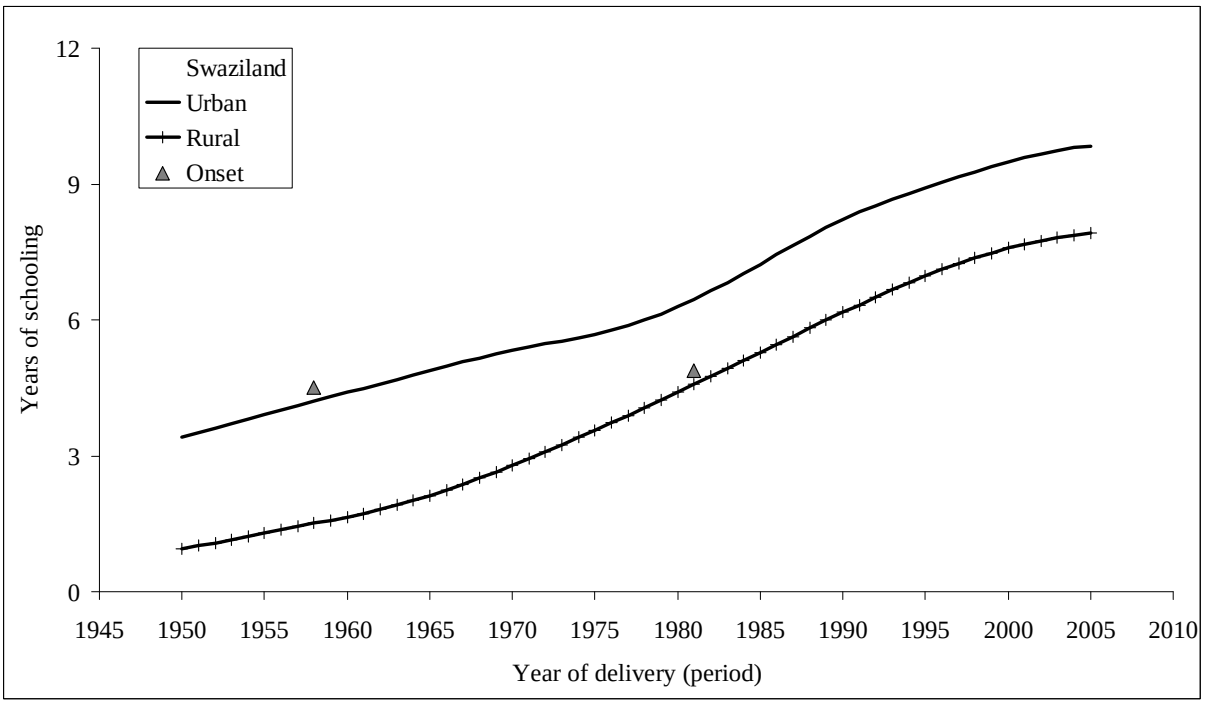


Figure B-29.2. Period trends in level of education, fertile women, Swaziland



30. Tanzania

Tanzania offers a wealth of data with information on level of education: four DHS surveys, conducted in 1991, 1996, 1999, and 2004, plus two AIS surveys conducted in 2003 and 2007. Consistency in levels, trends and sex differences appeared remarkable among the six surveys. (Table B-30.1)

Table B-30.1. Basic characteristics of surveys, Tanzania

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1991	7,919	5.02	9,119	3.30
DHS	1996	6,805	5.48	8,213	3.93
DHS	1999	3,253	5.55	3,938	4.13
AIS	2003	5,911	6.11	6,716	4.85
DHS	2004	8,895	6.08	10,009	4.77
AIS	2007	7,678	6.02	8,933	4.94

Cohort trends

Men born at the end of the 19th century had already some level of education, which increased steadily for a long period, up to cohort born in 1967. Thereafter, the level of education for men stagnated and even slowly regressed for about 20 years. Trends were similar for women, with some delay. The female level of education took off only for those born after 1935, peaked for those born in 1972, then stagnated up to the last cohorts born in 1987. The gap between the two sexes, which was large for cohorts born in the 1940's (about 2.5 years) was reduced to a small value for the cohorts born after 1970 (less than 0.5 years on average). The stagnation of the level of education for the recent cohorts seems to be associated with the economic recession that stroke the country from 1976 to 1997, during which income per capita declined by some 20%, and probably with political choices reducing investments in the education sector. (Figure B-30.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, with a steady increase from 1950 to 2005 in both urban areas and rural areas. However, the increase was more rapid in urban areas, and tended to stagnate in rural areas in the recent years, so that the gap between both sectors increased markedly to reach 2.0 years in 2005. Fertility decline started at rather low and similar levels of education, 1.5 years in 1972 in urban areas and 1.6 years in 1978 in rural areas. (Figure B-30.2)

Figure B-30.1. Cohort trends in level of education, Tanzania

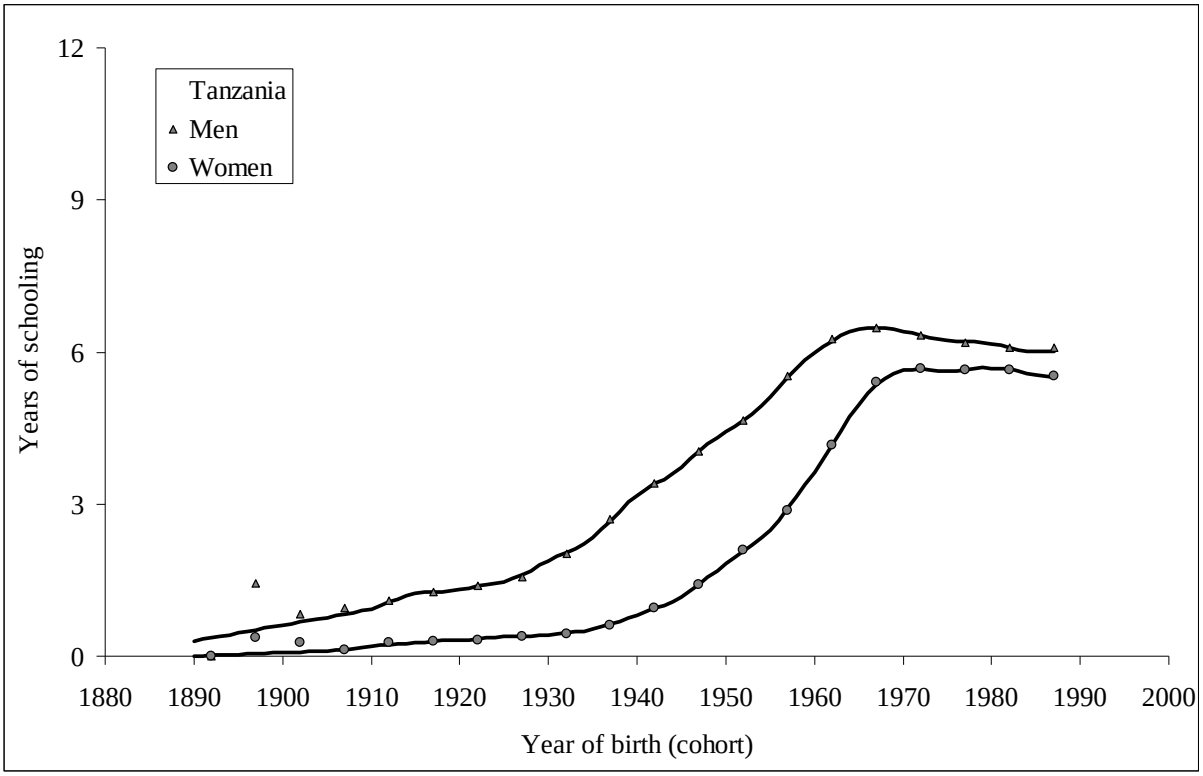
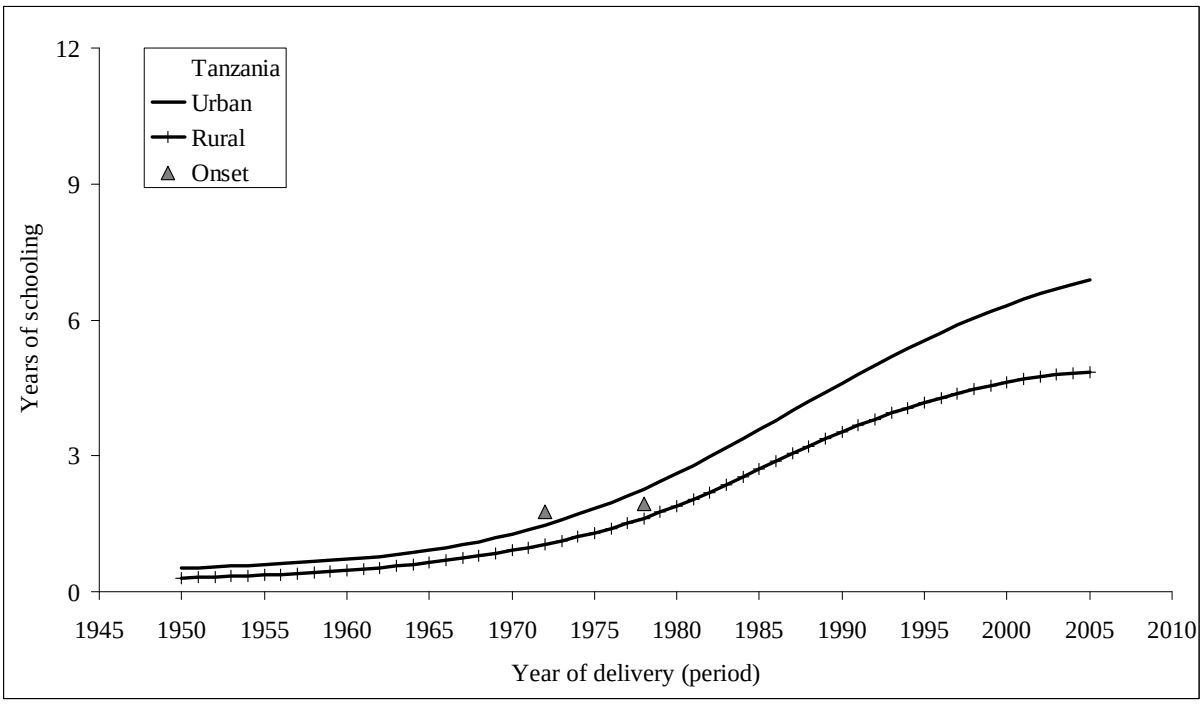


Figure B-30.2. Period trends in level of education, fertile women, Tanzania



31. Togo

Only one DHS survey was available in Togo with information on level of education, conducted in 1998. Levels and sex differences appeared plausible. (Table B-31.1)

Table B-31.1. Basic characteristics of surveys, Togo

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1998	6,779	4.60	8,340	1.98

Cohort trends

Level of education increased irregularly in Togo. For men, it took off for those born around 1910, increased steadily up to cohort 1962, then was reduced for a few years, and started to increase again after cohort 1970. For women, it took off much later, for those born after 1940, stagnated for a few years from 1965 to 1970, and resumed its increase thereafter. The stagnation or regression in level of education of cohorts 1962-1970 seem related with economic downturns that affected the country from 1969 to 1976. This period was followed with a few years of economic growth up to 1979. The long recession that occurred later (1980-2005) could not have an effect on the cohorts under study. (Figure B-31.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, with a steady increase from 1950 to 2005. In urban areas the increase was slow from 1950 to 1990 and very slow from 1990 to 2005. In rural areas the increase in level of education was very slow but regular, so that the gap between urban and rural did not increase in the recent years. Fertility decline started at very low and similar levels of education, 0.9 years in 1967 in urban areas and 0.6 years in 1980 in rural areas. (Figure B-31.2)

Figure B-31.1. Cohort trends in level of education, Togo

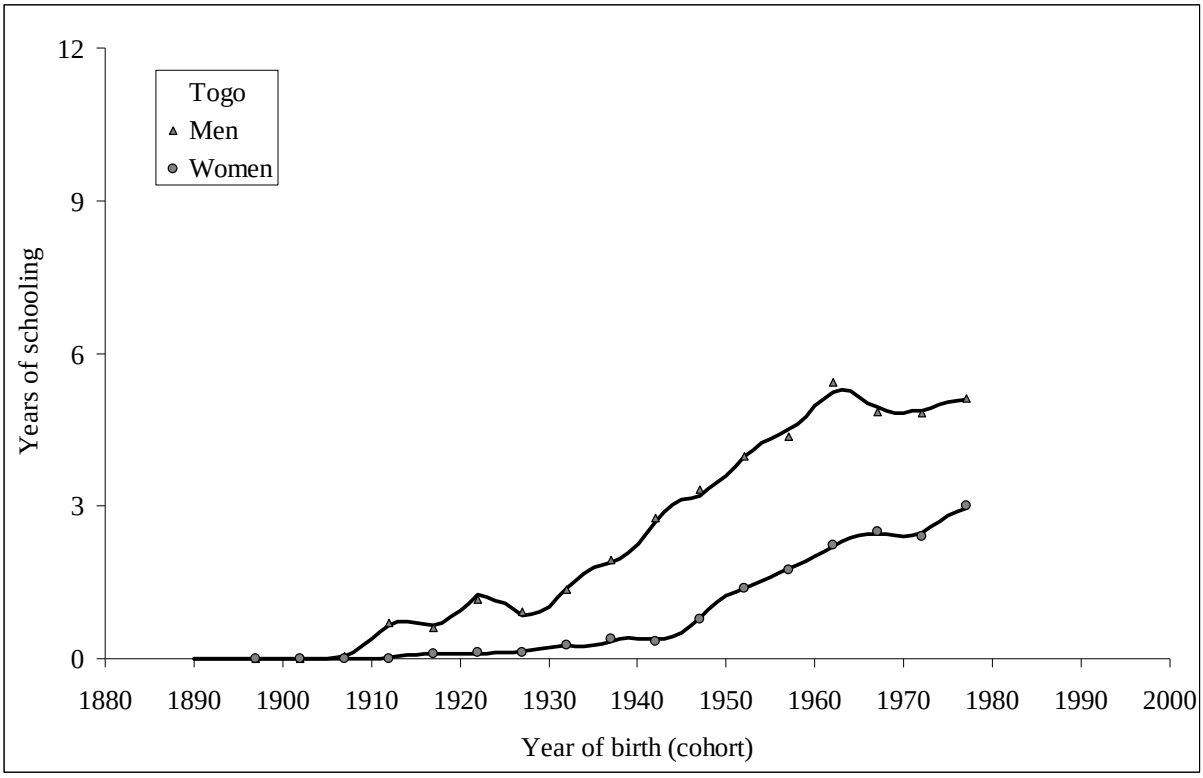
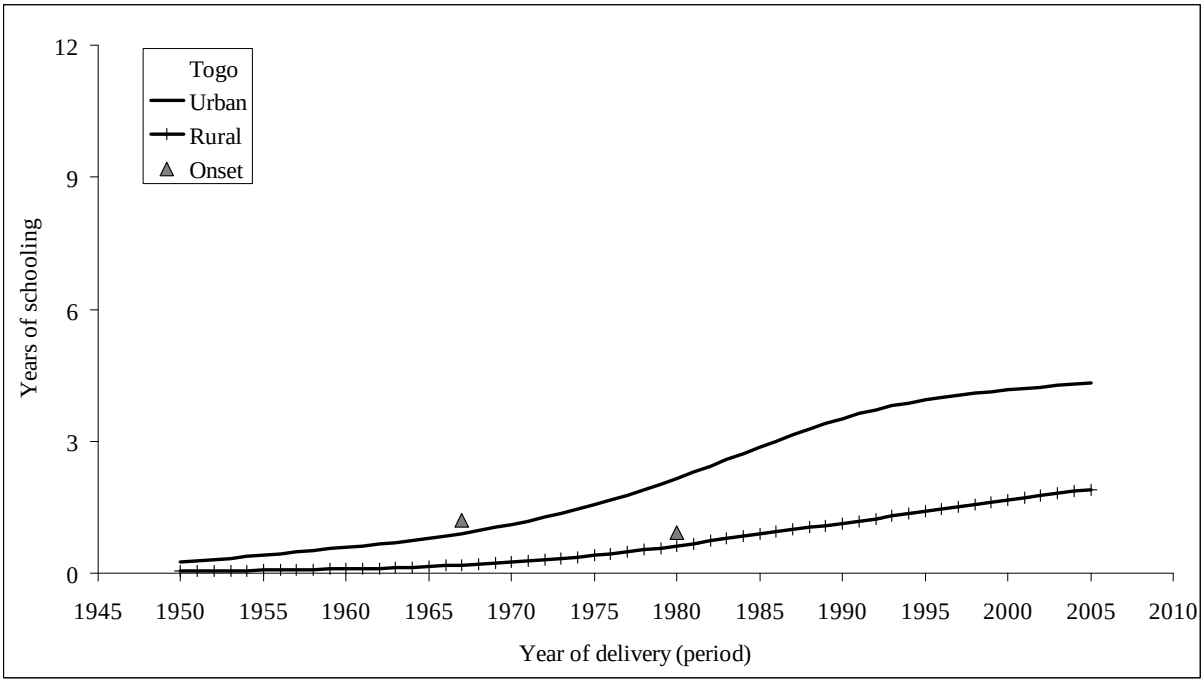


Figure B-31.2. Period trends in level of education, fertile women, Togo



32. Uganda

Three DHS surveys were available in Uganda with information on level of education, conducted in 1995, 2001 and 2006. Levels and trends were compatible between the surveys. (Table B-32.1)

Table B-32.1. Basic characteristics of surveys, Uganda

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1995	5,948	5.56	6,676	3.28
DHS	2001	6,170	6.42	7,000	4.06
DHS	2006	7,055	6.59	8,164	4.42

Cohort trends

Level of education increased steadily in Uganda since the early years, and there was a small minority of men and women educated as early as the beginning of the 20th century. For men, the level of education took off for those born around 1915, it increased rapidly up to cohort 1960, then increased slowly up to cohort 1987. For women, the increase was slow from cohort 1915 to cohort 1945, then more rapid up to the last cohort available. As a result, the gap between men and women increased markedly, peaked in the middle of the period and reached 3.5 years, then was reduced to a small value (1.0 years) for the most recent cohorts. Surprisingly, the tough years of the Idi-Amin Dada regime (1971-1979) did not seem to be associated with a regression in level of education, and even the long recession that stroke the country from 1969 to 1986 did not seem to have any visible effect on the level of education. (Figure B-32.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, with a steady increase from 1950 to 2005. In urban areas the increase was more rapid between 1960 and 1990 and slowed down from 1990 to 2005. In rural areas the increase in level of education was rather slow and steady, so that the gap between urban and rural increased over the years, reaching 3.3 years in 2005. Fertility decline started around 1967 at low levels of education (2.2 years). In rural areas the onset of fertility decline is still questionable: fertility stopped to increase around 1968, declined somewhat thereafter, but without entering a steady decline. (Figure B-32.2)

Figure B-32.1. Cohort trends in level of education, Uganda

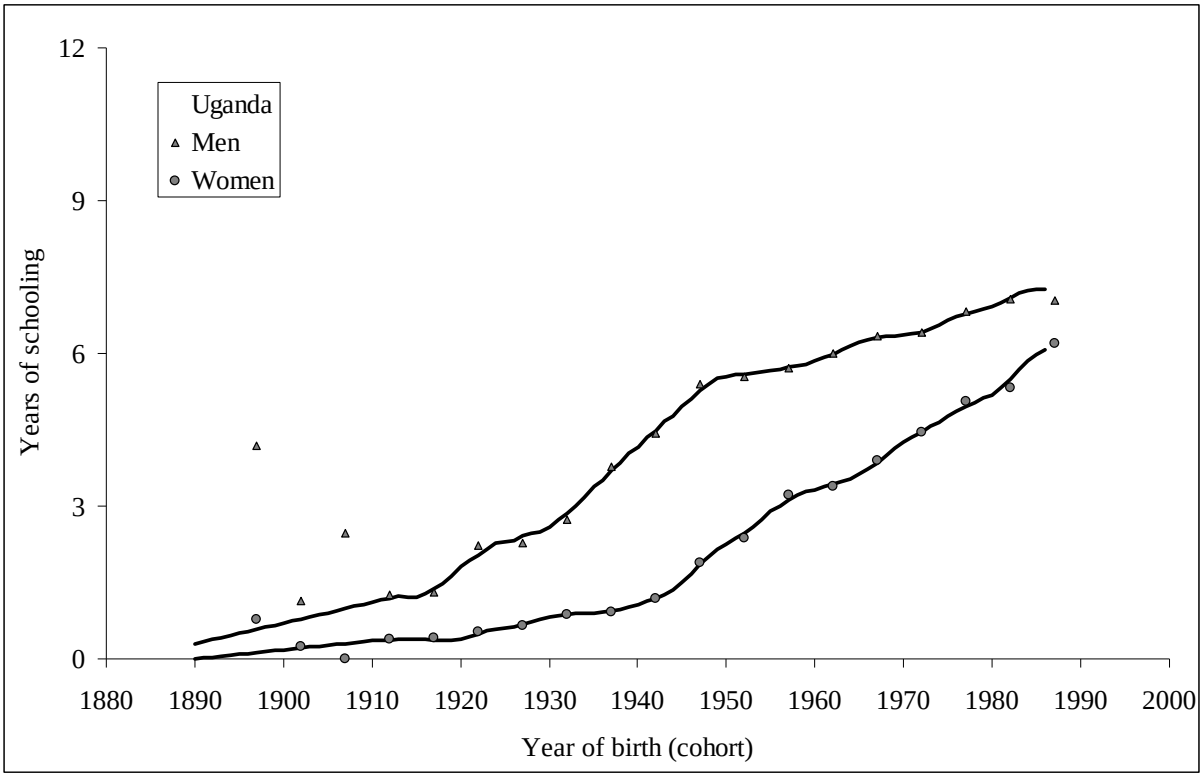
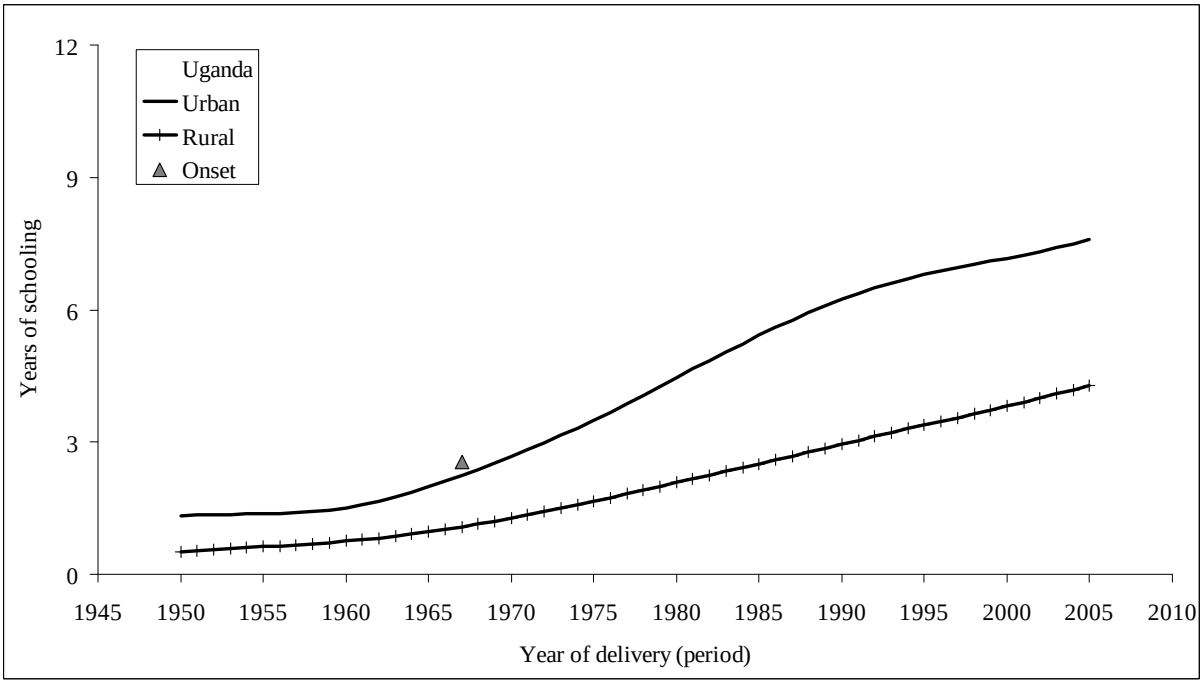


Figure B-32.2. Period trends in level of education, fertile women, Uganda



33. Zambia

Four DHS surveys were available in Zambia with information on level of education, conducted in 1992, 1996, 2001 and 2007. Levels and trends were compatible between the surveys. (Table B-33.1)

Table B-33.1. Basic characteristics of surveys, Zambia

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1992	6,503	6.85	6,643	4.65
DHS	1996	7,422	7.44	7,956	5.13
DHS	2001	6,883	7.59	7,269	5.53
DHS	2007	6,209	7.89	6,919	6.09

Cohort trends

Level of education increased irregularly in Zambia. There was a small minority of men educated as early as the beginning of the 20th century. For men, the level of education took off for those born around 1913, it increased rapidly up to cohort 1956, then regressed for some 20 years, and increased again for cohorts born after 1975. For women, the increase was slow from cohort 1915 to cohort 1940, then rapid up to cohort 1957, then slow until the last cohort available. As a result, the gap between men and women had ups and downs, with large values for cohorts born in the 1940's (3.5 years), and small values for recent cohorts (< 1.0 years). The decline in level of education for men, and the slow down in that of women from cohorts 1957-1972 seems more associated with the post-independence period than with economic downturns, since the 1964-1975 period was not a period of economic recession, but rather of a economic stagnation. Conversely, the large economic recession that lasted from 1975 to 1995, primarily due to the copper crisis, did not seem to have any effect on trends in level of education. (Figure B-33.1)

Period trends, fertile women

Period trends in level of education for fertile women were regular, with a steady increase from 1950 to 2005. In urban areas the increase was more rapid between 1965 and 1995 and slowed down in the next 10 years. In rural areas the increase in level of education was parallel to that of urban areas up to 1980, and slower thereafter. As a consequence, the gap between urban and rural increased after 1980, reaching 3.2 years in 2005. Fertility decline started at about the same time in urban areas (1977) and in rural areas (1980), at comparable medium levels of education: 3.7 years in urban, 3.0 years in rural. (Figure B-33.2)

Figure B-33.1. Cohort trends in level of education, Zambia

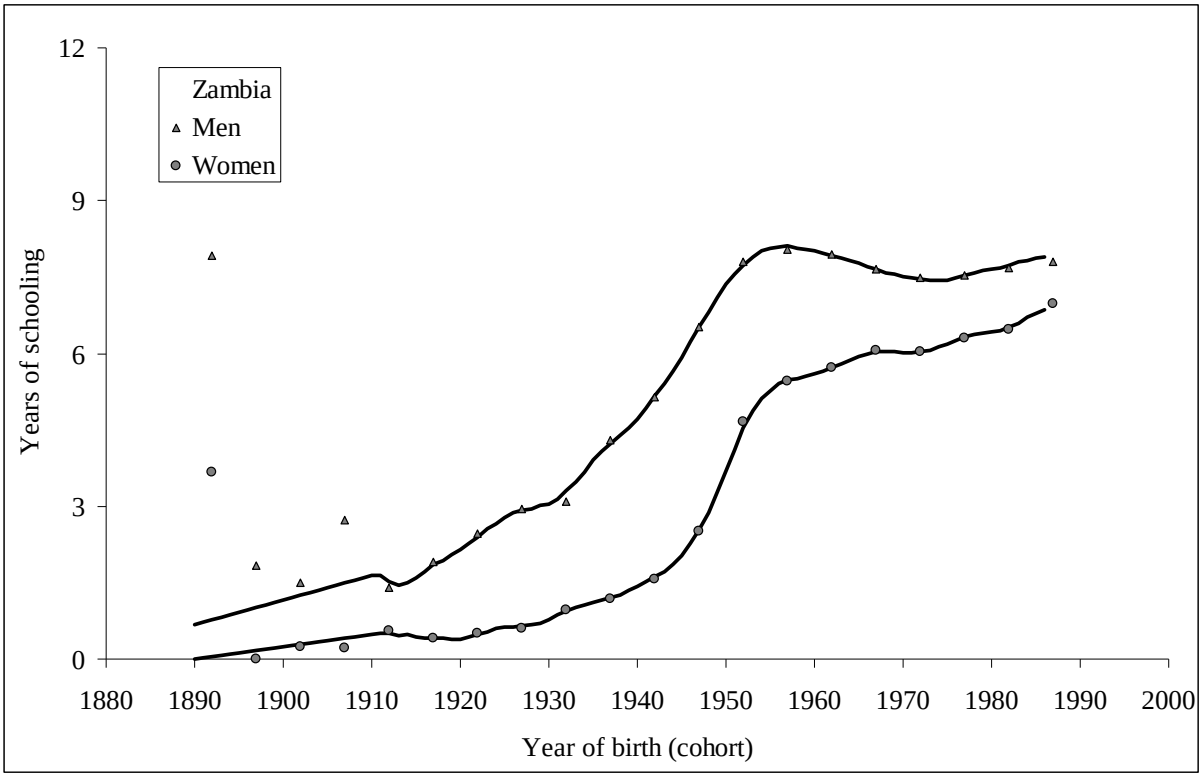
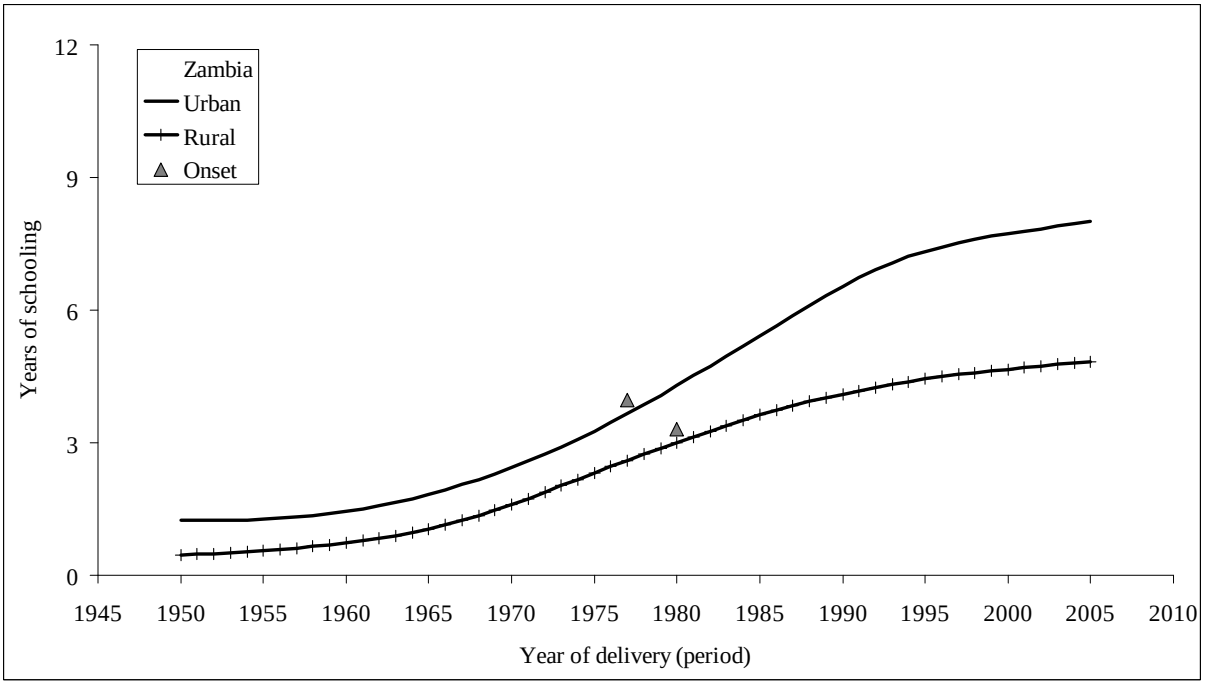


Figure B-33.2. Period trends in level of education, fertile women, Zambia



34. Zimbabwe

Three DHS surveys were available in Zimbabwe with information on level of education, conducted in 1994, 1999, and 2005. Levels and trends were compatible between the surveys. (Table B-34.1)

Table B-34.1. Basic characteristics of surveys, Zimbabwe

		Men 20-59		Women 20-59	
Survey	Year	Number	Years of schooling	Number	Years of schooling
DHS	1994	5,012	7.82	5,888	5.99
DHS	1999	5,104	8.62	5,656	7.00
DHS	2005	7,284	8.67	9,049	7.39

Cohort trends

Level of education increased rapidly in Zimbabwe for a long period of time, then stagnated. There was a small minority of men and women educated as early as the beginning of the 20th century. For men, the level of education took off for those born around 1920, it increased rapidly up to cohort 1968, then regressed slowly for about 20 years. For women, the increase was very much parallel, with a rapid increase from cohort 1915 to cohort 1970, then a slowing down followed by a steady state for cohorts 1977-1987. As a result, the gap between men and women, which was large and constant for a long time (about 2 years), narrowed markedly in the recent years, to reach very small values for recent cohorts (< 0.4 years). The decline in level of education for men born between 1968 and 1987 seems associated with the difficult years preceding independence (1974-1979) and the corresponding economic recession. The continuing decline in level of education for men and the stagnation for women for cohorts 1977-1987 could be associated with the economic stagnation of the 1981-1999 period. The large economic recession that started in year 2000 could not have an effect on the cohorts under study. (Figure B-34.1)

Period trends, fertile women

Despite the later fluctuations, period trends in level of education for fertile women were regular, with a steady increase from 1950 to 2005, in both urban and rural areas. In urban areas the level was already average in 1950 and continued to increase, in parallel with that in rural areas. As a consequence, the gap between urban and rural remained roughly steady over the years, and narrowed only little between 1985 and 2005. The average level was high in 2005 by African standards (9.4 years in urban, 7.4 years in rural) way above the African average. Fertility decline started early and at relatively high level of education in both urban areas (4.6 years in 1962) and in rural areas (3.4 years in 1978). (Figure B-34.2)

Figure B-34.1. Cohort trends in level of education, Zimbabwe

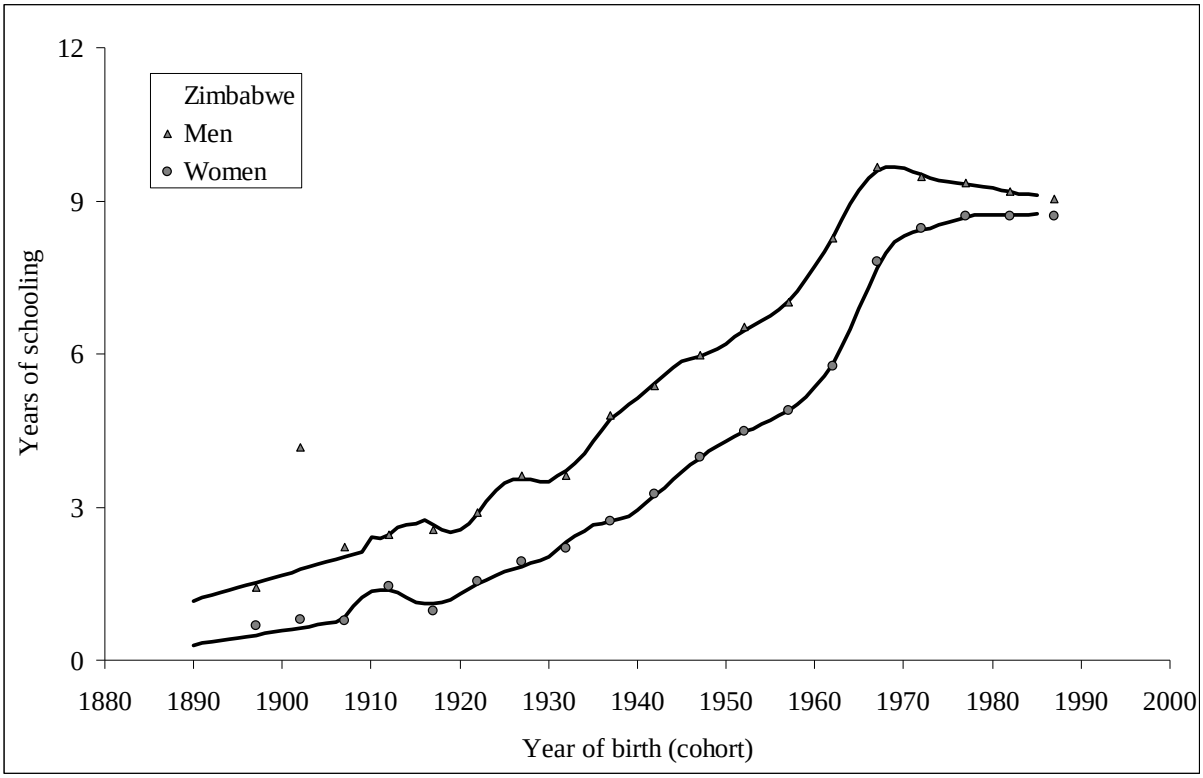
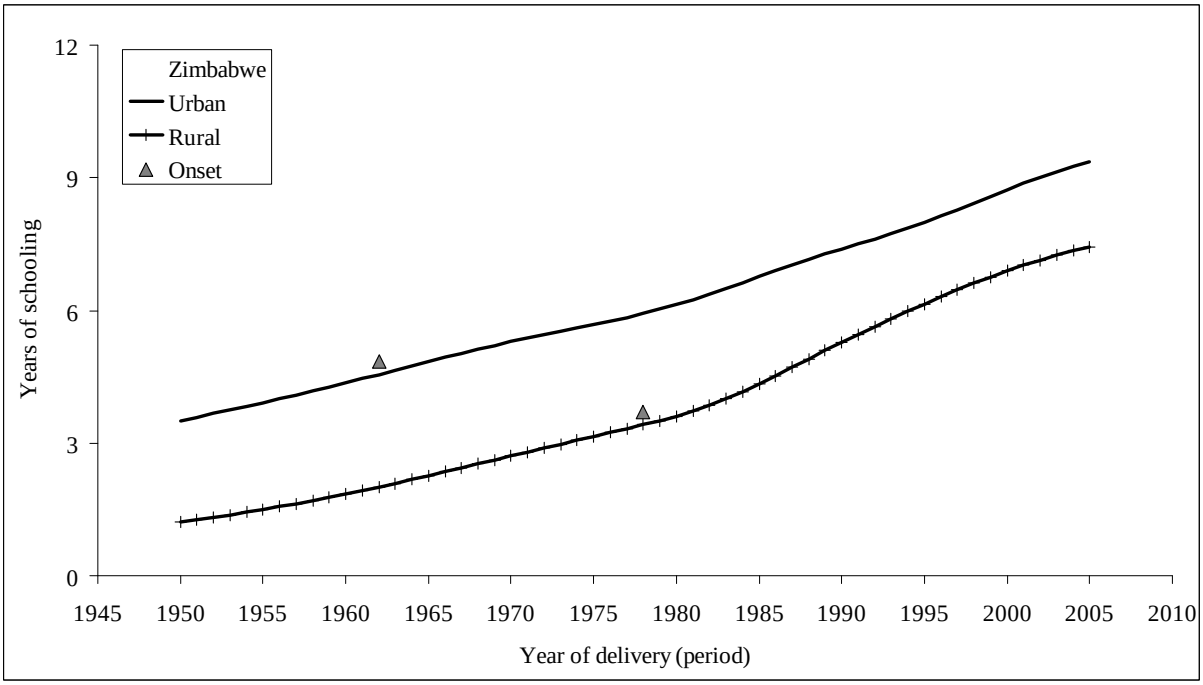


Figure B-34.2. Period trends in level of education, fertile women, Zimbabwe



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