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POVERTY AND FERTILITY IN SUB-SAHARAN AFRICA

Evidence from 25 countries

Draft

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ABSTRACT

This paper provides an overview of the relationships between poverty and fertility behaviour in Sub-Saharan Africa. Data from Demographic and Health Surveys carried out in 25 countries are used to examine differentials and changes by economic status in fertility, contraceptive use and age at marriage. Multivariate analyses are also performed to estimate the effect of economic status on fertility controlling for education and place of residence. Our results show among others that differentials by economic status in fertility, contraceptive use and age at marriage are observed in all the 25 countries studied. Overall, the poorest women have a larger number of children, marry younger and use less contraceptive methods. The fertility differentials by economic status also persist after controlling for education and place of residence, suggesting that poverty does constitute a break to fertility decline. Our analyses also show that fertility has decreased among the poorest women in countries where the fertility transition is well under way, and that the overall fertility changes are much more rapid than one would expect from purely compositional changes in terms of economic status, education and place of residence.

INTRODUCTION

Although Sub-Saharan Africa is the region where poverty is most widespread and where fertility is highest, empirical studies on the relationship between poverty and fertility in that region remain paradoxically quite rare (Eloundou-Enyegue 1998). Yet, the links between poverty and fertility behaviour have important implications for the demographic future of Sub-Saharan Africa. With half of its population living on less than 1$ per day, and three-quarters on less than 2$ per day (Chen and Ravallion, 2000), there will be no sustained fertility decline in Africa unless poverty is dramatically reduced or/and unless considerable fertility declines occur among the poor. Given that the incidence of poverty in Africa as a whole has been stagnating over the last two decades (Chen & Ravallion 2000), and that the situation is unlikely to improve significantly in the near future (Sahn & Stifel, 2002), widespread fertility control among the poor seems to be the only route to a sustained fertility decline in Sub-Saharan Africa.

The hypothesis of a sustained fertility decline under persistent poverty runs counter to the classical demographic transition theory and to the common idea that poverty is a key explanatory factor of high fertility (Schoumaker & Tabutin 1999; Egerö 1996). Economic approaches indeed tend to consider that high fertility is a rational response to poverty (World Bank, 1984), and consequently that fertility will not decline among the poor unless their conditions significantly improve. On the other hand, the idea of a decline of fertility among the poor is broadly consistent with the innovation diffusion approach. According to this view, fertility decline mainly results from the spread of ideas, values and technology to the entire population, regardless of their economic status (Casterline 2001).

Evidence of fertility changes in some extremely poor countries like Bangladesh and Nepal are consistent with the innovation diffusion framework (Adnan 2002; Cleland 2001), and studies in Latin America also tend to support this view. The fact that fertility transition is now under way in an increasing number of African countries (Garenne & Joseph 2002; Tabutin & Schoumaker 2001), in a context of widespread poverty, also suggest that poverty does not constitute an insuperable barrier to fertility decline, and that diffusion processes may be involved in these transitions.

Yet, few empirical studies have documented the relationships between economic status and fertility in Sub-Saharan Africa. For example, the question of whether and how fertility control has spread across economic strata within countries, and in particular if fertility control also

concerns the poorest segments of the population, has received little attention in Africa. At a more basic level, the bivariate relationships between economic status and fertility are also little documented. While it is well-known that female education and place of residence are strongly related to fertility behaviour, in Africa as elsewhere (Cohen, 1998; Shapiro and Tambashe, 2003), few studies have described the relationship between economic status and fertility behaviour, and to our knowledge, there is no synthesis on this topic on Africa. The lack of appropriate data is sometimes cited as a reason for this situation (McNicoll, 1997; Van de Walle and Meekers, 1992). Yet, it is surprising that the huge amount of data from Demographic and Health Surveys (DHS) has not been used more for that type of studies.

The overall objective of this paper is specifically to document the relationship between economic status and fertility behaviour in Sub-Saharan Africa in the early stages of fertility transition, using the most recent DHS. We first provide a short review of literature on the relationship between poverty and fertility, with a focus on Sub-Saharan Africa. The rest of this paper is devoted to empirical analyses of the relationship between economic status and fertility in 25 Sub-Saharan African countries.

Three broad questions are addressed in the first empirical part of the paper. (1) What are the differentials in fertility by economic status in 25 Sub-Saharan African countries? (2) Which proximate determinants account most for these differentials? (3) Are these differentials explained by other socio-economic determinants of fertility, in particular by women's educational level and place of residence? The second empirical part is devoted to the analysis of fertility trends in eight countries at different stages of fertility transition. More specifically, we briefly address four questions. (1) In each country, what proportion of fertility change can be accounted for by a shift in the distribution of the economic status of the population? (2) To what extent has fertility changed within economic groups, and in which groups has fertility changed most? (3) Which proximate determinants account for theses changes? (4) Can these changes be accounted for by changes in other socio-economic determinants of fertility?

While the overall objective of this paper is at this stage mainly descriptive, it will hopefully provide empirical evidence for the theoretical debates on explanatory factors of fertility transition in developing countries.

1 POVERTY AND FERTILITY IN AFRICA: A SHORT REVIEW OF LITERATURE

Poverty and high fertility are commonly associated in the demographic and development literature (Birdsall and Sinding, 2001). Sub-Saharan Africa, which has both the highest

incidence of poverty and the highest level of fertility, illustrates in a sense that relationship at the macro level. We will not dwell on macro relationships, recently reviewed by Eastwood and Lipton (2001), and we will rather focus on the micro level (individual and household), the level at which fertility decisions are made. At that level, as it has been underlined in previous works (Schoumaker and Tabutin, 1999; Birdsall, 1980), women from poor households often have larger families. It is almost always the case in the course of fertility transition. Relationships are usually less clear-cut in high fertility settings, where slightly higher fertility levels among the poorest women have been reported in several studies (Schoumaker and Tabutin, 1999). What is the situation in Sub-Saharan Africa?

1.1 Relationships between economic status and fertility in Sub-Saharan Africa

The literature on that topic in Sub-Saharan Africa is in fact quite scarce. In a previous literature review on the relationships between economic status and fertility, we found about 50 such relationships reported in 32 studies (Schoumaker and Tabutin, 1999), but only six of them were on Sub-Saharan Africa. In spite of the limited number of studies, we found a diversity of relationships between economic status and fertility. There was no relationship between those two variables in Botswana in the 1970s (Chernichovsky, 1984), a slightly positive relationship in Sierra Leone at the same period (Ketkar, 1979), a slightly negative relationship in Burkina Faso in the 1990s (Langani, 1997) and in a small town in Southern Sudan in the 1980s (Cohen and House, 1994), an inversed-J relationship between economic status and fertility in rural Cameroon in the 1980s (Noumbissi and Sanderson, 1998), and strongly negative relationships in some settings, such as in urban Cameroon in the 1980s (Noumbissi and Sanderson, 1998) and in South Africa in the 1990s (Schoumaker, 1999).

Several recent studies complete that picture. Using data from Demographic and Health Surveys conducted in the 1990s, the World Bank has produced a series of demographic and health indicators by wealth quintiles for 22 Sub-Saharan African Countries (Gwatkin, Rutstein, *et al.*, 2000). These results indicate that, in most countries, fertility clearly decreases with increasing economic status. A recent study by Talnan and Vimard (2003) in Côte d'Ivoire, using the 1994 DHS, also shows a negative relationship between economic status and fertility, even when controlling for various socio-economic variables. On the other hand, Ainsworth (1989), using the Côte d'Ivoire LSMS survey, had found a slightly negative relationship between economic status and fertility among uneducated women. Finally, Mencarini and Dovandri (2002) also observe a negative relationship between economic status

and parity in rural Botswana and in rural South Africa, using data from surveys on a few villages in the 1990s[1].

We thus find a diversity of relationships, on a variety of settings and periods. However, most of these relationships are negative, i.e. fertility is usually higher among the poor. One should note however that comparisons and generalisations from these studies are handicapped by several factors: (1) the diversity of the populations on which these studies are based (rural, urban or national, all women or uneducated women,…), (2) the diversity of the indicators of fertility (cumulated, recent) and (3) of indicators of economic status used in these studies, and (4) the fact that the categories of economic status are defined differently in different studies. Our empirical analyses aim, amongst others, at obtaining results that are comparable across countries and across periods.

1.2 Explanatory approaches: a (very) brief summary

How can we explain the relationships between poverty and fertility? Theses associations can reflect different types of causal and non-causal relationships: (1) Influences of poverty on fertility, (2) effects of fertility on poverty, and (3) influences of common factors on both poverty and fertility (Birdsall and Griffin, 1988; Eloundou-Enyegue, 1998; Merrick, 2001). The relationships between economic status and fertility also involve different mechanisms, which will be only briefly summarized here (for more details, see Birdsall, 1994; Desai, 1992; Eloundou-Enyegue, 1998; Lipton, 1983; Lockwood, 1997; Schoumaker, 1998).

The positive relationships, in which fertility slightly increases with economic status, have usually been explained by the reduced reproductive capacity of the poor (more sterility, higher foetal mortality,…), more frequent marriage dissolutions (widowhood, divorces), and more frequent and longer breastfeeding (Birdsall, 1980; Lipton, 1983; Lipton, 1999). Some authors have also argued that, in some settings, the very poor also had a lower demand for children, leading to a lower fertility (Egerö, 1996). The negative relationships – fertility is higher among the poor – have received much more attention. The explanations for these relationships frequently rely on the idea that high fertility is an economically rational response to poverty (Lipton, 1999). In short, according to these economic approaches, the benefits of having children outweigh their costs, leading to a high demand for children and a high

[1] Shapiro et Tambashe (2003) also observe a positive relationship between economic status and contraceptive use in Kinshasa in the early 1990s.

fertility. Old-age security and the work of children are two of the benefits frequently cited to explain the large families of the poor. These ideas are found amongst others in the Caldwell theory (Caldwell, 1982) and in the works of Birdsall (Birdsall, 1994; Birdsall and Griffin, 1988) and Cain (1981). The costs of the children of the poor are also often believed to be lower, because of (amongst other) the lower investment in child quality (health, education) among the poor and the externalisation of costs through several mechanisms (child fostering, gender inequalities, intergenerational transfers of costs,…) (Merrick, 2001). Measuring costs and benefits of children over the parental life cycle is clearly a difficult task, especially in the African context, and it comes as no surprise that few empirical studies throw light on the question of the economic rationality of the high fertility of the poor (Stecklov, 1999)[2].

The economic approach is frequently opposed to approaches based on the concept of the diffusion of values, ideas and technologies, even though they are not incompatible (Casterline, 2001). Briefly stated, according to the diffusion approaches, the higher fertility of the poor does not reflect their economic rationality, but is rather explained by the fact that the idea of fertility control and information on contraceptive methods have not reached the poor, and/or that contraception is not available to them. Fertility will thus decline among the poor with some delay, but an improvement in their economic status is not a necessary condition for this to happen (Birdsall, 1980; Cleland, 1994).

Other variables (child mortality, female education, place of residence) are obviously involved in the relationships between poverty and high fertility. Higher mortality among the poor tends to increase their fertility through various mechanisms, such as replacement and insurance effects (Heer, 1983). Lower levels of female education among the poor may also partly explain their higher fertility (Birdsall and Griffin, 1988) and the concentration of poverty in rural areas (Sahn & Stifel, 2002) also certainly accounts for some part of the poverty-fertility relationships. Finally, although the effects of poverty on fertility are more frequently cited in the literature, the opposite influences may of course also partly explain the association between poverty and high fertility. The negative effect of early and repeated pregnancies on the accumulation of human capital of mothers (education, professional experience) is one of the possible mechanisms. The intergenerational transmission of poverty in high fertility families is another one (Eloundou-Enyegue, 1998).

[2] For a critical review, see Lockwood (1997).

In summary, the relationships between poverty and fertility can be explained by various causal mechanisms. This paper does not aim at testing specific hypotheses on the causal mechanisms linking poverty and fertility however. At this stage, our objective is simply to propose descriptive analyses which, although they do not provide answers on the mechanisms linking poverty and fertility, will allow us to identify directions to be explored in further research.

2 AN ANALYSIS OF DHS SURVEYS IN 25 AFRICAN COUNTRIES

As we mentioned before, empirical studies on the relationship between economic status and fertility in Africa remain scarce and difficult to compare. The empirical objective of this paper is to provide new analyses based on the Demographic and Health Surveys of 25 Sub-Saharan African countries, using a methodology that facilitates comparisons across countries and over time. Both bivariate and multivariate methods are used.

2.1 The data

This study uses data from the DHS surveys collected since the mid 1980s in Sub-Saharan Africa. The DHS provide cross-nationally comparable data on, amongst other, fertility, contraceptive use, and marriage. Although the DHS do not collect information on incomes or expenditures – the classical variables for measuring living standards (Ravallion, 1996) – a proxy for economic status can be measured by using questions on ownership of consumer durable goods and on housing characteristics (Bollen, Glanville, *et al.*, 2001).

We use the individual data files of DHS surveys conducted in 25 countries of Sub-Saharan Africa (Figure 1). The selection of these countries was based on the accessibility of the data files from Macro International and on the availability of variables used to build an asset index comparable across countries and periods[3]. The 25 countries are fairly representative of Sub-Saharan Africa: some very poor countries (Chad, Niger) and some rather rich countries (South Africa, Gabon) are included, as well as countries from various regions and of different sizes (Table annex 1).

[Figure 1]

[3] Some countries have been excluded, either because the data files were not available, or because some variables were not collected in the survey. The 1990 Sudan survey, conducted on ever-married women, is also excluded from our set of countries.

First, we provide cross-sectional analyses using the most recent DHS surveys of the 25 countries (all dating from the 1990s onwards). We next turn to analyses of fertility changes by economic status in eight countries with comparable data at two points in time.

2.2 Indicators and methodology

Two approaches are used: bivariate relationships between economic status and fertility behaviour (general fertility, contraceptive use, age at marriage) and multivariate analyses of recent fertility using Poisson regression. Economic status is the main independent variable in the multivariate analyses, and education and place of residence are the other socioeconomic variables included in the regressions. The indicators are briefly described below.

2.2.1 Indicators of economic status

In this study, economic status is measured by an "asset index", i.e. a composite indicator constructed by aggregating data on asset ownership and housing characteristics. Several recent studies with DHS data have used such indices to measure economic status (Bollen, Glanville, *et al.*, 2001; Filmer and Pritchett, 2001; Gwatkin, Rutstein, *et al.*, 2000; Sahn and Stifel, 2000), and a few authors have shown that the relationship between economic status and fertility obtained with such proxy variables were similar to those measured with indicators such as the expenditures per person (Bollen, Glanville, *et al.*, 2001; Schoumaker, 1999)[4].

The asset index is computed as a weighted sum of a series of binary variables measuring asset ownership and housing characteristics. In this study, the *same variables and the same weights* are used for all the surveys. In other words, the indicator is computed in a strictly identical way for all the countries and for the various surveys in the same country. Overall, eight variables are included in the indicator (radio, television, refrigerator, motorcycle, car, finished floor, piped water and flushing toilet)[5].

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[4] One should note that an asset index is essentially a measure of long-term economic status (Bollen, Glanville, *et al.*, 2001; Cohen and House, 1994; Filmer and Pritchett, 2001), and is thus not very sensitive to time variations in the household's level of living.

[5] These variables are available in all the surveys retained for this study. Data on the materials of roofs and walls were collected in a little less than half of the surveys and were thus not included in the asset index. Electricity was not included either because it was not collected in some surveys at the end of the 1980s (Senegal, Togo). The possession of a bicycle was excluded of the asset index because it was negatively correlated to the other variables. The three variables on housing characteristics (water, floor, toilets) have been transformed into binary variables for reasons of comparability across surveys. Some countries such as Malawi and Ethiopia were excluded of the analyses because no data was available on some of the variables used in the asset index (refrigerator, television).

Asset weights are estimated using principal components analysis. The principle of that method is to transform a set of correlated variables into a set of new independent variables (components), which are linear transformations of the original variables (Hewett and Montgomery, 2001). The first component is retained as the asset index. This approach has been used in several recent studies using DHS data (Filmer and Pritchett, 2001; Gwatkin, Rutstein, *et al.*, 2000; Hewett and Montgomery, 2001). An original aspect of our work is to perform the principal components analysis with the data from all the surveys pooled together, so that we obtain one set of weighting factors for the eight variables that is common to all the surveys (Table 1)[6].

[Table 1]

The values of the indicator range from 0 to 3.46. Using this asset index, five categories of economic status are defined in the same way for all the surveys[7]. Defining categories in the same way in all the surveys facilitates comparisons across countries and over time within countries. In other words, the same categories refer to the same range of values of the asset index, whatever the country or the period considered.

[Figure 2]

The first category, the *poorest women*, is composed of women living in households with no assets and with rudimentary housing conditions (Figure 2). Overall, these women constitute almost one quarter of the women aged 15-49 in the 25 surveys (Table 2). There is, however, a strong heterogeneity across countries: they represent less than 5% of the women in South Africa and Gabon, and more than half of the population in Uganda and Chad. The second category, which we will call the *very poor*, live in slightly better conditions: their households possess one consumer good (usually a radio, rarely a motorcycle) and sometimes enjoy slightly better housing conditions than the poorest women (Figure 2). They also represent one-quarter of the women aged 15-49, with a high 45% in Burkina Faso and a low 8% in South Africa. The third category, which we call the *poor*, differs from the previous category mainly by better housing conditions. Most of these women live in houses with finished floor and approximately half of them have access to piped water. None of them has consumer

[6] The data files of 38 surveys were pooled together and the analysis was performed on 270 000 cases (women aged 15-49). Cases were weighted based on the sampling probabilities and on the ratio of the total population of the countries to the sample size of the DHS surveys.

[7] This approach is similar to the one used by Filmer and Pritchett (2001) on Indian States, but is different from the approach used in the study by the World Bank (Gwatkin, Rutstein, *et al.*, 2000), in which quintiles were defined separately in each country.

goods other than a radio or (rarely) a motorcycle. They represent 21% of the women in the 25 countries (40% in Togo, 6% in Chad). Women in the *middle* category represent 15% of the total (26% in Zimbabwe, 2% in Chad) and possess more consumer durable goods (especially television) than women in the previous categories and also have more flushing toilets. Finally, the better off women have more televisions, refrigerators, cars and flushing toilets. They constitute a little less than 15% of the total number of women, with a high 52% in Gabon and a low 1% in Chad.

[Table 2]

Two other variables are included in multivariate analyses: (1) the educational level of women (no education, primary, secondary and over) and (2) the place of residence (urban, rural).

2.2.2 Fertility indicators and regression methods

Five indicators of fertility and of its proximate determinants are used. Fertility is measured by the total fertility rate (TFR) over the 5 years preceding the survey. Contraceptive use is measured by the proportion of married women using a modern contraceptive method at the time of the survey and by the Bongaarts index of contraception (Cc). The median age at first union among women aged 15-49 is computed using life tables, and the Bongaarts marriage index (Cm) is also used in this study. The Bongaarts indices are expressed in the same metric, which facilitates comparisons of the weights of these proximate determinants in fertility differentials (Singh, Casterline, *et al.*, 1985).

Total fertility rates and the effects of explanatory variables on fertility are estimated using Poisson regression (Schoumaker, 2004; Trussell and Rodriguez, 1990). An advantage of using Poisson regression to compute TFRs by economic status is that they can be based on a smaller number of cases. Another advantage of that method is that other explanatory variables (education, place of residence) can be included in the same regression model, allowing us to compare the relationship between economic status and fertility before and after controlling for other socio-economic factors.

3 RELATIONSHIP BETWEEN ECONOMIC STATUS AND FERTILITY IN 25 SUB-SAHARAN COUNTRIES

In this first empirical part, we briefly treat three points. First, we measure the relationship between economic status and fertility and evaluate the regularity of that relationship across the 25 countries of this study. The second point deals with the role of two proximate

determinants (contraception and marriage) in the fertility differentials by economic status. In the third point, we evaluate the extent to which the relationships between level of living and fertility can be accounted for by two other socio-economic determinants of fertility (education and place residence).

3.1 Do the poorest women have a higher fertility in Sub-Saharan Africa?

Figure 3 shows the relationships between economic status and fertility in the 25 countries of this study (see also Figure annex 1). These results clearly show that the poorest women have a much higher fertility than the better off women in all the countries of this study. On average, their fertility is twice as high as that of the better off women, and it is up to 3 to 4 times higher in some countries (Madagascar, Togo, and Tanzania). In all the countries, the poorest women's fertility is above 5 children, and above 6 children in 20 of them. Conversely, the better off women's fertility is below 5 children in the 25 countries, and exceeds 4 children in only 3 countries (Niger, Chad, and Zambia). In other words, there is a clear negative relationship between economic status and fertility.

[Figure 3]

That general relationship should be qualified on several counts. Firstly, fertility decreases only above a threshold of economic status in several countries (Table 3, Figure annex 1). Only in 5 countries is the fertility of the "very poor" at least 10% lower than that of the poorest women. In 10 countries, fertility starts to decrease significantly (10% lower than that of the poorest women) from the third category onwards (poor women). In three countries (Mozambique, Rwanda, and Mali), there are no fertility differentials between the first three categories of economic status, and in two countries, fertility is 10 % lower than that of the poorest women only among the better off women (Central African Republic and Chad). In other words, even though in all the countries the poorest women have more children than the better off women, a slight improvement in economic status does not necessarily lead to a lower fertility. Differences between the two extreme categories also differ widely across countries. Overall, larger differentials are observed in countries where the fertility transition is under way. However, very large differentials are also found in high fertility countries (Madagascar), and small differentials exist in countries with declining fertility (Nigeria).

[Tableau 3]

Secondly, there is a large heterogeneity of fertility among countries in each category of economic status. For example, fertility levels among better off women vary from less than 2 children per woman (Madagascar) to more than 4 children (Niger). Among the poorest women, fertility varies from 5 children per woman in South Africa to 8 children in Niger. Overall, the poorest women's fertility is lower in countries where the fertility transition is well under way (South Africa, Zimbabwe, Kenya and Ghana) compared to countries where the transition is recent or has not yet started. This illustrates a point that will be confirmed in the analyses of fertility changes: *fertility decline also occurs among the poorest women in some of the countries where fertility transition is well under way.*

3.2 Which proximate determinants account for these differentials?

What are the respective weights of contraceptive use and age at marriage in the fertility differentials by economic status? Before comparing their weights, we first look at the relationships between economic status and each of these proximate determinants of fertility.

Contraceptive use is clearly related to economic status (Figure 4, Figure annex 2). At low levels of living, except for three high prevalence countries, contraceptive use is uniformly low. The proportion of the poorest women using modern contraception is on average 6% and exceeds 10% in only three countries: South Africa, Kenya and Zimbabwe. The heterogeneity is much higher among the better off women: it ranges from 13% (Guinea) to almost 70% (Zimbabwe). It is above 20% in 16 countries and above 40% in 6 of them. These results illustrate several points. First, the degree of fertility control among the poorest women is extremely low in most countries, confirming that these women are more "resistant" to fertility control. Nevertheless, the moderate levels of contraceptive use among the poorest women in Zimbabwe, South Africa and Kenya also illustrate the fact that extreme poverty is not an insuperable obstacle to fertility control, although it clearly acts as a break. One should note that these countries are characterized by lower levels child mortality (even though they are now on the increase) and by higher levels of female education (Table annex1 1). They also have stronger family planning programmes than the other countries (National Research Council, 1993). In other words, fertility control among the poorest women seem to be more widespread in settings with better health conditions, higher levels of social development and stronger family planning programmes.

[Figure 4]

A clear relationship between age at first marriage and economic status is also apparent from our results (Figure 5, Figure annex 3), with the notable exception of South Africa and Namibia, where there is no relationship between economic status and age at marriage (uniformly high)[8], and with the exception also of Chad and the Central African Republic, where ages at marriages are uniformly low. Among the poorest women, age at first marriage is below 19 years in 22 out of 25 countries. Early marriage is thus the rule among the poorest women almost everywhere. Conversely, among the better off women, it is above 19 years in 23 of these countries and exceeds 23 years in 10 countries. Despite an overall positive relationship between level of living and age at marriage, there is some heterogeneity across countries, reflecting, among others, cultural differences among countries (National Research Council, 1993).

[Figure 5]

What are the respective weights of these two proximate determinants on fertility differentials by economic status? To answer this question, we compare the Bongaarts indices of marriage and contraception (Cm and Cc) for each category of economic status in the 25 countries (Figure 6). The marriage index is on the horizontal axis, the contraception index on the vertical axis, and each point represents a category of economic status. The poorest women are located towards the upper right corner (high values of the indices) and the better off women towards the lower left corner. A point located above the diagonal line indicates that the contraception index is greater than the marriage index, i.e. that the reducing effect of contraception is lower than the reducing effect of marriage. The slope of the relationship between the two indices illustrates which of the marriage index and the contraception index most accounts for the fertility differentials. A slope greater than one thus indicates that the differentials depend more on contraception than marriage, while a slope smaller than one indicates that age at marriage accounts for a larger part of the fertility differentials.

[Figure 6]

Let us first note that the five points are located below the diagonal line in most countries, indicating that the reducing effect of marriage is still greater than the effect of contraception for all the economic groups. Zimbabwe is a noteworthy exception, with all the points largely below the diagonal line. As far as the differentials are concerned, all the situations are found in the countries of this study. In a few countries (Zambia, Cameroon, Senegal), the 5 points

[8] And where births oustide marriage are frequent.

are almost parallel to the diagonal line, indicating that the reducing effects of contraception and marriage progress in the same way with increasing levels of living. In other countries, the differentials are largely accounted for by differences in contraceptive use. It is clearly the case in South Africa and Namibia, and to a lesser extent in Burkina Faso and Uganda. Finally, in about ten countries (Benin, Comores, Togo, Guinea, Ghana,…), differences in age at marriage account for a larger part of the fertility differentials. In summary, both age at marriage and contraceptive use contribute to explaining these fertility differentials by economic status, and there does not seem to be any clearly dominant factor. Let us underline however that other proximate determinants may also have important effects on the fertility differentials in some countries. It is most probably the case for induced abortions, which could not be taken into account in this study because of the lack of data on the topic.

3.3 Do fertility differentials by economic status result from the effects of education and place of residence?

Does the relationship between economic status and fertility simply reflect the fact that better off women tend to live in urban areas and are more educated, or does it persist after controlling for education and place of residence? To answer this question, we have estimated two Poisson regressions in each country. The first regression includes the age groups and economic status as explanatory variables; the second regression also includes women's educational level and place of residence. The exponentials of the Poisson regression coefficients measure *rate ratios*, e.g. the exponential of the coefficient for the better off women measures the ratio of the TFR of these women to the TFR of the poorest women, taken as the reference category. These rate ratios are compared before controlling (horizontal axis) and after controlling (vertical axis) for education and place of residence (Figure 7). In this way, we estimate how much of the relative difference of fertility between the poorest women and the better off women can be accounted for by their differences in terms of education and place of residence.

[Figure 7]

All the countries are located above the diagonal line (Figure 7), indicating, as expected, that the differences of fertility between the poorest women and the better off women are smaller when education and place of residence are controlled for. On average, the rate ratios are equal to 0.5 (fertility twice lower among the better off women) when education and place of residence are not controlled for, and are equal to 0.67 when these variables are controlled for.

This clearly indicates that the fertility differentials by level of living do not simply reflect the effects of education and place of residence, although these two variables account for approximately one-third of the differentials. In other words, economic status has an effect on fertility beyond the effects of those two socioeconomic determinants.

Again we find some heterogeneity among countries. In some countries, differentials by level of living are strongly reduced when controlling for the other two variables. For example, the rate ratios are reduced by more than half in Nigeria, Burkina Faso, Niger and Cameroon. Conversely, in countries such as Madagascar, Kenya, Zimbabwe and Rwanda, controlling for education and place of residence does not affect the differentials in a significant way.

4 ECONOMIC STATUS AND FERTILITY CHANGES IN 8 SUB-SAHARAN AFRICAN COUNTRIES

In the previous section, we showed that there were large fertility differentials by economic status in most of the countries of this study. These differentials result among others from differentials in the level of contraceptive use and the age at first marriage, and they usually remain largely significant after controlling for education and place of residence. The fact that the fertility of the poorest women remains significantly higher than that of the better off women after controlling these variables suggests that poverty is indeed a break to fertility control in Sub-Saharan Africa. Yet, as we mentioned before, data from Zimbabwe, Kenya and South Africa also indicate that fertility has decreased among the poorest women. In this second empirical part, we look more specifically at the question of fertility changes and at their relationships with economic status. This is done by comparing data from several DHS surveys in the same countries. First we estimate the impact of changes in the composition of the population in terms economic status on fertility changes in eight countries. We then examine fertility changes within categories of economic status, and briefly evaluate the role of proximate determinants and other socioeconomic determinants of fertility in these changes.

4.1 Fertility changes and changes in economic status

In this section, we compare data at two points in time in eight African countries at different stages of fertility transition: Burkina Faso, Cameroon, Ghana, Kenya, Niger, Senegal, Togo and Zimbabwe (Table 4). 6 of these 8 countries have experienced a fertility decline of at least 10 % between the two surveys and are thus clearly in the process of fertility transition. Kenya and Ghana have experienced large fertility changes (around 30 %) over the last 10 years, and

fertility has also decreased substantially in Zimbabwe, Togo and Cameroon (2 % per year). The decline has been slower in Senegal (1 % per year) and neither Burkina Faso nor Niger has experienced significant fertility changes.

[Tableau 4]

Before examining fertility changes by economic status, we first evaluate what proportion of the overall fertility changes in these countries can be accounted for by compositional changes of economic status. The idea that fertility changes result – at least partly - from an increase in the level of living of the population is implicit in many works on fertility differentials, but is in fact rarely analyzed. To answer this question we estimate regressions in the 6 countries where fertility has decreased by at least 10 % between the two surveys. The data from the two surveys are pooled together and a dummy variable for the survey is taken into account to measure relative changes in fertility. The first series of models only includes the age groups and the dummy variable, and the second series of models also includes economic status as an explanatory variable. Comparing the regression coefficients of the dummy variable before and after controlling for the level of living gives an estimate of the proportion of relative fertility change that is not accounted for by compositional changes. Results, reported in the last column of Table 4, suggest that changes in the distribution of economic status contributed significantly to fertility changes only in Zimbabwe (three-quarters of the changes). In the five other countries, the proportion of fertility decline accounted for by compositional changes varies from -2 % in Cameroon to 26 % in Ghana. In other words *fertility changes in these countries seem largely independent from changes in the economic status of the population as captured by our indicator*. Most of the overall fertility changes in fact results from fertility changes *within* the different categories of economic status, a finding consistent with similar results reported by Birdsall (1980) for some developing countries in the early 1980s.

4.2 Fertility changes within categories of economic status

The analysis of fertility changes by economic status shows contrasted situations (Figure 8). Firstly, in countries where no fertility change is apparent at the national level (Burkina Faso and Niger), slight decreases in fertility are observed among the better off women. They weigh very little on the national trends however, and in Niger, the decrease observed the better off women is more than compensated by a slight increase among the poorest women. Countries at the beginning of fertility transition (Senegal, Togo, Cameroon) show very similar patterns: no fertility change occurs among the poorest, and larger (relative) changes occur as the level of

living increases. Fertility has been reduced by 20% in Senegal, 30 % in Togo and 34 % in Cameroon among the better off women, against 5%, 16% and 12 % among the very poor (and 0 % among the poorest). Finally, in Kenya and in Ghana, two countries where the fertility transition is well under way, fertility has clearly decreased for all the economic groups. It has decreased by more than 40% among the better off women in both countries, and the poorest women have also experienced large fertility changes: 23% in Kenya and 17 % in Ghana over a 10-year period. Zimbabwe is somewhat an exception, with surprisingly very small fertility changes within categories of level of living.

[Figure 8]

These fertility trends by economic status illustrate several points. First, in countries with no or recent fertility changes, the poorest women are the last to control their fertility. Fertility has decreased more rapidly among the better off women, resulting in growing fertility differentials by economic status. On the other hand, as we mentioned before, these results also illustrate that fertility has significantly declined among the poorest women in the countries where fertility transition is well under way (Kenya, Ghana). In Zimbabwe, even though the recent changes are small and concentred among the poorest and better off women, fertility must have decreased at all levels of living in the past.

4.3 The effects of proximate determinants and other socio-economic determinants on fertility changes within categories of economic status

Figure 9 shows the relationship between the Bongaarts contraception and marriage indices in the 5 categories of economic status at two points in time in each of the eight countries. In four countries (Senegal, Togo, Ghana, Kenya), the relationship gets closer to the diagonal line (and crosses it in the case of Kenya), indicating that the contraception index has changed more rapidly than the marriage index. In the countries that have experienced large fertility changes (Kenya, Ghana), the contraception index has decreased at all the levels of living. In Niger and Zimbabwe, changes have mainly occurred among the better off women, and contraceptive use has also changed more rapidly than age at marriage. Conversely, the marriage index has changed more rapidly than the contraception index among the better off women in Burkina Faso and Cameroon. In summary, even though the increase of age at marriage has had an impact on fertility changes, its effect has usually been weaker than the effect of contraception. As we mentioned before, some other proximate determinants that may have important effects are not taken into account in this study.

[Figure 9]

Finally, one should note that the fertility changes within categories of level of living are not (or very slightly) accounted for by changes in the level of education and place of residence. Regressions (results not shown) enable us to evaluate that only about 10 % of the changes can be explained by the changing composition of the population in these categories of economic status. In other words fertility changes are largely independent from the changes of the composition of the population.

5 DISCUSSION AND CONCLUSION

What preliminary conclusions can be drawn from theses analyses? Let us first summarize the main results.

- Fertility differentials by economic status are observed in all the 25 countries studied, and overall, the poorest women have a larger number of children. These fertility differentials result, among other, from differentials in contraceptive use and age at marriage, although the weights of these two proximate determinants vary across countries.
- The differentials by economic status persist after controlling for education and place of residence. This result thus suggests that economic status has an effect on fertility beyond the effects of these two socio-economic variables, and that it constitutes a break to fertility decline.
- Lower fertility and higher levels of contraceptive use are recorded among the poorest women in the countries that are the most advanced in the fertility transition, and analyses of changes show that fertility has decreased in all the economic groups in these countries. This indicates that, even though fertility has declined with some delay among the poor, poverty does not represent an insuperable obstacle to fertility changes, at least in these countries.
- Fertility changes within countries are largely independent from changes in the distribution of the population by economic status. They are also little related to changes in educational levels and changes in distribution by place of residence. In other words, fertility changes are much more rapid than one would expect from purely compositional effects.

We will not provide at this stage a detailed interpretation of the theoretical and policy implications of these results. Let us emphasize a few points however. First, the largest changes, which also concern the poorest women, have occurred in countries (Kenya, Ghana,

Zimbabwe, South Africa) where family planning programmes are more developed than elsewhere in Africa (National Research Council, 1993). This suggests that better family planning services also contribute to reducing fertility among the poorest women. This observation, the fact that fertility has declined in all the economic groups in these countries, and the fact that the fertility changes are little explained by compositional changes, are consistent with the innovation-diffusion framework. Our results suggest that better off women are the first to control their fertility and that fertility control spreads to the rest of the population, including the poorest women. This is consistent with the idea that poverty does not necessarily imply a need or a demand for a large number of children (Cleland, 1994). However, these results do not necessarily mean that economic factors do not come into play in explaining the observed fertility changes. For example, by increasing the costs of children, improved schooling may have contributed to fertility control among the poorest in a country like Kenya (Robinson, 1992).

Several other points would deserve more attention. First, other proximate determinants of fertility (postpartum insusceptibility, induced abortions…) could be taken into account and provide a more detailed picture of the behavioural and biological variables that account for the fertility differentials and changes by economic status. Child mortality is another essential factor that was only briefly mentioned in this paper. The level of mortality in the countries where fertility has changed most among the poorest women (Ghana, Kenya, South Africa and Zimbabwe) is overall lower than in other countries. At the aggregate level, child mortality is the variable that is most strongly related to fertility in Sub-Saharan Africa (Tabutin and Schoumaker, 2001), and it is a dimension that should certainly be taken into account in explaining the relationships between poverty and fertility. The analysis of differentials and changes in the demand for children by economic status could also provide further insight into the mechanisms underlying the relationships between economic status and fertility behaviour in Sub-Saharan Africa. In short, much remains to be done and the DHS data – in spite of their limitations – should be further exploited to that end.

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Table 1: Weights for the 8 variables included in the asset index.

Consumer goods and housing characteristics	Weight
Radio	0.198
Television	0.782
Refrigerator	0.802
Motorcycle	0.113
Car	0.420
Piped water	0.299
Finished floor	0.286
Flushing toilet	0.560

Table 2: Definition of the five categories of economic status and list of countries with minimum and maximum proportions of women aged 15-49 in each category economic status.

	Proportion of women in the 5 categories (%)		
Category of level of living (Value of the indicator)	Average in the 25 countries	Maximum	Minimum
The poorest	24.0 %	63.1 % (Chad)	2.5 % (South Africa)
(0)		52.9 % (Uganda)	4.8 % (Gabon)
Very poor	25.8 %	44.7 % (Burkina Faso)	7.6 % (South Africa)
(0.01 to 0.32)		40.8 % (Mali)	8.9 % (Gabon)
Poor	21.4 %	40.1 % (Togo)	5.7 % (Chad)
(0.33 to 0.79)		38.6 % (Benin)	10.3 % (Niger)
Middle	15.1 %	25.9 % (Zimbabwe)	2.2 % (Chad)
(0.80 to 2.13)		23.9 % (South Africa)	3.2 % (Rwanda)
Better off	13.7 %	51.7 % (Gabon)	0.8 % (Chad)
(2.14 to 3.46)		49.6 % (South Africa)	1.1 % (Uganda)
Mean value of the asset index	0.80	1.84 % (Gabon)	0.14 % (Chad)
		1.97 % (South Africa)	0.23 % (Uganda)

Table 3 : List of 25 countries classified by the category of economic status in which fertility is at least 10 % lower than that of the poorest women.

Economic Status			
Very poor	Poor	Middle	Better off
South Africa	Comoros	Mozambique	Central African Rep.
Namibia	Kenya	Rwanda	Chad
Zimbabwe	Uganda	Mali	
Madagascar	Benin		
Tanzania	Burkina Faso		
Cameroon	Guinea		
Gabon	Niger		
Côte d'Ivoire	Nigeria		
Ghana	Senegal		
Togo			

Table 4 : Fertility changes in the 1980s and 1990s in eight Sub-Saharan African countries .

Country	Surveys	TFR first survey	TFR latest survey	Relative fertility change (%)	Average annual relative fertility change (%)	% of fertility change accounted for by compositional changes in economic status
Burkina Faso	1992 & 1999	6.90	6.80	-1.4 %	-0.2%	-
Cameroon	1991 & 1998	5.95	5.15	-13.4 %	-2.1%	-2 %
Ghana	1988 & 1998	6.40	4.54	-29.1 %	-3.4%	26 %
Kenya	1989 & 1998	6.70	4.70	-29.9 %	-3.9%	9 %
Niger	1992 & 1998	7.26	7.47	+2.9 %	+0.4%	-
Senegal	1986 & 1997	6.62	5.90	-10.9 %	-1.0%	19 %
Togo	1988 & 1998	6.59	5.40	-18.1 %	-2.0%	21 %
Zimbabwe	1994 & 1999	4.54	4.08	-10.1 %	-2.1%	76 %

Table annex 1: Socio-economic characteristics of the 25 Sub-Saharan African countries of this study.

	Year of latest DHS	TFR	Current use of modern contraception	Median age at first marriage	% poorest and very poor	% women with some primary education	% urban	Under-five mortality (p. thousand)
Benin	2001	5.8	7.2%	19.0	33%	35%	40%	160
Burkina Faso	1999	6.8	4.8%	17.6	70%	14%	17%	219
Cameroon	1998	5.1	7.1%	17.9	47%	72%	35%	151
Central African Rep.	1995	5.4	3.2%	17.4	75%	48%	43%	157
Chad	1996	6.6	1.2%	16.2	91%	23%	23%	194
Comoros	1996	5.1	11.4%	20.0	46%	46%	30%	104
Côte d'Ivoire	1999	5.1	7.3%	19.2	21%	44%	42%	181
Gabon	2000	4.3	13.4%	20.1	13%	94%	80%	89
Ghana	1998	4.5	13.3%	19.3	36%	71%	36%	108
Guinea	1999	5.8	4.2%	16.6	57%	20%	32%	177
Kenya	1998	4.7	31.5%	19.8	57%	88%	23%	111
Madagascar	1997	6.1	9.7%	18.6	76%	79%	28%	159
Mali	2001	6.9	7.0%	16.7	57%	20%	30%	229
Mozambique	1997	5.6	5.1%	17.3	72%	57%	24%	201
Namibia	1992	5.2	26.0%	25.2	42%	86%	38%	84
Niger	1998	7.5	4.6%	15.3	81%	15%	20%	274
Nigeria	1999	5.1	8.5%	18.8	40%	62%	31%	140
Rwanda	2000	6.1	5.6%	20.9	75%	70%	17%	196
Senegal	1997	5.9	8.1%	18.3	32%	33%	44%	139
South Africa	1998	2.9	55.1%	25.0	10%	93%	60%	59
Tanzania	1999	5.6	16.9%	18.5	63%	73%	28%	147
Togo	1998	5.4	7.0%	19.3	36%	52%	38%	146
Uganda	1995	6.9	7.8%	17.5	82%	69%	15%	147
Zambia	1996	6.1	14.4%	18.2	53%	87%	45%	197
Zimbabwe	1999	4.1	50.3%	19.5	39%	93%	38%	102

Sources : All the indicators, except for under-five mortality, are computed by the author from individual DHS data files. Data on under-five mortality comes from STATCOMPILER (www.measuredhs.com).

The total fertility rate (TFR) is computed on the 5 years preceding the survey among women aged 15-49. Current use of contraception refers to women aged 15-49 in union at the time of the survey. The median age at first marriage is computed on all the women aged 15-49, using the life table method.

Table annex 2: Socio-economic and demographic characteristics of women by economic status in 25 Sub-Saharan African Countries (unweighted means).

	Level of living					
	The poorest	Very poor	Poor	Middle	Better off	Total
TFR (children per woman)						
Mean	6,6	6,2	5,4	4,5	3,2	5,5
Minimum	5,0 (South Africa)	4,5 (S. Africa)	3,7 (S. Africa)	2,7 (Madag.)	2,0 (Madag.)	2,8 (S. Africa)
Maximum	7,9 (Niger)	7,7 (Niger)	7,1 (Mali)	6,6 (Chad)	4,2 (Niger)	7,4 (Niger)
Current use of modern contraception (%)						
Mean	6,0	9,0	15,2	22,6	31,6	13,2
Minimum	0,3 (Chad)	1,5 (Senegal)	3,3 (Chad)	5,7 (Chad)	12,8 (Guinea)	1,2 (Chad)
Maximum	37,1 (Zimba.)	42,7 (Zimba.)	48,7 (Zimba.)	56,4 (Zimba.)	69,1 (Zimba.)	55,1 (S. Africa)
Bongaarts contraception index (Cc)						
Mean	0,93	0,89	0,83	0,75	0,66	0,85
Minimum	0,62 (Zimba.)	0,57 (Zimba.)	0,52 (Zimba.)	0,45 (Zimba.)	0,32 (Zimba.)	0,46 (S. Africa)
Maximum	0,99 (Chad)	0,98 (Senegal)	0,95 (Chad)	0,92 (Chad)	0,84 (Guinea)	0,98 (Chad)
Age at first marriage						
Mean	18,1	18,4	19,0	20,1	22,2	18,9
Minimum	15,2 (Niger)	15,2 (Niger)	15,9 (Niger)	16,7 (Chad)	18,1 (Chad)	15,3 (Niger)
Maximum	25,2 (S. Africa)	25,4 (S. Africa)	24,7 (S. Africa)	26,8 (Namibia)	25,7 (Namibia)	25,2 (Namibia)
Bongaarts marriage index (Cm)						
Mean	0,84	0,82	0,78	0,71	0,60	0,78
Minimum	0,63 (S. Africa)	0,63 (S. Africa)	0,66 (Kenya)	0,56 (Comores)	0,45 (Tanzania)	0,59 (S. Africa)
Maximum	0,95 (Niger)	0,93 (Niger)	0,90 (Mali)	0,83 (Chad)	0,78 (Chad)	0,91 (Niger)
% with some primary education						
Mean	42,9	51,5	64,2	76,3	87,1	57,9
Minimum	4,0 (Burkina)	6,6 (Burkina)	17,9 (Mali)	38,1 (Mali)	62,3 (Mali)	14,2 (Burkina)
Maximum	91,1 (Gabon)	94,4 (Gabon)	94,6 (Madag.)	98,0 (Zimba.)	99,0 (Zambia)	94,3 (Gabon)
% living in urban areas						
Mean	5,9	13,6	46,1	72,9	90,8	34,3
Minimum	0,0 (Zimba.)	0,1 (Zimba.)	6,6 (Zimba.)	49,0 (Nigeria)	71,3 (Nigeria)	80,2 (Gabon)
Maximum	15,1 (C. Africa)	35,9 (C. Africa)	84,4 (C. Africa)	92,7 (C. Africa)	99,5 (Burkina)	14,9 (Uganda)

Figure 1 : Map of Africa showing the 25 countries included in this study.

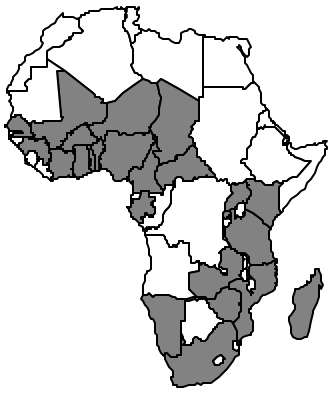

Figure 2 : Possession of consumer goods and housing characteristics by economic status (weighted proportions of women in the 25 DHS surveys).

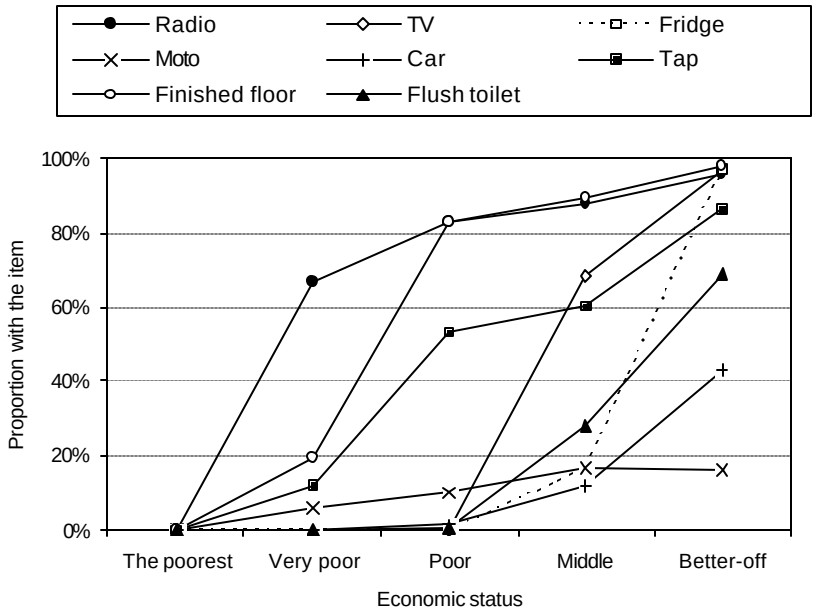

Figure 3: Fertility by economic status in 25 Sub-Saharan African Countries.

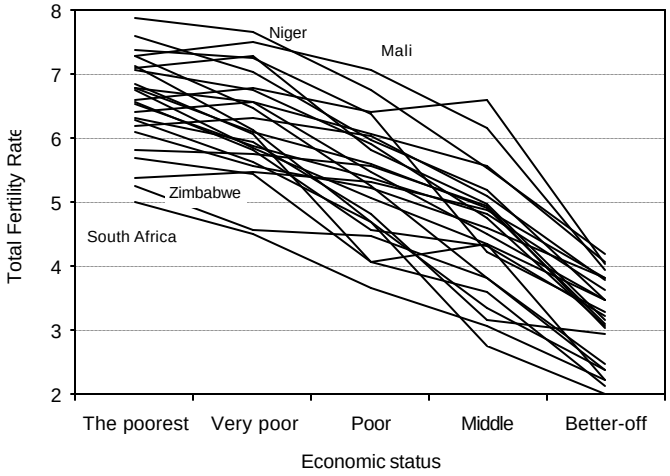

Figure 4: Current use of modern contraception by economic status in Sub-Saharan African Countries.

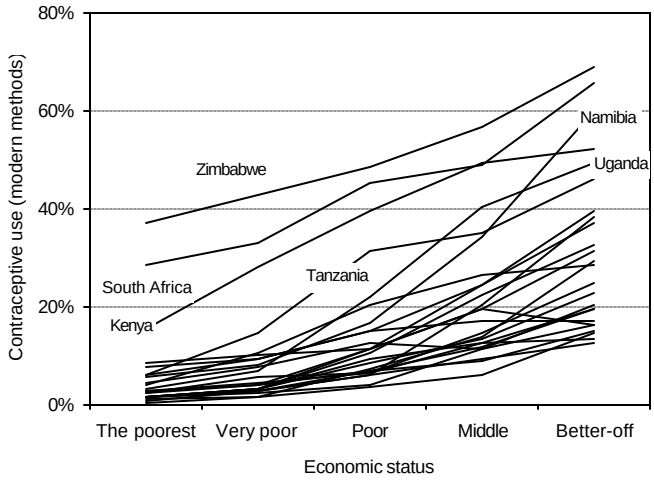

Figure 5: Median age at first marriage by economic status in Sub-Saharan African Countries.

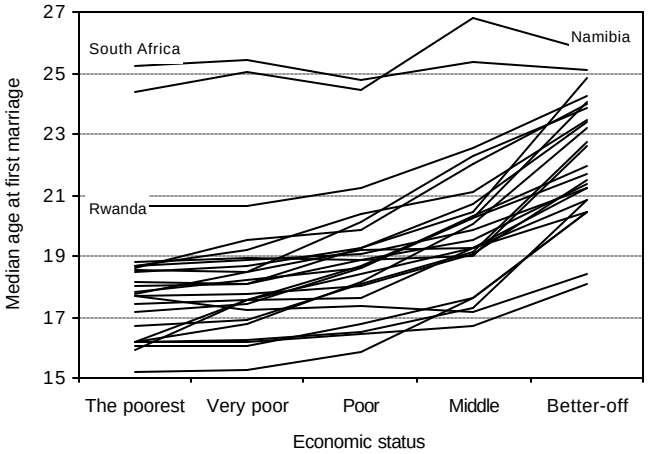

Figure 6 : Relationships between the marriage index (Cm) and the contraception index (Cc) by economic status in 25 Sub-Saharan African Countries in the 1990s.

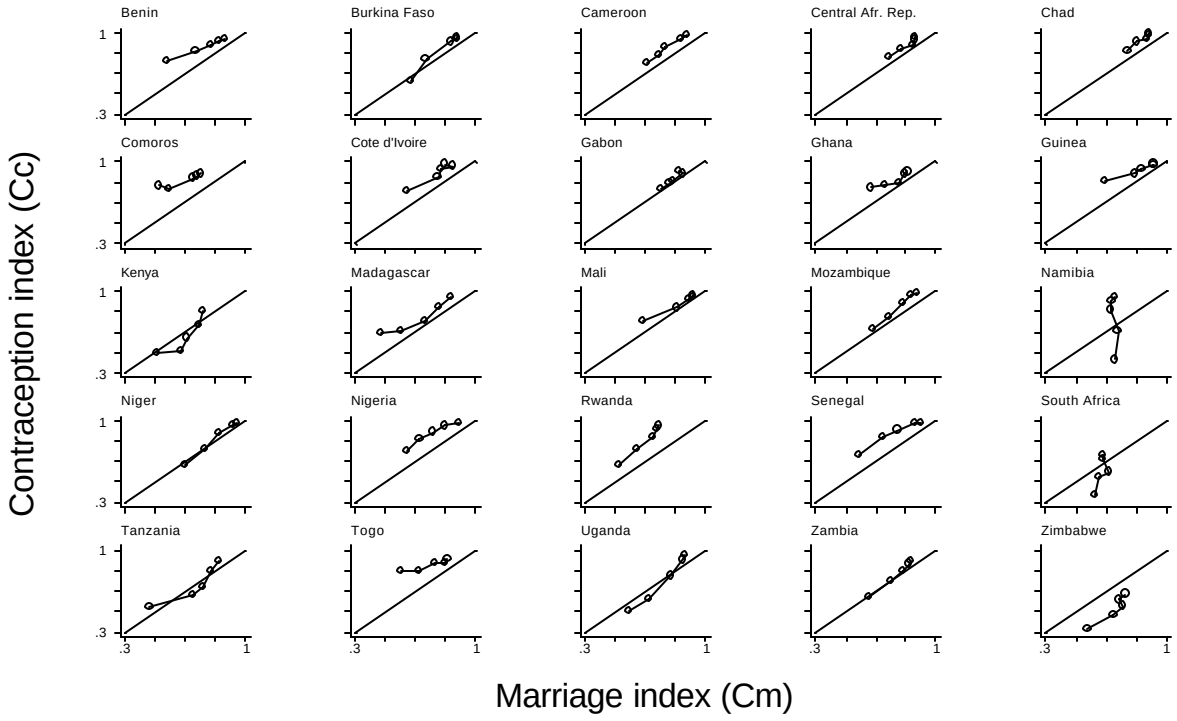

Figure 7: Ratios of the TFR of better off women to the TFR of the poorest women before and after controlling for education and place of residence in 25 Sub-Saharan African Countries.

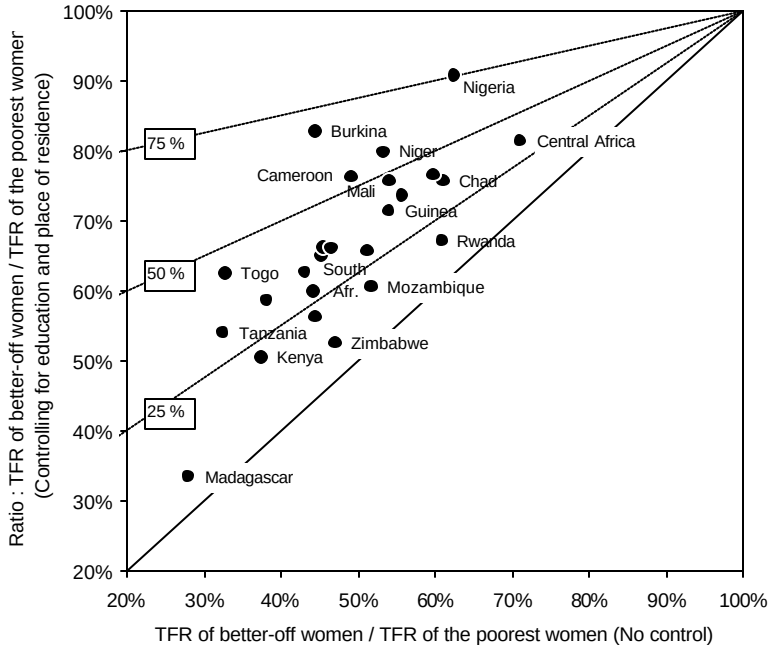

Figure 8. Fertility changes by economic status in eight Sub-Saharan African countries, 1980s and 1990s.

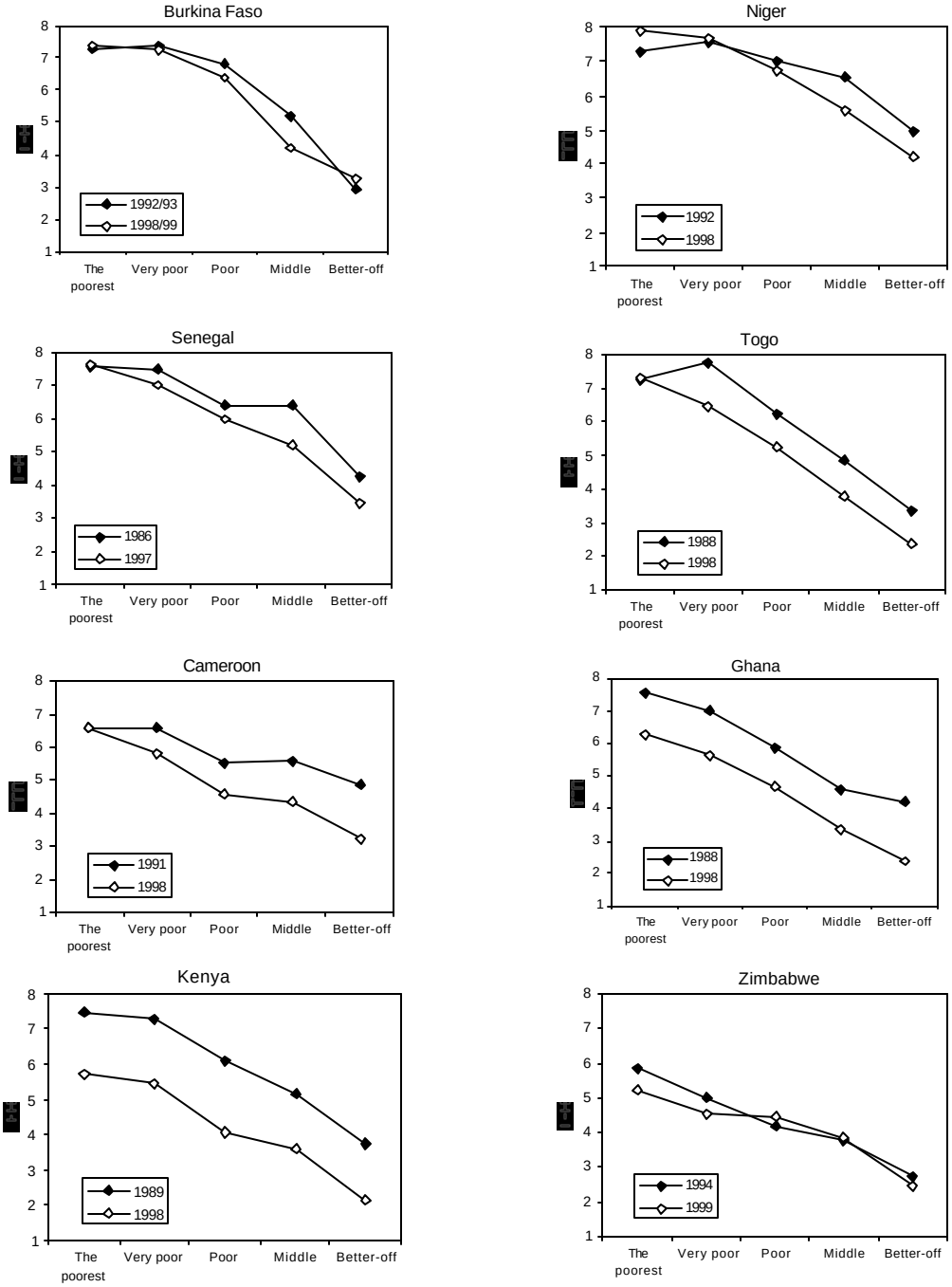

Figure 9. Changes in the Bongaarts contraception and marriage indices by economic status in eight Sub-Saharan African countries, 1980s and 1990s.

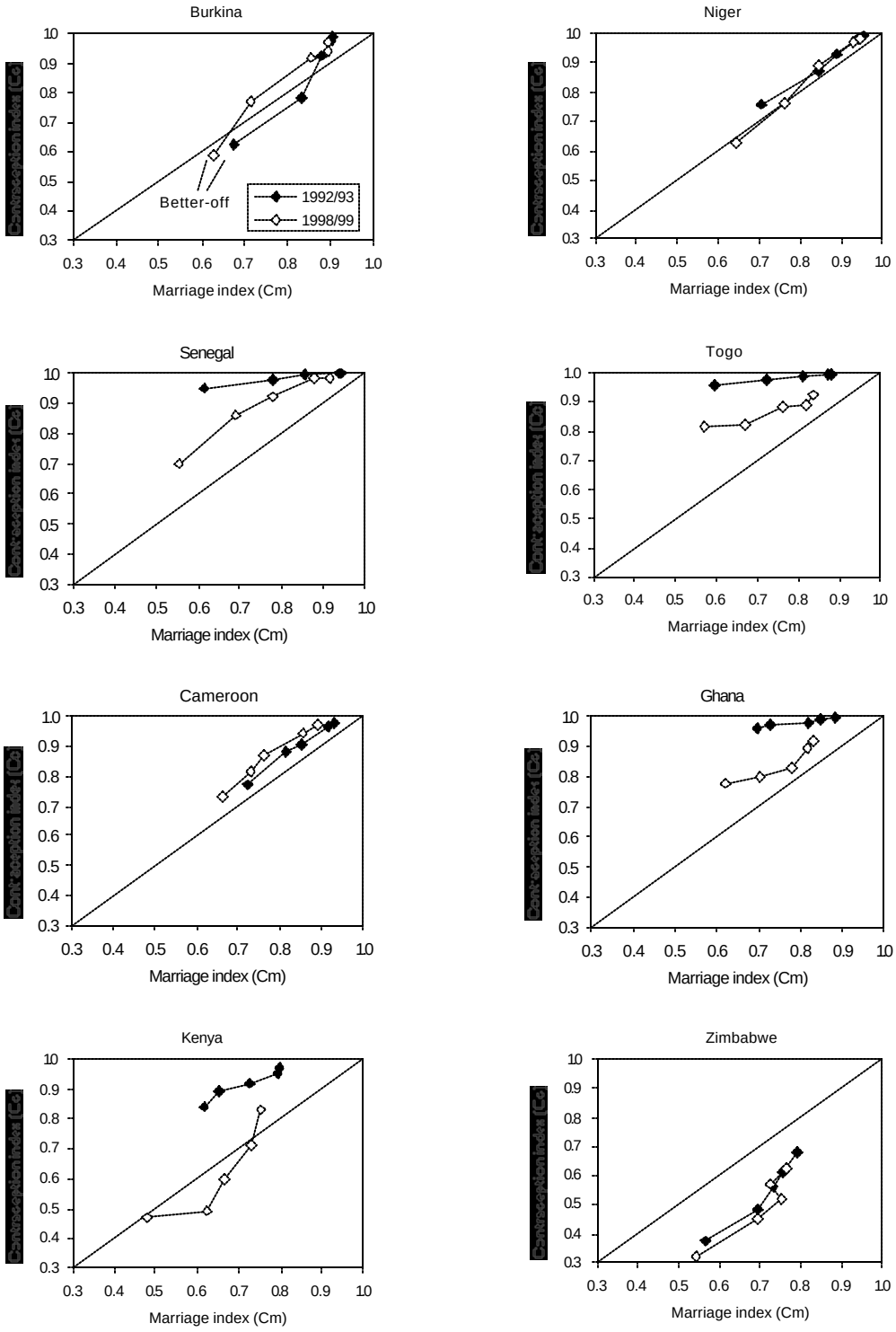

Figure annex 1: Relationships between economic status and fertility in 25 Sub-Saharan African countries.

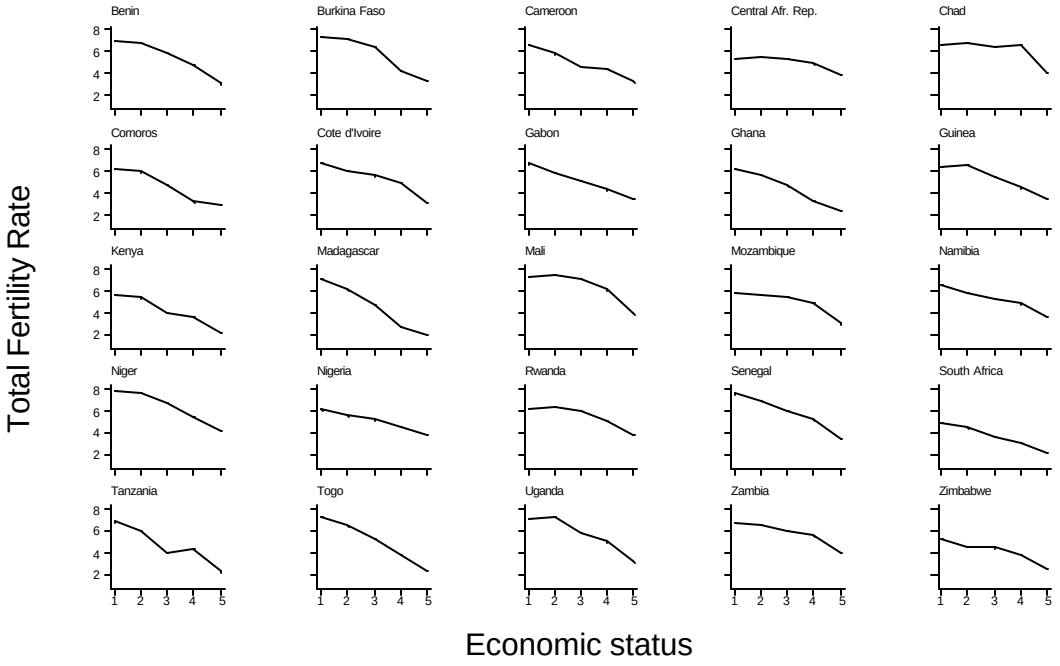

Figure annex 2. Relationships between economic status and contraceptive use in 25 Sub-Saharan African countries.

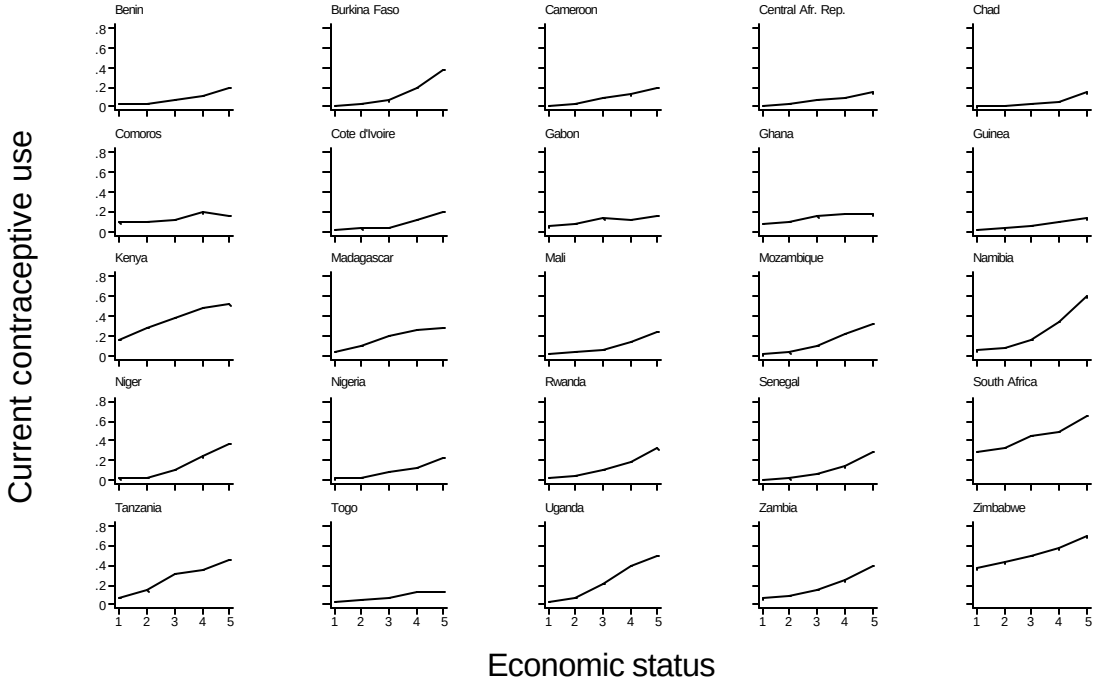

Figure annex 3. Relationships between economic status and age at marriage in 25 Sub-Saharan African countries.