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PREFACE

In December 2009, the Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat convened an Expert Group Meeting on Recent and Future Trends in Fertility at United Nations Headquarters in New York. The purpose of the meeting was to discuss recent changes in fertility trends in the major regions of the world and in selected countries as well as their determinants. Such a discussion set the stage for the consideration of a new approach to the projection of fertility in the preparation of the official United Nations population projections.

The meeting took place from 2 to 4 December 2009. Its agenda and list of participants can be found on the website of the Population Division (www.unpopulation.org). The papers prepared by experts participating in the meeting will be issued as part of the newly launched Expert Paper series available as downloadable PDF files and accessible on the Population Division website (www.unpopulation.org).

This paper describes the range of fertility transitions taking place across sub-Saharan African countries and changes in the proximate determinants of fertility (i.e., contraceptive use and method mix, union patterns, postpartum insusceptibility and abortion). Using the demographic computer application FamPlan, the impact of the proximate determinants on the future course of fertility is examined for Burkina Faso, Ghana, Niger and Nigeria. The paper also shows the degree to which high, medium and low fertility variants in population projections reflect the trends observed for the proximate determinants of fertility.

The Expert Paper series aims at providing access to government officials, the research community, non-governmental organizations, international organizations and the general public to overviews by experts on key demographic issues. The papers included in the series will mainly be those presented at Expert Group Meetings organized by the Population Division on the different areas of its competence, including fertility, mortality, migration, urbanization and population distribution, population estimates and projections, population and development, and population policy.

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INTRODUCTION

The revision of the United Nations population projections for all countries of the world every two years is a complex process that involves incorporating new data and analyses and formulating assumptions about changes in each population component (i.e., mortality, fertility and international migration) (United Nations, 2009a). For sub-Saharan African countries, making population projections is further complicated for three main reasons. First, the quality of available data is often poor. The absence of a complete civil registration system in most countries means that fertility and mortality trends have to be estimated from survey and census data of varying quality. Second, the HIV and AIDS epidemic has had varying impacts on mortality and fertility in countries across the region. Third, the fertility declines that started in many sub-Saharan African countries in the 1980s are diverse, with stalls and reversals, and in other countries the fertility transition is still in an early phase (Schoumaker, 2008).

According to United Nations estimates (United Nations, 2009b), all sub-Saharan African countries but one were considered either high-fertility countries (with no fertility reduction or only an incipient decline until 2010) or medium-fertility countries (with declining fertility but a fertility level still well above 2.1 children per woman in 2005-2010). Nearly half of the sub-Saharan African countries (23 out of 49) had an estimated fertility level above five children per woman, about one-quarter of countries (13 countries) had an estimated fertility level between four and less than five children per woman, and another quarter (12 countries) had a fertility level between 2.1 and less than four children per woman. Only one country, Mauritius, with a total fertility of 1.8 children per woman in 2005-2010, could be classified as a low-fertility country (i.e., with a total fertility at or below 2.1 children per woman).

What are the prospects of future population growth for these countries given that growth will depend primarily on future fertility declines? In *World Population Prospects: The 2008 Revision* (United Nations, 2009b), the medium-fertility assumption is that fertility in all countries will converge eventually toward a level of 1.85 children per woman. However, not all countries will reach this level during the projection period, that is, by 2045-2050. Under the medium-fertility assumption, fertility in high- and medium-fertility countries is assumed to follow a path derived from models of fertility decline established by the United Nations Population Division on the basis of the past experience of all countries with declining fertility during 1950-2010. The high-fertility and low-fertility scenarios assume that, during most of the projection time period, total fertility would be consistently 0.5 children higher or 0.5 children lower than the fertility level of the medium variant, respectively, and these scenarios highlight uncertainties about future fertility trends. Under the low-fertility assumption, 39 sub-Saharan African countries (or three out of four countries) are projected by 2045-2050 to have fertility at or below 2.1 children per woman, and only one country is projected to have a fertility level of more than three children per woman. By contrast, under the high-fertility assumption, no country is projected to have fertility below 2.1 children per woman by 2045-2050, and 16 countries have a projected fertility level of more than three children per woman. These results point to the considerable variation that population projections can have for the region.

The fertility transition will continue to be somewhat unpredictable in sub-Saharan Africa. The future pace of fertility decline will vary from one country to another depending on the levels of development achieved and socio-economic factors such as levels of education, female employment and urbanization. The pace of fertility decline will depend also on the interplay of the “proximate” determinants of fertility, since these determinants constitute the mechanisms through which the reduction of fertility is achieved. Given the amount of data available in sub-Saharan Africa on the proximate determinants through successive surveys and the direct effects these determinants have

on the pace of fertility decline, this paper focuses on the proximate determinants of fertility and explores their role in projections of fertility levels.

The paper will first review the diversity among the fertility transitions in sub-Saharan African countries and then review the existing data on the "proximate" determinants of fertility, namely union patterns, postpartum insusceptibility and levels and trends of contraceptive prevalence. Next, the paper will focus on four countries: Burkina Faso, Ghana, Niger and Nigeria. With estimated total fertility levels for 2005-2010 of 3.8 children per woman in Ghana, 5.3 in Nigeria, 6.0 in Burkina Faso and 7.2 in Niger (United Nations, 2009b), these countries were selected because they were representative of the diversity of the fertility declines observed recently in sub-Saharan Africa, despite the fact they are all located in Western Africa (see table 1). The paper will examine for these countries the consistency between the fertility assumptions made in the 2008 revision of *World Population Prospects* and possible future values of the proximate determinants of fertility. Alternative projections of fertility based on these future values have also been made for those countries. Finally, the paper discusses different options regarding the formulation of assumptions on future fertility trends for the elaboration of population projections.

A. THE DIVERSITY OF THE FERTILITY TRANSITIONS IN SUB-SAHARAN AFRICA

Evidence of fertility decline in several sub-Saharan African countries became clear in the 1980s, with a 20-year lag compared to what had been observed in Asia, Latin America and the Caribbean. It was assumed at that time that the fertility decline in sub-Saharan Africa would catch up with the rapid fertility declines observed elsewhere in developing countries. However, the assumption made in the United Nations population projections up to the 1990s, namely that all countries of the world, including sub-Saharan African countries, would converge to 2.1 children per woman before the year 2050 proved to be too simplistic. The "paradigm" of 2.1 children per woman before the year 2050 for all countries was thus abandoned, and the countries of the world were classified as high-fertility countries, medium-fertility countries or low-fertility countries and new specific procedures of projecting future fertility levels were elaborated for each group.

Some 30 years after the onset of the fertility decline in sub-Saharan Africa, what evaluation can be made about fertility declines in the various countries of the sub-Saharan region? Such an assessment can be made by using the retrospective projections, i.e. 1950-2010, which are incorporated in the United Nations projections (United Nations, 2009b). When looking at the evolution of fertility between 1975-1980, which generally corresponds to the observed maximum of fertility in the region, and 2005-2010, four different types of fertility transitions emerge (table 1).

The first type corresponds to an "early transition" that started in the 1960s. It only pertains to three countries with a relatively high per capita income and where fertility is lower than three children per woman for the 2005-2010 period. These countries are: South Africa, Mauritius and Reunion.

The second type corresponds to "a recent and well-under-way transition", with a significant decrease in fertility of about three or four children per woman during the last 30 years. It pertains to 10 countries, where fertility is estimated in 2005-2010 between three and four children per woman (exceptions are Côte d'Ivoire at 4.5 and the Comoros at 4.3) compared to six or seven children per woman at the end of the 1970s. These countries are (by magnitude of fertility decline): Zimbabwe, Botswana, Namibia, Cape Verde, Swaziland, Côte d'Ivoire, Djibouti, Ghana, Comoros and Sao Tome and Principe. A majority of these countries are small in size or have relatively small

populations, half of them have a mostly urban population, and many have experienced important migratory movements (either emigration or immigration).

These two types of fertility transition countries represent only 14 per cent of the population of the region. The countries which have experienced an early transition represent only six per cent of the total population of sub-Saharan Africa, and the countries which have experienced a recent and regular fertility transition, eight per cent.

The third type of fertility transition corresponds to "a rather slow and irregular transition," with a fertility decrease of -2.6 to -1.6 children per woman since the end of the 1970s, with a few stagnations in the decreases that were observed earlier. This type corresponds to 19 out of 48 countries (or 40 per cent of countries) where fertility is estimated in 2005-2010 close to or above five children per woman, compared to six to eight children at the end of the 1970s (except for Lesotho and Gabon where fertility was lower than six children per woman in the 1970s and is estimated in 2005-2010 at about three children). Listed by decreasing magnitude of fertility decline, these countries are: Kenya, Rwanda, Lesotho, Senegal, Togo, Sudan, Zambia, Cameroon, Mauritania, Malawi, Gabon, The Gambia, Madagascar, Congo, Burkina Faso, Benin, Nigeria, Tanzania and Guinea. In the majority of these countries, over half of the population lives in rural areas. Half of the Western African countries (coastal countries) and half of the Middle African countries belong to this group compared with only a third of the Eastern African countries.

The fourth and last type of fertility transition corresponds to "a very slow or incipient transition," with no fertility decline or a decline of up to -1.5 children per woman in 30 years. This very slow or incipient fertility transition characterizes 16 countries. Eleven of these countries had in 2005-2010 total fertility levels ranging 7.2 to 6.0 children per woman and they are (listed by decreasing level of total fertility): Niger, Guinea-Bissau, Liberia, Burundi, Democratic Republic of the Congo, Mali, Uganda, Sierra Leone, Angola, Chad and Somalia. Five countries with this last type of fertility transition had in 2005-2010 total fertility levels ranging from 5.4 to 4.6 children per woman (listed by decreasing level of total fertility): Equatorial Guinea, Ethiopia, Eritrea, Mozambique and Central African Republic. Most of these countries are landlocked, have low levels of urbanization and several of them have experienced war or civil strife. Among all 16 countries, five are in Western Africa, five are in Middle Africa and six are in Eastern Africa (countries located in the Horn of Africa or on high plateaus) (see figure 1).

Countries with the last two types of fertility transition account for about 85 per cent of the population of sub-Saharan Africa. The 19 countries with a rather slow and irregular transition account for 50 per cent of the population of sub-Saharan Africa, and the 16 countries with a very slow or incipient transition account for 35 per cent of the population.

From this review, the fertility transition in sub-Saharan Africa, which is now spanning at least 30 years, is slow and uneven and the result of varying levels of development and other factors. Many of the countries characterized by a very slow or incipient transition are landlocked countries or countries that have experienced prolonged conflicts and civil wars. Examining the various values and evolution of the proximate determinants of fertility provides a more in-depth understanding of these different types of fertility transitions in sub-Saharan Africa.

B. THE RECENT EVOLUTION OF THE PROXIMATE DETERMINANTS OF FERTILITY

Numerous surveys on fertility and contraceptive prevalence have been undertaken in sub-Saharan African countries since the late 1970s. They include those implemented under the World Fertility Survey programme (WFS), Contraceptive Prevalence Surveys (CPS), the Demographic and Health Surveys (DHS) and the Multiple Indicator Cluster Surveys (MICS). The Demographic and Health Surveys provide data on the proximate determinants of fertility included in the Bongaarts model, except abortion (Bongaarts, 1978). The proximate determinants are the percentage of women of reproductive age who are in union, the mean duration of postpartum insusceptibility (PPI), the contraceptive prevalence among women in union of reproductive age (15 to 49) and the associated method mix, and the percentage of childless women at ages 45 to 49, as a proxy for sterility. The other surveys generally provide data on only two determinants: the percentage of women in union and contraceptive prevalence.

1. *Percentage* of *women of reproductive age in union*

Data on the percentage of women in union (those married plus those living together) are available for 37 sub-Saharan African countries from the Demographic and Health Surveys (DHS) undertaken mostly between 2000 and 2008-2009. These data have been organized by sub-regions and by the percentage of women in union (table 2 and figure 2).

At least 50 per cent of the women aged 15 to 49 are in union in all but four countries in Southern Africa. Women aged 15 to 49 in union are defined in the surveys as those who indicated that they were married or living with a partner (i.e., "living together"). In three countries of Middle Africa (Central African Republic, Congo and Gabon) the percentages of women who reported to be living with a partner are higher than the percentages of women who reported to be married, and in Central African Republic and Mozambique a majority of women (55 per cent) reported to be living with a partner. The percentage of women in union is between 60 per cent and 80 per cent in Western Africa, Middle Africa and Eastern Africa, but only between 40 per cent and 50 per cent in Southern Africa. The highest percentages (between 70 per cent and 80 per cent) are mostly in land-locked countries or in Western Africa.

The data from the 16 countries where at least three Demographic and Health Surveys have been conducted indicate a decreasing trend in the percentage of women in union, particularly in Western Africa (table 3). For five out of seven countries in Western Africa and for Cameroon, the decrease in the percentage of women in union ranges between -0.4 to -0.6 percentage points per year between the first and the last survey. Niger registered virtually no decrease, and in Benin the decrease was very small. In four out of the eight Eastern African countries with at least three surveys, decreases in the percentage of women in union range between -0.3 to -0.4 percentage points per year. Surprisingly, an increase was observed in Madagascar, and in the three other countries, the decreases were very small.

To sum up, for the seven countries in Western Africa and Cameroon where at least three Demographic and Health Surveys have been conducted, the un-weighted average of the differences in the percentages of women in union between the first and the most recent survey stands at -0.39 percentage points per year. For the eight Eastern African countries for which similar data are available, the un-weighted average is also negative but more modest at -0.09 percentage points per year. Of the 16 countries examined, 10 registered yearly decreases between -0.26 (Uganda) and -0.63 (Burkina Faso). This decreasing trend in the percentage of women of reproductive age in union in these countries is likely related to urbanisation and increases in education levels of women.

2. *The duration of postpartum insusceptibility (PPI)*

A longer duration of postpartum insusceptibility (PPI) has a lowering effect on fertility (Bongaarts, 1978). Data on mean duration of postpartum insusceptibility—or the mean number of months since a woman's last birth when her menstrual period has not resumed or she has not resumed sexual intercourse—are also available from relatively recent surveys for 37 sub-Saharan African countries. These data have been organized by sub-regions and by the decreasing ranking of mean durations of postpartum insusceptibility (table 4 and figure 3).

The mean duration of postpartum insusceptibility is quite long in all countries, compared to what is observed in other developing countries in Asia and Latin America. This reflects primarily the long periods of breastfeeding in the region that also have a lowering effect on fertility (Bongaarts, 1978). The mean duration of postpartum insusceptibility varies between 15 and 20 months in a majority of countries. The highest values, above 20 months, are observed in Guinea and Burkina Faso, and the lowest values, between 11 and 13 months, are observed in Mauritania, Gabon, Madagascar and the Comoros.

Trend data for the 16 countries with multiple DHS survey results indicate a slightly decreasing trend in the mean duration of postpartum insusceptibility, particularly in West Africa (table 5). The decrease is between -0.1 to -0.3 months per year between the first and the last survey for six out of the seven countries in Western Africa and for Cameroon, and for three out of the eight Eastern African countries. There has been virtually no change in the other four Eastern African countries while, in Zimbabwe, a slight increase occurred (0.1 months per year).

Overall, for the seven countries in Western Africa and Cameroon where at least three Demographic and Health Surveys have been conducted, the un-weighted average of the differences in months in the mean duration of postpartum insusceptibility between the first and the most recent survey stands at -0.18 months per year. For the eight Eastern African countries for which similar data are available, the un-weighted average is also negative but smaller in magnitude at -0.06 months per year. Out of the 16 countries examined, 10 registered yearly decreases between -0.10 months per year (Mali) and -0.32 months per year (Benin and Nigeria).

This decline in the length of post-partum insusceptibility diminishes the lowering effect on fertility (through the reduction of birth intervals) of the presently long periods of breastfeeding often associated with postpartum abstinence. It has generally been assumed that during the fertility transition this effect was compensated by the negative effect on fertility of the decrease in the percentage of women in union (United Nations, 2000). Globally, this assumption is certainly correct, but it is not necessarily verified in all countries at all stages of their fertility transition and should be better documented.

3. *Contraceptive use and method mix*

Data are available on the levels of contraceptive use (whether modern or traditional, folk or other methods) in sub-Saharan Africa for 46 countries, almost representing the entire population of the region (MEASURE DHS, 2009; United Nations, 2009c; MICS-3, 2006). These data are recent, since in 29 countries (or two-thirds of countries with data) they pertain to surveys conducted between 2004 and 2009. There are only seven countries where the most recent survey was implemented before 2000 (between 1995 and 1999 for the Central African Republic, Comoros, Côte d'Ivoire and South Africa, and in 1991 for Mauritius, 1990 for Sudan and 1988 for Bostwana). The average reference period of these surveys (weighted average) is 2006 for Western Africa, 2005 for Eastern Africa, 2005 for Middle Africa and 1998 for Southern Africa.

The quality of data on the use of modern methods is considered better than the data on the use of traditional, folk and other methods. The effectiveness of the latter methods is low, and data on their use is not always collected and reported accurately. As a result, the quality of the data on the levels of use of traditional, folk and other methods varies according to countries and from one survey to the other. This explains why results by countries have been classified by sub-region and by increasing order of the use of modern methods according to the most recent available data and not by increasing order of use of any method (table 6, figure 4).

Women who report using breastfeeding as a contraceptive method (often called "MAMA" and considered as a modern method) have been excluded from the analysis here for two reasons. First, not all surveys consider breastfeeding or MAMA as a contraceptive method. Second, for the other surveys, the reported percentage of women using breastfeeding as a contraceptive method varies from near zero to about five per cent. Therefore, for the purpose of comparison and accuracy of the data used, it was deemed preferable to exclude breastfeeding from the analysis.

The use of modern contraception in Western Africa and Middle Africa is still quite low. In Western Africa, the percentage of women in union who were using a modern method was around 15 per cent in only two countries: Ghana and Burkina Faso (an exception is Cape Verde, where contraceptive prevalence reached 57 per cent in the most recent survey). No more than 10 per cent of women in union were using a modern method in all other countries in Western Africa. In Middle Africa, use of a modern method was at most around 12 per cent (with the exception of Sao Tome and Principe, where it reached 27 per cent). In Eastern Africa, modern method use was somewhat higher, albeit with stark contrasts due to the heterogeneous nature of this sub-region. Contraceptive prevalence rates for modern methods was above or close to 50 per cent in only two countries (Zimbabwe and Mauritius) and between 25 and 40 per cent in five countries, namely Madagascar, Malawi and Kenya, Rwanda and Zambia. In the remaining nine countries, use of modern methods usually averaged between 10 per cent and 20 per cent. By contrast, in Southern Africa, contraceptive prevalence rates for modern methods were relatively high in all countries and averaged between 32 per cent and 55 per cent. It is worth noting that percentage of women in union who use modern contraception was particularly low (no more than five per cent) in Angola, Chad, Central African Republic, Mauritania, Niger and Somalia.

Despite the varying quality of the data on the use of traditional, folk and other methods, it is worth looking at the levels of contraceptive use of any method (i.e., modern plus traditional, folk and other methods). In countries where reported use of traditional, folk and other methods is high, level of contraceptive use for any method is logically higher than the level of contraceptive use for modern methods only. In Middle Africa, where the use of traditional method was high (with the exception of Sao Tome and Principe), contraceptive prevalence for any method exceeded 20 per cent in the Cameroon, Congo, Democratic Republic of the Congo and Gabon. In five Middle African countries, the level of traditional method use was even higher than the use of modern methods.

In Western Africa, the use of traditional methods was far from negligible in most countries, but more women reported using these methods than modern methods in only four countries: Benin, Côte d'Ivoire, Niger and Togo. However, when considering the use of any contraceptive methods, only two countries (Ghana and Togo) reached a contraceptive prevalence rate for any method above 20 per cent (in addition to Cape Verde). In Eastern Africa, the reported use of traditional methods as a percentage of all methods used varies from more than 90 per cent in Somalia to about five per cent in Ethiopia, Djibouti and Zimbabwe. The special case of Mauritius is worth mentioning. When taking into account traditional methods, which represent one third of all methods used, Mauritius

stands as the sub-Saharan African country with the highest level of contraceptive prevalence at 75 per cent (and also associated with the lowest total fertility of 1.9 children per woman in 2005-2010). In Southern Africa, where contraceptive prevalence rates are higher than in the other sub-regions, reported use of traditional methods is low everywhere and represents only two to six per cent of all the methods used.

Overall, by the middle of the 2000s contraceptive prevalence rates for modern methods in most sub-Saharan African countries were less than 20 per cent (in 32 out of 46 countries), representing 82 per cent of the population in the region, and less than 30 per cent in 37 countries, representing 91 per cent of the population in the region. Taking into account the whole range of contraceptive methods used, utilization rates were lower than 20 per cent in half of the countries (23 countries), representing over 60 per cent of the population in the region, and lower than 30 per cent in 31 countries, representing 80 per cent of the population. By comparison, around 2000, contraceptive prevalence rates for any method were above 50 per cent in more than half of the countries in Asia and Latin America and the Caribbean. In Asia, only five countries had rates lower than 20 per cent and no country in Latin American and the Caribbean was at this level (Guengant and Rafalimanana, 2005). Moreover, these low levels of contraceptive use (the main factor behind fertility decline) in sub-Saharan African countries representing 80 percent of the population of the region are consistent with the slow or incipient fertility transitions characterizing three out of four countries in the region, representing 85 per cent of the population.

4. *Slow increase of contraceptive use*

Among the 46 countries with data on recent levels of contraceptive use, 37 countries, representing more than 95 per cent of the population of sub-Saharan Africa, have comparable data from at least one previous survey to enable measurement of change over time in contraceptive use. The average duration of time (weighted) between the first available surveys and the most recent ones is 25 years for Western Africa, 22 years for Southern Africa, 18 years for Eastern Africa and 14 years for Middle Africa. The difference between the levels of contraceptive use between the more recent survey and the older one divided by the number of years between the two surveys gives the “average annual percentage point of increase in contraceptive prevalence”. Average annual percentage points of increase were calculated for each country for modern methods and for any method (see table 7). The results obtained for those countries with a minimum span of 10 years between the two surveys considered (31 countries) are also presented by sub-region, by increasing order of the average annual increase for modern methods (figure 5).

The annual average increase in the use of modern contraceptive methods was particularly low in Western and Middle Africa, where it reached no more than 0.5 points per year. The highest increase was recorded for Burkina Faso at 0.7 points per year from the 1992-1993 DHS to the 2006 Burkina Faso MICS survey, though the methodology of each survey is not similar and this may have affected the results (MICS-3, 2006). The next highest average annual increases were in Ghana (0.5 points per year between 1979-1980 and 2008) and Cameroon (0.5 points per year between 1978 and 2004). The result for the Central African Republic (0.6 points per year between 1994-95 and 2000) is not necessarily representative of a trend since there is a mere six-year span between the two surveys considered. In Eastern Africa, increases are around or above one percentage point per year in most countries. Among the countries with a minimum span of 10 years between the two surveys considered, the highest increase in the use of modern contraceptive methods is the one registered for Zimbabwe, with an astounding average of two percentage points increase per year between 1979 and 2005-2006 (or over 27 years). Next are the average increases observed in Madagascar (1.4 percentage point increase per year between 1992 and 2008-2009) and Malawi (1.3 percentage points increase per year between 1984 and 2004). The large average annual

increases observed for the Comoros and Mozambique relate to short periods of time and need to be confirmed by future surveys. In Southern Africa, increases in the use of modern contraceptive methods are between 0.5 points per year for Swaziland and 1.9 points per year for Namibia. The 1.3 point increase per year observed for Botswana between 1984 and 2000 is also worth noting. Weighted averages (data not shown) in the increase of modern contraceptive methods reach 0.3 points per year over an average period of 25 years in Western Africa, 0.2 points per year for an average period of 14 years in Middle Africa, 1.2 points per year over an average period of 18 years in Eastern Africa and 0.9 points per year for an average period of 22 years in Southern Africa.

While the quality of the responses and data on the use of traditional, folk and other methods vary from one survey to another and among countries, the available data show that in most countries the levels of use of these methods have not varied much over time or are declining. Indeed, these levels are more or less the same or have decreased over time in 24 of 37 countries. This evolution means that most of the increases in contraceptive use are the result of increases in the use of modern methods or are attributable to the transition from traditional and folk methods that are less effective in preventing pregnancy to modern methods that are more effective in preventing pregnancy. Therefore, for most countries, the increase in the use of any contraceptive method is often close to the increase in the use of modern methods, or it is lower when the increase in the use of modern methods leads to the abandonment of traditional methods (or to an underreporting of the use of these methods, compared to previous surveys).

Among the countries with a minimum span of 10 years between the two surveys, reported use of traditional methods increased noticeably in only a few countries such as the Democratic Republic of the Congo and Mauritius (0.6 percentage points per year) and Cameroon (0.4 percentage points per year). In three other countries, Côte d'Ivoire, Niger, and Togo, reported increases of use of traditional methods reach 0.3 percentage points per year. These increases lead to higher annual average increases of contraceptive use for any method, but these cases are isolated and mostly limited to countries with low contraceptive prevalence rates. The use of traditional methods may not be negligible in certain contexts, especially when the overall use of contraceptive methods is low. However, it seems that progress in contraceptive use and fertility control happens primarily through the increase in the use of modern methods, often at the expense of the use of traditional methods.

The comparison of the results on contraceptive use in the 16 countries where at least three Demographic and Health Surveys (DHS) are available allow for a more precise assessment of recent trends in contraceptive use, especially in the use of modern methods (table 8). In the seven Western African countries concerned, and Cameroon, increases in the use of modern methods between the most recent survey and the oldest survey vary from 0.2 to 0.7 percentage points per year, yielding an unweighted average of 0.4 percentage points per year. In the eight Eastern African countries with at least three surveys, increases in the use of modern methods vary from 0.9 to 1.7 percentage points per year, yielding an unweighted average of 1.2 percentage points per year. For each period between two consecutive surveys, the values observed reveal for most countries a pattern of ups and downs, perhaps a reflection of uneven or discontinued support to family planning programmes over the past 10 to 20 years.

During the last survey intervals, use of modern methods has decreased or stagnated in three countries, namely Benin, Ghana and Niger. Increases in the use of modern methods were also lower in the last survey interval than in the previous survey intervals in six countries with persistently low contraceptive prevalence rates: Malawi, Mali, Senegal, Tanzania, Uganda and Zambia. This pattern also characterizes Zimbabwe, but this can be considered normal since the contraceptive prevalence rate is already high in Zimbabwe. A recuperation pattern—an increase in use of modern methods in the last survey interval after a decrease or a stall in previous surveys—was observed in Kenya,

Nigeria and Rwanda. In Rwanda, an astounding increase of 6.8 percentage points per year in the use of modern contraception was observed between 2005 and 2007-2008. This is probably the result of an aggressive programme that was able to meet pent-up demand for family planning (May and Kamurase, 2009). However, this result pertains to a short time period and needs to be put into perspective. The average increase in contraceptive prevalence in Rwanda between 2000 and 2007-2008 was 2.9 percentage points per year, and it was 0.9 percentage points per year between 1992 and 2007-2008. In Kenya, after the stall in contraceptive use observed between 1998 and 2003, a 1.3 percentage point increase per year was observed between 2003 and 2008-2009 yielding an average increase of 1.1 percentage points per year between 1989 and 2008-2009. In Nigeria, after the decrease in the use of contraceptive methods reported between 1999 and 2003, a very small recovery in the use of modern methods of 0.3 percentage points per year was observed for the 2003-2008 period, yielding an average increase between 1980 and 2008 of 0.3 percentage points per year.

Only three countries out of the 16 examined appear to have had quite regular and growing increases in use of modern methods over time. The first country is Madagascar, where increases in the use of modern methods shifted from less than 1.0 percentage point per year between 1992 and 1997 to 2.3 percentage points per year between 2003 and 2008-2009. The second country is Burkina Faso, which experienced sharp increases in the use of modern methods from a mere 0.1 percentage points per year in the 1992 and 1998-1999 interval to 1.6 percentage points per year in the last short 2003-2006 interval (this result should be confirmed by the new ongoing DHS survey). Contrary to what happened in Madagascar, the use of traditional methods in Burkina Faso decreased by 0.7 percentage points during the last period, hence an increase in the use of any method of only 0.9 percentage points per year. Cameroon, with only two surveys, is the last country that experienced an increase in the use of modern methods from 0.4 percentage points per year during the first survey interval (1992-1998) to 0.9 percentage points per year during the last survey interval (1998-2004). The case of Ethiopia, where a 1.5 percentage point increase in the use of modern methods has been observed between 2000 and 2005, is also worth mentioning but, as said before for Burkina Faso, this high increase could be considered as exemplary only if it is confirmed over a longer period by a new DHS survey.

These diverse trends point to the uneven and intermittent support of family planning programmes over the past decades. They point also to the need to study increases in the use of contraceptive methods over relatively long periods of time. Increases above two percentage points per year could be achieved through vigorous programmes over short periods of time, especially in countries where previous decreases or stalls occurred or in countries where there is a high level of unmet need for contraception, which is the case in most sub-Saharan African countries. Available data for sub-Saharan Africa, as for developing countries in other regions, indicate that sustained increases of use of contraceptive methods rarely exceed 1.5 percentage points per year during the fertility transition. With such an increase in the contraceptive prevalence rate, the fertility transition can be achieved in about 40 years (Guengant, 2009; Guengant and Rafalimanana, 2005). But the shift from low to high levels of contraceptive use, and the parallel move from high to low levels of fertility, requires a major change within the societies concerned and these processes take time.

Overall, there is a trend toward an increase in the percentage of women using contraceptive methods that varies from about 0.5 percentage points per year to 1.5 percentage points per year in most of the sub-Saharan African countries. There is also an indication that the use of traditional methods is not increasing, but rather stagnating or even decreasing, which means that they represent a declining percentage of all the methods used as the contraceptive prevalence rate increases.

5. *The other proximate determinants*

The proximate determinants for which there is a relatively large amount of available data are those just reviewed: the proportion of women in union, the duration of the period of postpartum insusceptibility and level of contraceptive use and efficacy of the methods used. According to some researchers, the two other proximate determinants—induced abortion and the prevalence of pathological sterility—tend to play a lesser role, except in specific situations (Stover and others, 2006). However, as induced abortion is illegal in most sub-Saharan Africa countries, information about its incidence is difficult to obtain. Some argue that abortion is far from negligible in several sub-Saharan African countries, particularly in urban areas (Guttmacher Institute, 2009). Available data for developing countries are usually derived from incomplete statistics, surveys or indirect estimates based on hospital data. However, data (of better quality, in principle) are also available from the countries where abortion is legal.

The compilation made by the Alan Guttmacher Institute in 1997 for 66 countries, including 23 developing countries, reveals very different total abortion rates (as cited in Stover and others, 2006). In the 1990s, total abortion rates (i.e., the average number of induced abortions per woman) were estimated for South Africa and Bangladesh at around 0.1, and the rate estimated for Tunisia was 0.3. Total abortion rates given for developed countries generally ranged from 0.2 to 0.7 induced abortions per woman (e.g., 0.5 for Hong Kong and Singapore and 0.6 for the Republic of Korea). Abortion rates ranged from 0.8 to more 2.0 per woman in most Eastern European countries (where abortion has long been practiced) and several developing countries. Abortion rates were estimated at around 0.8 for China, Mexico, Mongolia and Turkey, 1.2 for Colombia, 1.3 for Brazil, 1.5 for the Dominican Republic and 1.8 for Peru. The highest rates close to or about 2.5 were those reported for Cuba, the Russian Federation and Vietnam. These diverse rates reflect the very different ways women control their fertility during the fertility transition and even after, since many of the countries studied here have already reached below-replacement fertility.

The most recent review made by the Guttmacher Institute on abortion and unintended pregnancy in Africa at the sub-regional level indicates that the annual number of induced abortions rose between 1995 and 2003, from 5.0 million to 5.6 million for the whole continent (Guttmacher Institute, 2009). Despite the increase in the number of abortions, the annual abortion rate declined between 1995 and 2003 from 33 to 29 abortions per 1,000 women aged 15 to 44. The decline in the rate was a result of the increase in the number of women of childbearing age. The estimated abortion rate in 2003 ranges from 39 per 1,000 women aged 15 to 44 in Eastern Africa to 26-28 per 1,000 women in Middle and Western Africa and 24 per 1,000 women in Southern Africa. Relative to the 31 million births per year estimated for sub-Saharan Africa in the 2008 Revision of *World Population Prospects* during the 2000-2005 period, this estimate corresponds to an abortion ratio of 175 abortions per 1,000 live births, which means that about one pregnancy out of seven is terminated by an induced abortion.

Despite these figures; most of the projections using a proximate determinants model assume abortion is negligible (i.e., equal to zero) either because of the lack reliable data or because many of these projections focus on contraceptive needs. However, it seems advisable to make some assumption about the rate of abortion because the induced abortion rate affects the level of contraceptive prevalence required to reach a given total fertility rate (Stover and others, 2006). In fact, if the abortion rate is set to zero, the levels of contraceptive use needed to reach a given fertility level will be more or less overestimated depending on the importance of abortion.

Concerning sterility, the extent of sterility is measured by the percentage of women who are childless at the end of their reproductive period, assuming that all women in union attempt to have

at least one child. Since natural sterility is not likely to change much, this determinant will have a significant impact on fertility only in societies with high levels of pathological sterility which are associated with significant infertility and subfecundity. This has been observed in certain regions of sub-Saharan Africa, mainly in Middle Africa, where primary and secondary infertility are caused by sexually transmitted infections. Except for these specific situations, the percentages of childless women in union vary depending on the country and on the data source (Demographic and Health Surveys or other surveys or census data). The average percentage of childless women in union calculated from 33 Demographic and Health Surveys undertaken in sub-Saharan African countries in the past 10 years is 2.9 per cent, which can be considered as representative of natural sterility (Stover and others, 2006).

C. Evaluating the impact of the proximate determinants: assumptions for Burkina Faso, Ghana, Niger and Nigeria

Using the data just reviewed, the paper now evaluates the impact of the proximate determinants on the future course of fertility in four sub-Saharan Africa countries by using the FamPlan computer program developed by The Futures Group International (Stover and others, 2006). Based on the Bongaarts model (Bongaarts, 1978; Bongaarts, 1982) and starting from a classic cohort-component demographic projection (Stover and Kirmeyer, 2008), FamPlan enables an evaluation of the interrelationships between total fertility, on the one hand, and the proximate determinants of fertility and average method effectiveness resulting from the method mix, on the other hand. The authors of this paper already conducted a similar exercise for the United Nations Workshop on Prospects for Fertility Decline in High Fertility Countries that took place in New York in July 2001. This previous work was carried out at a sub-regional level for Eastern Africa, Middle Africa and Western Africa (Guengant and May, 2001). One of the authors pursued this exercise for the Expert Group Meeting on Completing the Fertility Transition that took place in New York in March 2002 (Guengant, 2002). Again, the latter exercise was restricted to the sub-regional level and considered eight sub-regions with intermediate fertility levels, namely Northern Africa, Southern Africa, South-central Asia, South-eastern Asia, Western Asia, the Caribbean, Central America and South America.

Conducting this exercise at the country level is useful since it refers to national situations and avoids the challenge of proximate determinant values from heterogeneous countries compensating for one another at the sub-regional level, although geographic areas within countries are not homogenous either.

Burkina Faso, Ghana, Niger and Nigeria were selected for this exercise for several reasons. First, they represent three different types of fertility transitions in sub-Saharan Africa. Ghana represents the “recent and well-under-way transition” group of countries, with a significant decrease in fertility of about three or four children per woman during the last thirty years. Benin and Nigeria represent countries undergoing “a rather slow and irregular transition,” with a fertility decrease of 2.6 to 1.6 children per woman since the end of the 1970s. Niger represents the group characterized by “a very slow or incipient transition,” with no fertility decline or a decline of up to 1.5 children per woman in 30 years. Second, these four countries have had different histories in the formulation and implementation of population and reproductive health programmes. Ghana adopted a population policy very early, in 1969, and launched a National Family Planning Programme in 1970. Nigeria adopted a national policy on population for development in 1988 and established a National Population Commission the same year. Burkina Faso and Niger adopted their first national population policies in 1991 and 1992, respectively. Third, although these four countries belong to the same sub-region, namely Western Africa, two of them are coastal countries and Anglophone

and two are landlocked countries and Francophone. Fourth, the four countries exhibit different levels of fertility (from 4.2 children per woman in Ghana to seven children per woman in Niger).

The initial values in 2010 of each parameter needed for running the FamPlan model are presented in table 9. These values were estimated by extrapolating the last value given by the most recent survey (2006 for Burkina Faso and Niger, and 2008 for Ghana and Nigeria). Various assumptions were then made and tested. Three variants concerning the increase of contraceptive use and two assumptions for each of the other parameters (the method mix and the other proximate determinants of fertility) were retained: one assuming a constant value and another assuming that the trends identified through the analysis of data presented above will continue (except for sterility). Some of the assumptions presented below may be deemed simplistic or arbitrary. However, the objective of this exercise is to evaluate the interplay of the various factors in shaping the future fertility levels and not to produce another set of projections. The following set of assumptions was retained:

1. *Annual percentage point increases in contraceptive prevalence assumptions*

a. 0.5 percentage point increase per year, maintained constant over the 2010-2050 period;

b. 1.0 percentage point increase per year, maintained constant over the 2010-2050 period;

c. 1.5 percentage points increase per year, maintained constant over the 2000-2030 period, decreasing thereafter to avoid reaching contraceptive prevalence rates higher than the highest rates observed presently in many developing and developed countries (i.e., around or higher than 75 percent).

2. *Method mix assumptions*

a. Constant method mix assumption:

For each country the initial method mix (see table 9) was maintained constant over the 2010-2050 period.

b. More efficient method mix assumption:

For each country, it was assumed that the percentage of traditional methods used will decrease to 10 per cent of all methods by year 2050. This corresponds to a shift to a more efficient method mix, from an average efficiency in 2010 varying from 70 per cent to 80 per cent (except for Burkina Faso where it was higher) to an average efficiency in 2050 of about 90 per cent. This assumption also corresponds to small changes in the percentage of women using traditional methods, which remains between 3 per cent and 7 per cent between 2010 and 2050.

3. *Percentage of women in union assumptions*

a. Constant percentage of women in union assumption:

For each country the initial percentage of women in union was maintained constant over the 2010-2050 period.

b. Reduced percentage of women in union assumption:

For each country, it was assumed that the initial percentage of women in union will decrease, but never drop below 50 per cent. The assumptions on the percentage point decrease in the percentage of women in union are as follows: -0.5 points per year for Burkina Faso; -0.3 points per year up to 2020 and less thereafter for Ghana; -0.25 points per year for Niger; and -0.4 points per year for Nigeria. Such decreases lead to the following percentages of women in union by 2050: 53.3 per cent for Burkina Faso, 50.5 per cent for Ghana, 75.1 per cent for Niger and 53.8 per cent for Nigeria.

4. *Postpartum insusceptibility assumptions*

a. Constant duration of postpartum insusceptibility assumption:

For each country, the initial mean duration of postpartum insusceptibility was maintained constant over the 2010-2050 period.

b. Reduced duration of postpartum insusceptibility assumption:

For each country, it was assumed that the initial mean duration of postpartum insusceptibility will decrease, but never drop below 10 months. The assumptions on the percentage point decrease in the mean duration of postpartum insusceptibility are as follows: -0.2 points per year for Burkina Faso; -0.2 points per year up to 2020 and less thereafter for Ghana; -0.1 points per year for Niger; and -0.1 points per year for Nigeria. Such decreases lead to the following mean duration of postpartum insusceptibility by 2050: 11 months for Burkina Faso, 10.4 months for Ghana, 12 months for Niger and 10.4 months for Nigeria.

5. *Total abortion rate assumptions*

a. Negligible abortion assumption:

For each country, the total abortion rate was maintained at zero over the 2010-2050 period.

b. Moderate abortion assumption:

For each country, the total abortion rate was assumed to be 0.5 per woman and maintained constant at this value over the 2010-2050 period.

6. *Sterility*

For each country, the average percentage of women in union who were childless was maintained constant at three per cent over the 2010-2050 period.

D. Implied contraceptive prevalence rates associated with the United Nations fertility variants for Burkina Faso, Ghana, Niger and Nigeria

The analysis first evaluates the contraceptive prevalence required between 2010 and 2050 to reach each of the three 2050 United Nations fertility variants—low, medium and high—as proposed in the 2008 revision of the population projections made for these four countries. In this

case, the dependent variable is the level of contraceptive use, according to the various assumptions made about the future method mix and the values of the other proximate determinants

The United Nations fertility variants include implicitly all the changes in the various factors affecting the future course of fertility. Therefore, we assumed that the three United Nations variants implicitly included changes in the method mix, the percentage of women in union and the mean duration of postpartum insusceptibility (and possibly the recourse to abortion, but as discussed earlier this is difficult to assess). Therefore, in order to evaluate the contraceptive prevalence rates required to match the fertility variants projected by the United Nations in 2008 for Burkina Faso, Ghana, Niger and Nigeria, we ran the FamPlan model with the change in assumptions presented above for the method mix, the percentage of women in union and the mean duration of postpartum insusceptibility. The results obtained are presented in table 10.

First, by 2050 the contraceptive prevalence rates associated with the United Nations medium fertility variant range from 55 per cent to 60 per cent in the four countries. This corresponds to an increase of more than one percentage point per year up to 2020-2025 at least. As seen before, such increases are above the increases observed in recent years for these four countries, particularly for Niger and Nigeria. Indeed, the implied increase in the contraceptive prevalence rate associated with the United Nations medium variant of fertility is one percentage point per year between 2010 and 2050 for Niger, whereas the average increase observed between 1992 and 2006 was 0.5 percentage points per year for all methods. In Nigeria, the implied increase in the contraceptive prevalence rate associated with the United Nations medium fertility variant is two percentage points per year between 2010 and 2020, whereas the average increase observed between 1981-1982 and 2008 was 0.4 percentage points per year for all methods and remained at 0.4 percentage points per year between 2003 and 2008.

The low fertility variant for the first ten years of projections (2010-2015 and 2015-2020) for the four countries corresponds with increases in contraceptive prevalence between 1.5 percentage points per year (Niger) and 2.5 percentage points per year (Nigeria), well above the percentage point increases observed in recent years.

Only for the first five year period of projections (2010-2015) does the high fertility variant correspond with an increase in contraceptive prevalence close to what has been observed in the countries in recent years, except for Nigeria where the implied increase in contraceptive prevalence for 2010-2015 reaches 1.2 percentage points per year (versus 0.4 percentage points observed recently in the country). The United Nations high fertility variant assumes an acceleration in the increase of the contraceptive prevalence rate up to the year 2030 or 2035, followed by a deceleration, which is logical since it is assumed under the high variant that the fertility transition will be well advanced in 2030 or 2035 in the four countries.

What is to be concluded from this exercise? First, it should be kept in mind that each county is unique and that the paths of the fertility transition can vary substantially from one country to another. Second, abortion has not been included in the simulations presented here and may play an important role in the fertility transitions of these countries. Third, the high or accelerating increases in the contraceptive prevalence rates that are associated with the three United Nations fertility variants at the beginning of the projection period (even with the high fertility variant) are not certain to occur in the present sub-Saharan African context.

E. Alternative projection of fertility for Burkina Faso, Ghana, Niger and Nigeria

Alternative projections of fertility were made considering total fertility as a dependent variable of the various proximate determinants. In other words, what could be the levels of fertility associated with different variants of the increase in contraceptive use during the 2010-2050 period, in combination with the various assumptions made on the future method mix and the values of the other proximate determinants?

The level of total fertility can be considered as a dependent variable of the method mix and the proximate determinants, and does not need to be determined a priori or empirically as is usually the case (i.e., by fixing a total fertility rate to be reached at a given horizon or by extrapolating recent trends or assuming that future fertility declines will resemble those observed elsewhere). Furthermore, with the FamPlan program it is possible to estimate the impact of each factor on the future course of fertility. This can be done by combining the three different variants of increases in contraceptive prevalence (0.5, 1.0 and 1.5 percentage point increases per year) along with the constant assumptions and contrasting with the assumptions of changes presented in section C for the method mix, the percentage of women in union, the mean duration of postpartum insusceptibility and the level of abortion. Four scenarios were identified and run for each of the three variants of increases in contraceptive prevalence, which yielded 12 runs for each country.

Scenario A shows the impact of an increase in contraceptive prevalence only and considers for each contraceptive prevalence variant that the method mix, the percentage of women in union and the duration of postpartum insusceptibility remain constant, and abortion is equal to zero (in addition with the unique assumption on sterility).

Scenario B shows the combined impacts of an increase in contraceptive use and a shift to a more efficient method mix, considering for each variant of contraceptive prevalence that the percentage of women in union and the duration of postpartum insusceptibility remain constant and abortion is equal to zero.

Scenario C shows the combined impacts of an increase in contraceptive use, a shift to a more efficient method mix, a reduced percentage of women in union and a reduced duration of postpartum insusceptibility, considering that for each contraceptive prevalence variant abortion is equal to zero.

Scenario D shows the combined impact for each contraceptive prevalence variant of all factors: contraceptive use increase, shift to a more efficient method mix, reduced percentage of women in union, reduced duration of postpartum insusceptibility and a moderate abortion rate.

The total fertility rates obtained for each country for the different variants of increases in contraceptive prevalence and the four scenarios just described are presented in Table 11.

The variant of a 0.5 percentage point increase per year in contraceptive prevalence between 2010 and 2050 can be considered as a low contraceptive use increase variant corresponding to a high fertility variant. Under this variant and scenario A (impact of increase of contraceptive prevalence only), total fertility remains above four children per woman by 2050 in all countries except Ghana. Under scenario B, the use of more efficient methods yields lower total fertility levels than in scenario A, with differences ranging from -0.1 to -0.5 children per woman. Logically, the higher the use of traditional methods in 2010, the larger the reductions in total fertility due to the assumed shift to more modern methods, as in the case of Niger. Next, the difference between the results of scenario B and scenario C shows the combined impact of the assumed declines in the

proportion of women in union and the mean duration of postpartum insusceptibility. The assumption that the impacts of changes in these two determinants usually compensate each other is more or less verified here for Ghana and Niger under the assumptions made for these countries. Yet this is not the case for Burkina Faso and Nigeria, where the combined impacts of these two determinants bring lower levels of fertility than in scenario B. The difference is about -0.3 children per woman in the case of Burkina Faso and -0.5 children per woman in the case of Nigeria. The impact of the assumption of a total abortion rate of 0.5 maintained constant during the entire projection period yields a further decrease in the expected total fertility rates by 2050 of about 0.10 children per woman for all countries.

The variant of a 1.0 percentage point increase per year in contraceptive prevalence between 2010 and 2050 can be considered as a medium contraceptive increase variant corresponding to a medium fertility variant. Under this variant and scenario A, total fertility by 2050 remains above four children per woman in Niger, three children per woman in Burkina Faso and Nigeria and reaches 2.4 children per woman in Ghana. As seen previously, the levels of total fertility by 2050 obtained with scenarios B, C and D are lower than those obtained with scenario A. For Burkina Faso and Ghana, which have the highest contraceptive prevalence rates in 2010, the total fertility rates by 2050 obtained with scenario D are about 0.5 children per woman lower than the ones obtained with scenario A. For Niger and Nigeria, total fertility is around one child per woman lower between scenarios A and D. Under this variant and scenario D, the 2050 total fertility rate obtained for Ghana is below replacement level (1.9 children per woman) but still above replacement for Burkina Faso and Nigeria (2.6 and 2.3 children per woman, respectively) and still higher for Niger (3.6 children per woman).

Last, the variant of a 1.5 percentage point increase per year in contraceptive prevalence at the beginning of the projection period (see above) can be considered as a high contraceptive increase variant corresponding to a low fertility variant. Under this variant and scenario A, total fertility by 2050 remains at around four children per woman in Niger, 2.7 and 2.8 children per woman in Burkina Faso and Nigeria, respectively, and reaches 2.0 children per woman in Ghana. As seen previously, the total fertility rates by 2050 obtained with scenarios B, C and D are lower than those obtained with scenario A. For Burkina Faso and Ghana, the total fertility rates by 2050 obtained with scenario D are again about 0.5 children per woman lower than those obtained with scenario A, and one child per woman lower for Niger and Nigeria. Under this high contraceptive increase variant, the total fertility rates obtained for Ghana by 2050 with scenarios C and D are below replacement level (about 1.7 children per woman, as well as for Nigeria with scenario D (1.9 children per woman)). They are at replacement level with scenario C for Nigeria and with scenario D for Burkina Faso. By contrast, but not surprisingly, the 2050 levels of total fertility obtained for Niger remain still around three children per woman with scenarios C and D.

The comparison between the levels of total fertility in 2050 obtained under the variant 0.5 and 1.5 percentage point increases in contraceptive prevalence reveals important differences from one country to another. First, the total fertility rates obtained under the 0.5 percentage point increase variant appear between 1 to 1.5 children per woman higher than the total fertility rates obtained under the 1.0 percentage point increase variant (about one child per woman more for Ghana and Nigeria, and 1.3 and 1.5 children per woman more for Burkina Faso and Niger, respectively). However, the difference between the total fertility rates obtained under the 1.0 percentage point increase variant and the 1.5 percentage point increase variant are smaller. Indeed, they are close to the difference of 0.5 children per woman assumed by the United Nations between the medium and low fertility variants. Overall, the differences between the levels of total fertility obtained with the 0.5 percentage point increase in contraceptive prevalence and the 1.5 percentage point increase variants well exceed the one child per woman difference assumed by the United Nations between

the low and high fertility variants. This, as just seen, is caused by the fact that the differences between the levels of total fertility obtained under the 1.0 percentage point increase variant and the two other variants are not symmetrical, and are much more important between the 0.5 and 1.0 percentage point variants than between the 1.0 and 1.5 percentage point variants.

When comparing these results with the United Nations fertility variants, the level of total fertility assumed under the United Nations medium fertility variant appears close to the total fertility level obtained under the 1.0 or 1.5 percentage point increase variants with scenario C or D for Burkina Faso, Niger and Nigeria. In the case of Ghana, where total fertility in 2010 is at an intermediate level (4.3 children per woman), the total fertility levels obtained under the 1.0 or 1.5 percentage point increase variants and scenario C and D are lower than the 2050 levels of fertility assumed by the United Nations under the medium and low variants. This may be the result of an overestimation of the future fertility decline projected for Ghana with the FamPlan model.

These results confirm that high increases in contraceptive prevalence are needed to reach the levels of fertility projected by the United Nations for the 2010-2050 period. This is the case in particular for the United Nations low and medium fertility variants. The corresponding high increases in contraceptive prevalence required are not consistent with the rather low pace of increases observed in recent years in the four countries examined here. The United Nations high fertility variant also assumes a much faster fertility decline between 2010 and 2050 than one would expect should the current low rate of increase in contraceptive prevalence continue, especially in countries that still have high fertility levels in 2010. However, an acceleration in the use of contraceptive methods cannot be totally excluded.

F. DISCUSSION

The results obtained from the preceding exercises—estimating the contraceptive prevalence rates associated with the United Nations fertility variants and making alternative projections considering the level of total fertility as a dependent variable of the various proximate determinants—have limitations. A critical limitation is that there has been no discussion in this paper about the quality of the data used, and obviously these data are not perfect (Schoumaker, 2008). In further research, the FamPlan model could be tested retrospectively (e.g., for the 1980-2010 period) in order to evaluate the consistency between the results obtained from the model and what has been observed. Another limitation is the lack of data, particularly over time, to support assumptions about the abortion rate.

Most population projections (including those from the United Nations) continue to be based upon assumptions about the level of total fertility considered as an independent variable. Yet there is now a large amount of data available on fertility transitions in developing countries as well as on most of the proximate determinants associated with these transitions. These data are available for numerous countries of the world and for almost all sub-Saharan African countries. With the exception of data on abortion, the increased availability of survey data on the proximate determinants now makes it more feasible to estimate future fertility levels using the proximate determinants framework. Nevertheless, the difficulties associated with the use of the proximate determinants framework to project future fertility levels should not be overlooked.

The first question that arises concerning the use of the proximate determinants for projecting future fertility is whether it is suitable for all countries of the world: high-fertility countries, medium-fertility countries as well as low, below-replacement fertility countries. Some researchers argue that this framework is better suited for high-fertility countries, but others have argued that the

proximate determinants framework could help, to a certain extent, to explain the future course of fertility and fertility differentials in very different settings, including below-replacement fertility countries (Guengant, 2002).

The second question is the question of convergence. Is the present assumption of the United Nations that all countries will converge eventually toward a level of 1.85 children per woman a realistic one? Of course, it is not possible to give a definite answer to this question. A related issue is the validity for sub-Saharan African countries of the path of fertility decline derived from models of fertility decline based on the past experience of all countries with declining fertility during 1950-2010. Fertility transitions in sub-Saharan African countries might not follow what has been experienced elsewhere for a variety of reasons. One of these reasons is that future support of governments and donors for population and reproductive health programmes might not be as strong as it has been during the 1950-2010 period because new, more pressing priorities will emerge. Another reason is related to the way the high and low fertility variants of the United Nations population projections are developed. For countries with still high fertility levels and very uncertain future paths of fertility decline, the difference of one child between the high and low fertility variants (plus 0.5 children and minus 0.5 children from the medium variant) might not reflect the possibly much larger differences between the various variants one may envision for these countries. Testing three variants of increases in contraceptive use that lead to larger differences in total fertility levels between the low and high variants is attractive. However, the linearity of the projected increases in contraceptive use adopted in this paper is probably not the best approach. A further step is to update analyses of past fertility transitions and their corresponding changes in the proximate determinants. Another line of future inquiry is to identify new patterns of fertility transitions, especially at the regional level (and including patterns of different increases in contraceptive use) as well as fertility stalls or stalling transitions (Bongaarts, 2008; Bongaarts, 2006; Shapiro and Gebreselassie, 2008).

Another important question relates to the fact that population projections and the assumptions made should be easily understood by users of these projections. The present assumption that all countries will converge eventually toward a level of 1.85 children per woman, considered as the medium variant, plus 0.5 children and minus 0.5 children for the high and low fertility variants, is not too difficult to understand, although many users continue to think that the United Nations projections continue to be based on the assumption that all countries will converge eventually toward replacement level (i.e., 2.1 children per woman). Making projections with assumptions on the method mix and on each of the proximate determinants will be more difficult to remember, and will not necessarily be easily understood by the many users of the United Nations populations projections.

In fact, making assumptions on the method mix and on each of the proximate determinants is a complicated endeavour. It requires fixing limits and setting parameters for convergence over time. The decrease in the share of traditional methods towards more effective modern methods during the fertility transition is relatively well documented. However, high levels of contraceptive use have been achieved in several countries through reliance on sterilization, a very uncommon method in sub-Saharan Africa. The priority given in the region to reversible methods presently lessens the average method-mix effectiveness, since the effectiveness of several of the methods used (especially condoms, pills and even IUDs) is not 100 percent. In order to increase significantly the average method-mix effectiveness, it would be necessary to have a much more important recourse to reversible methods with maximum effectiveness (i.e., 100 percent), such as injectables and implants.

Concerning the other determinants, one can assume that the percentage of women in union will continue to decrease as well as, to a lesser extent, the mean duration of postpartum insusceptibility. Yet the patterns of decline in the factors vary from one country and from one region to another. The linear decreases and the lower limits adopted in this paper for the future percentage of women in union and the mean duration of postpartum insusceptibility remain somewhat arbitrary. Concerning abortion, lack of access to adequate health services and effective contraceptive methods is likely to increase the use of abortion, but the costs and conditions under which illegal abortions are performed in most sub-Saharan African countries are serious limitations to this option (Guttmacher Institute, 2009). As a result, the trade-off between contraception and abortion will work differently depending on the country. Making assumptions about future abortion rates will probably be more difficult than making assumptions on the other proximate determinants.

To sum up, one should continue to explore new approaches for projecting fertility levels; document the interrelationships between fertility levels, the method mix and the proximate determinants; and improve the clarity of explanations about population projection assumptions for the users of such projections.

G. CONCLUSION

Population projections will continue to be an important tool for policymakers and planners, who need to know how many children need to be immunized or educated, how many people need food or employment and so on. Yet population projections are also necessary to provide some sense of the population-related challenges that lie ahead. In this respect, it is important to underline the fact that population projections are not predictions, and that the medium-variant scenario is not necessarily the most likely.

In the short term (i.e., 10 to 15 years) population projections, especially the medium-variant scenario, can be considered reasonable scenarios for basic planning purposes. For the medium and long term (i.e., beyond 15 years), it should be clear that population projections are more a decision-making tool than a likely prospect; that is, a tool to explore and possibly modify future scenarios. For this reason, it seems important to explore the possibility of widening the difference between the high and low fertility variants. It is also important to indicate to the users of population projections that they should not restrict their appreciation of future population prospects to the medium variant, be it at the country, regional and even world level. Indeed, it is important that projections users examine with as much attention the different variants proposed in order to appreciate the different challenges associated with each of these variants.

Compared to the findings of a similar exercise done by the authors in 2001, recent data indicate that there has been no acceleration in the use of contraception in most countries of sub-Saharan Africa in the past 10 years. In fact, increases in contraceptive prevalence rates per year remain still below or close to 0.5 percentage points per year in Western and Middle African countries, and in several Eastern African countries. However, one of the important findings of this paper is that analyses using the proximate determinants framework should not be limited solely to increases in contraceptive use. Changes in the contraceptive method mix, the percentage of women in union, the duration of postpartum insusceptibility and the abortion rate also play important roles and should be carefully examined. The quality of the data, especially of total fertility rates from surveys for the most recent period, should also be carefully analysed since they may overestimate recent fertility declines. All this reinforces the hypothesis that fertility declines will not occur in all sub-Saharan African countries at the same pace as those observed in Asia and Latin America and the Caribbean. For several more decades, the fertility declines in Western and Middle Africa, in

particular, are likely to lag behind those that have taken place elsewhere (including Southern Africa and, to a lesser extent, Eastern Africa).

Population projections should better highlight the large uncertainties about future fertility declines in sub-Saharan Africa. In that respect, making population projections with fertility variants based on assumptions on the method mix and the proximate determinants allows linking future populations and fertility levels to changes in variables that reflect larger social, cultural and economic changes in society. As seen in this paper for the four countries examined, the three fertility variants from the 2008 revision of *World Population Prospects* do not reflect the trends observed recently for the proximate determinants. In fact, only the high variant and only the beginning of the projection period is associated with values of the proximate determinants that are close to what have been observed in recent years. Even for the high variant, the assumed acceleration of the increase of contraceptive use is far from assured. Given that many users of population projections may consider only one variant—usually the medium fertility variant—a false impression is created that the fertility decline is well underway in sub-Saharan Africa and will seemingly accelerate. It should be clear that the medium fertility variant of the United Nations or the medium variant of increase in contraceptive use (1.0 percentage point per year) implies roughly a rapid doubling of the increases in contraceptive use observed recently in the four countries studied, or a tripling even, if one considers the low fertility variant of the 2008 revision of *World Population Projections* or the rapid variant of an increase in contraceptive use (1.5 percentage points per year).

For this reason, population projections with fertility variants based on assumptions on the method mix and the proximate determinants should be encouraged at the national level. Such projections have already been made in Burkina Faso, Chad, Madagascar and Niger and the results were used for the reformulation of population policies and reproductive health programmes (Guengant, 2003; Guengant and others, 2009; Harouna and others, 2005; Ningam and others, 2002).

Making such projections at the international level raises other more complex issues. For instance, should this type of projection be done for all countries of the world or only for high fertility countries? How can the assumptions made on the proximate determinants be justified, particularly those on abortion? For the high fertility countries and also for the intermediate fertility countries, it is important to verify the consistency of the fertility variants adopted with plausible values of the increases in contraceptive use and of the other proximate determinants.

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TABLE 1: TYPES OF FERTILITY TRANSITION BETWEEN 1975-1990 AND 2005-2010

Region	Country	Total Fertility Rate (TFR)				Difference between	Average difference between TFR per 10-year period for		
		1975-1980	1985-1990	1995-2000	2005-2010	2005-2010 1975-1980	30 years 1975-1980 2005-2010	20 years 1985-1990 2005-2010	10 years 1995-2000 2005-2010
A. Early transition (Total Fertility Rate < 3)									
EA	Mauritius	3.1	2.2	2.1	1.9	*-1.2*	-0.40	-0.16	-0.19
EA	Reunion	3.3	2.5	2.3	2.4	*-0.9*	-0.31	-0.09	0.02
SA	South Africa	5.0	3.9	3.0	2.6	*-2.4*	-0.79	-0.61	-0.31
B. Recent transition, well under way (Total Fertility Rate, about 3 to 4)									
EA	Zimbabwe	7.3	5.7	4.1	*3.2*	-4.1	-1.37	-1.24	-0.86
SA	Botswana	6.4	5.1	3.7	*2.9*	-3.5	-1.16	-1.11	-0.80
SA	Namibia	6.6	6.2	4.4	*3.2*	-3.4	-1.14	-1.49	-1.21
WA	Cape-Verde	6.8	5.9	4.1	*3.4*	-3.4	-1.13	-1.27	-0.73
SA	Swaziland	6.7	6.1	4.5	*3.5*	-3.3	-1.09	-1.34	-1.04
WA	Côte-d'Ivoire	7.4	6.9	5.6	4.5	-3.0	-0.98	-1.22	-1.16
EA	Djibouti	6.8	6.4	5.1	4.0	-2.9	-0.95	-1.23	-1.16
WA	Ghana	6.7	6.1	4.8	*3.8*	-2.8	-0.94	-1.13	-0.98
EA	Comoros	7.1	6.5	5.4	4.3	-2.8	-0.92	-1.10	-1.10
MA	Sao Tome & Pr.	6.5	5.7	4.8	*3.9*	-2.7	-0.88	-0.91	-0.95
C. Slow and irregular transition (Total Fertility Rate, about 4 to 5)									
EA	Kenya	7.6	6.5	5.0	5.0	-2.6	-0.88	-0.77	-0.04
EA	Rwanda	8.5	8.3	6.1	5.9	-2.6	-0.86	-1.17	-0.18
SA	Lesotho	5.7	5.1	4.4	*3.4*	-2.3	-0.77	-0.89	-1.00
WA	Senegal	7.0	6.8	5.7	4.7	-2.3	-0.77	-1.06	-1.00
WA	Togo	7.1	6.6	5.8	4.8	-2.3	-0.77	-0.90	-1.00
NA	Sudan	6.5	6.1	5.4	4.2	-2.3	-0.76	-0.93	-1.18
EA	Zambia	7.4	6.7	6.0	5.2	-2.2	-0.73	-0.74	-0.82
MA	Cameroon	6.4	6.1	5.1	4.3	-2.1	-0.70	-0.90	-0.79
WA	Mauritania	6.4	6.0	5.3	4.4	-2.0	-0.68	-0.80	-0.89
EA	Malawi	7.6	7.2	6.4	5.6	-2.0	-0.67	-0.79	-0.85
MA	Gabon	5.0	5.0	3.8	*3.1*	-1.9	-0.65	-0.97	-0.77
WA	Gambia	6.6	6.2	5.5	4.7	-1.9	-0.64	-0.74	-0.83
EA	Madagascar	6.6	6.3	5.8	4.8	-1.8	-0.61	-0.76	-1.02
MA	Congo	6.3	5.6	4.9	4.5	-1.8	-0.60	-0.53	-0.38
WA	Burkina Faso	7.8	7.4	6.8	6.0	-1.8	-0.58	-0.72	-0.77
WA	Benin	7.1	6.9	6.3	5.4	-1.7	-0.56	-0.74	-0.83
WA	Nigeria	6.9	6.8	6.3	5.3	-1.6	-0.53	-0.76	-0.93
EA	Tanzania	6.7	6.4	5.7	5.2	-1.6	-0.52	-0.60	-0.50
WA	Guinea	7.0	6.8	6.2	5.4	-1.6	-0.52	-0.70	-0.72
D. Very slow or incipient transition (Total Fertility Rate >5)									
EA	Ethiopia	6.8	6.8	6.3	5.3	-1.5	-0.50	-0.77	-1.05
EA	Eritrea	6.5	6.3	5.9	5.1	-1.5	-0.48	-0.63	-0.88
EA	Mozambique	6.5	6.3	5.9	5.1	-1.4	-0.47	-0.61	-0.74
MA	C.Af.Republic	5.9	5.7	5.3	4.6	-1.3	-0.44	-0.56	-0.72
EA	Somalia	7.3	7.0	6.8	6.0	-1.2	-0.40	-0.48	-0.71
WA	Mali	7.6	7.5	7.2	6.5	-1.0	-0.35	-0.48	-0.70
WA	Niger	8.1	8.0	7.7	7.2	-0.9	-0.31	-0.39	-0.50
MA	Angola	7.2	7.2	6.9	6.4	-0.8	-0.26	-0.39	-0.47
EA	Uganda	7.1	7.1	7.0	6.5	-0.6	-0.21	-0.32	-0.49
MA	Chad	6.7	6.7	6.6	6.2	-0.5	-0.18	-0.25	-0.42
MA	Equat. Guinea	5.7	5.9	5.9	5.4	-0.3	-0.11	-0.27	-0.51
WA	Liberia	6.9	6.9	6.8	6.8	-0.1	-0.04	-0.07	-0.03
WA	Sierra Leone	6.5	6.5	6.5	6.5	0.0	-0.01	-0.02	-0.03
WA	Guinea-Bissau	7.1	7.1	7.1	7.1	0.0	-0.01	-0.01	-0.03
EA	Burundi	6.8	6.8	6.8	6.8	0.0	0.00	0.00	0.00
MA	D. R. Congo	6.6	6.7	6.7	6.7	0.1	0.03	0.00	0.00

NOTE: NA: Northern Africa, WA: Western Africa, EA: Eastern Africa, MC: Middle Africa, SA: Southern Africa

Source: data compiled from *World Population Prospects: The 2008 Revision* Population Data base. Available from http://esa.un.org/unpp/index.asp (accessed 5 November 2009)

TABLE 2: PERCENTAGE OF WOMEN OF REPRODUCTIVE AGE IN UNION BY COUNTRY. CLASSIFIED FOR EACH SUB-REGION BY THE DECREASING RANKING OF PERCENTAGE OF WOMEN IN UNION

Country, year of last survey and sub-region	*Married*	*Living together*	*In union*
WESTERN AFRICA			
Niger 2006	85.9	0.2	86.1
Mali 2006	79.2	5.6	84.8
Guinea 2005	75.3	3.8	79.1
Benin 2006	68.6	6.7	75.3
Burkina Faso 2006 (1)	75.3	-	75.3
Nigeria 2008	69.1	1.5	70.6
Togo 1998	60.5	7.4	67.9
Senegal 2005	64.9	2.7	67.6
Liberia 2007	41.6	22.4	64.0
Côte d'Ivoire 1998-9	47.6	13.7	61.3
Mauritania 2000-1	58.8	-	58.8
Ghana 2008	45.4	13.1	58.5
MIDDLE AFRICA			
Chad 2004	74.1	2.5	76.6
Central.Afr.Rep. 1994-5	13.8	55.6	69.4
Cameroon 2004	52.0	15.2	67.2
D.R. Congo 2007	57.6	8.6	66.2
Congo 2005	19.9	36.5	56.4
Gabon 2000	21.1	33.0	54.1
EASTERN AFRICA			
Malawi 2004	66.8	4.3	71.1
Mozambique 2003	15.5	54.8	70.3
Madagascar 2008-9	60.5	8.8	69.3
Tanzania 2004	58.5	8.8	67.3
Burundi 1987	66.5	0.7	67.2
Eritrea 2002	61.8	3.7	65.5
Ethiopia 2005	63.4	1.1	64.5
Uganda 2006	48.7	13.9	62.6
Zambia 2007	60.9	0.7	61.6
Kenya 2008-9	54.2	4.1	58.3
Zimbabwe 2005-6	56.3	1.4	57.7
Comoros 1996	52.4	1.2	53.6
Rwanda 2007-8	37.6	15.6	53.2
SOUTHERN AFRICA			
Lesotho 2004	51.6	0.7	52.3
South Africa 1998	33.7	9.5	43.2
Swaziland 2006	31.9	9.5	41.4
Botswana 1988	28.3	10.8	39.1
Namibia 2006-7	19.9	15.3	35.2
NORTHERN AFRICA			
Sudan 1990	55.5	-	55.5

Source: data from MEASURE DHS, STATcompiler (2009)
Available from http://www.statcompiler.com (accessed 4 November 2009)
NOTE*:* - no data
(1) Data from the 2006 Burkina Faso Multiple Indicator Cluster Survey

TABLE 3: EVOLUTION OF ANNUAL PERCENTAGE POINT DECREASES IN THE PERCENTAGE OF WOMEN IN UNION IN 16 SUB-SAHARAN AFRICAN COUNTRIES WITH AT LEAST THREE SURVEYS

Country and sub-region	*Year of the Demographic and Health Surveys (DHS)*	*Difference in percentage of women in union, in percentage point per year between successive surveys from the first survey (D1) to the most recent one (D3, D4, or D5)*				
		Percentage point per year difference between				
		DHS 2 and DHS 1	*DHS 3 and DHS 2*	*DHS 4 and DHS 3*	*DHS 5 and DHS 4*	*The first and last survey*
WESTERN	AFRICA					
Benin	1996, 2001, 2006	-0.62	0.38			-0.12
Burkina Faso	1992-93, 1998-99, 2003, 2006(1)	-0.57	-0.67	-0.70		-0.63
Ghana	1988, 1993, 1998, 2003, 2008	0.00	-1.14	-0.46	-0.76	-0.59
Mali	1987,1995-96, 2001, 2006	-0.86	-0.24	0.26		-0.38
Niger	1992, 1998, 2006	-0.22	0.24			0.04
Nigeria	1990, 1999, 2003, 2008	-0.91	-0.02	-0.16		-0.43
Senegal	1988, 1993, 1998, 2003 2008	-0.76	-0.69	-0.06		-0.45
Cameroon	1986, 1992-93, 1997, 2005	-1.03	0.05			-0.53
			Average Western Africa and Cameroon			-0.39
EASTERN	AFRICA					
Kenya	1989, 1993, 1998, 2003, 2008-09	-1.33	0.00	-0.26	-0.33	-0.42
Madagascar	1992, 1997, 2003-04, 2008-09	0.62	0.29	0.92		0.58
Malawi	1992, 2000, 2004	-0.06	-0.10			-0.08
Rwanda	1992, 2000, 2005, 2007-08	-1.03	0.04	1.80		-0.30
Tanzania	1992, 1996, 1999, 2004	0.30	-0.27	0.30		0.16
Uganda	1988, 1995, 2001-02, 2006	0.77	-0.96	-0.87		-0.26
Zambia	1992, 1996, 2001-02, 2007	-0.50	0.04	0.06		-0.10
Zimbabwe	1988, 1994, 1999, 2005-06	-0.18	-0.14	-0.52		-0.30
			Average	*Eastern*	*Africa*	-0.09

Source: data from MEASURE DHS, STATcompiler (2009). Available from http://www.statcompiler.com (accessed 4 November 2009)

(1) Data from the 2006 Burkina Faso Multiple Indicator Cluster Survey

TABLE 4: MEAN DURATION OF POSTPARTUM INSUSCEPTIBILITY (PPI), IN MONTHS BY COUNTRY CLASSIFIED FOR EACH SUB-REGION BY THE DECREASING RANKING OF MEAN DURATION OF POSTPARTUM INSUSCEPTIBILITY

Country, year of last survey and sub-region	*Mean duration of post-partum insusceptibility in months*
WESTERN AFRICA	
Guinea 2005	22.6
Burkina 2003	20.4
Togo 1998	19.3
Côte d'Ivoire 1998-9	17.7
Niger 2006	16.4
Benin 2006	15.7
Liberia 2007	15.5
Ghana 2008	15.2
Nigeria 2003	15.1
Senegal 2005	14.8
Mali 2006	13.6
Mauritania 2000-1	12.9
MIDDLE AFRICA	
Central Afr. Rep.1994-5	17.5
Chad 2004	16.7
D.R. Congo 2007	14.5
Cameroon 2004	14.4
Congo 2005	13.3
Gabon 2000	13.0
EASTERN AFRICA	
Burundi 1987	19.5
Mozambique 2003	19.1
Ethiopia 2005	17.9
Eritrea 2002	17.0
Rwanda 2005	16.8
Zimbabwe 2005-6	15.4
Malawi 2004	15.0
Tanzania 2004	14.6
Zambia 2007	14.3
Kenya 2003	13.6
Uganda 2006	13.4
Madagascar 2003-4	13.1
Comoros 1996	11.3
SOUTHERN AFRICA	
Lesotho 2004	17.2
South Africa 1998	16.0
Swaziland 2006	15.4
Namibia 2006-7	15.3
Botswana 1988	14.6
NORTHERN AFRICA	
Sudan 1990	14.7

Source: data from MEASURE DHS, STATcompiler (2009). Available from http://www.statcompiler.com (accessed 4 November 2009)

TABLE 5: EVOLUTION OF THE ANNUAL DECREASES IN THE MEAN DURATION OF POSTPARTUM INSUSCEPTIBILITY (PPI), IN MONTHS, IN 16 SUB-SAHARAN AFRICAN COUNTRIES WITH AT LEAST THREE SURVEYS

Country and sub-region	*Year of the Demographic and Health Surveys (DHS)*	*Average difference per year in months in the mean duration of postpartum insusceptibility (ppi), between successive surveys from the first survey (D1) to the most recent one (D3, D4, or D5)*				
		Average difference per year in months between				
		DHS 2 and DHS 1	*DHS 3 and DHS 2*	*DHS 4 and DHS 3*	*DHS 5 and DHS 4*	*The first and last survey*
WESTERN	AFRICA AND CAMEROON					
Benin	1996, 2001, 2006	-0.52	-0.12			-0.32
Burkina Faso	1992-93, 1998-99, 2003	0.00	-0.38			-0.16
Ghana	1988, 1993, 1998, 2003, 2008	-0.06	-0.32	-0.08	-0.16	-0.16
Mali	1987,1995-96, 2001, 2006	0.01	-0.24	-0.14		-0.10
Niger	1992, 1998, 2006	0.05	0.00			0.02
Nigeria	1990, 1999, 2003, 2008	-0.41	-0.13			-0.32
Senegal	1988, 1993, 1998, 2003 2008	-0.12	-0.14	-0.20		-0.16
Cameroon	1986, 1992-93, 1997, 2005	-0.13	-0.32			-0.22
			Average Western Africa and Cameroon			-0.18
EASTERN	AFRICA					
Kenya	1989, 1993, 1998, 2003, 2008-09	0.38	-0.16	0.00		0.05
Madagascar	1992, 1997, 2003-04, 2008-09	-0.12	-0.12			-0.12
Malawi	1992, 2000, 2004	-0.28				-0.28
Rwanda	1992, 2000, 2005, 2007-08	-0.09	0.02			-0.05
Tanzania	1992, 1996, 1999, 2004	0.05	-0.43	-0.22		-0.18
Uganda	1988, 1995, 2001-02, 2006	0.10	-0.07	-0.13		-0.02
Zambia	1992, 1996, 2001-02, 2007	0.15	0.18	-0.36		0.00
Zimbabwe	1988, 1994, 1999, 2005-06	0.23	0.04	0.05		0.11
			Average	*Eastern*	*Africa*	-0.06

Source: data from MEASURE DHS, STATcompiler (2009) Available from http://www.statcompiler.com (accessed 4 November 2009)

TABLE 6: CONTRACEPTIVE PREVALENCE AMONG WOMEN OF REPRODUCTIVE AGE IN UNION BY COUNTRY CLASSIFIED FOR EACH SUB-REGION BY INCREASING RANKING PERCENTAGE OF MODERN METHODS USERS

Country, year of last survey and sub-Region	*Contraceptive method used*			*Percentage of traditional methods among all methods used*
	Any method	*Modern methods*	*Traditional methods*	
WESTERN AFRICA				
Guinea 2005	7.4	4.0	3.4	46
Niger 2006	11.2	4.9	6.3	56
Mauritania 2000-1	8.1	5.2	2.9	36
Benin 2006	16.8	5.8	10.8	64
Sierra Leone 2008	7.5	6.0	1.5	20
Guinea-Bissau 2006	10.0	6.0	4.0	40
Mali 2006	7.7	6.3	1.4	18
Côte d'Ivoire 1998-9	15.0	7.2	7.8	52
Nigeria 2008	13.0	8.1	4.9	38
Gambia 2000	9.6	8.9	0.7	7
Togo 2000	21.7	9.3	12.4	57
Senegal 2005	11.5	10.0	1.5	13
Liberia 2007	11.4	10.3	1.2	11
Burkina Faso 2006 (1)	16.3	13.3	3.0	18
Ghana 2008	23.3	16.4	6.9	30
Cape Verde 2005	61.0	57.0	4.0	7
MIDDLE AFRICA				
Chad 2004	2.8	1.7	1.1	39
Central Afr.Rep.1994-5	14.8	3.3	11.5	78
Angola 2001	5.9	4.5	1.4	24
D.R. Congo 2007	20.7	5.8	14.9	72
Gabon 2000	31.1	11.7	19.4	62
Cameroon 2004	25.3	12.4	12.9	51
Congo 2005	44.1	12.5	31.6	72
Sao Tome &Princ.2000	29	27	2	7
EASTERN AFRICA				
Somalia 2006	15	1	14	93
Eritrea 2002	6	5.2	0.8	13
Burundi 2000	13.5	10.0	3.5	26
Comoros 1996	20.9	11.3	9.6	46
Mozambique 2003	16.5	11.8	4.7	28
Ethiopia 2005	14.7	13.8	0.9	6
Djibouti 2000	18	17	0.8	4
Uganda 2006	23.6	17.8	5.8	25
Tanzania 2004	25.8	19.5	6.3	24
Rwanda 2007-8	35.3	26.4	8.9	25
Zambia 2007	34.8	26.7	8.1	23
Madagascar 2008-9	39	28.2	10.8	28
Malawi 2004	32.5	28.2	4.3	13
Kenya 2008-9	44.9	38.9	6	13
Mauritius 1991	74.7	48.9	25.8	35
Zimbabwe 2005-6	60.3	58.5	1.8	3
SOUTHERN AFRICA				
Botswana 1988	33	31.7	1.3	4
Lesotho 2004	37.3	35.2	2.1	6
Swaziland 2006	48.8	46.9	2.9	6
Namibia 2006-7	55.1	53.5	1.6	3
South Africa 1998	56.3	55.2	1.1	2
NORTHERN AFRICA				
Sudan 1990	8.7	5.5	3.1	36

NOTE: and Breastfeeding and MAMA not included in the method used

Source: data from MEASURE DHS, STATcompiler (2009) Available from http://www.statcompiler.com (accessed 4 November 2009) and UN Population Division Policy Brief (New York) No. 2009/1

TABLE 7: ANNUAL PERCENTAGE POINT INCREASES IN CONTRACEPTIVE PREVALENCE
BY SUB-REGION AND BY DECREASING RANKING OF POINT PREVALENCE INCREASE IN MODERN METHOD USE

Country and sub-region	*Year first survey*	*Year last survey*	*Number of years between the surveys*	*Annual increase modern methods*	*Annual increase traditional methods*	*Annual increase any method*
WESTERN AFRICA						
Benin	1981/2	2006	25	0.2	0.1	0.3
Burkina Faso	1992/3	2006	14	0.7	-0.1	0.6
Côte d'Ivoire	1980/1	1998/9	18	0.4	0.3	0.7
Gambia	1990	2000	10	0.2	-0.4	-0.2
Ghana	1979/80	2008	29	0.4	0.1	0.5
Guinea	1992/3	2005	13	0.2	0.2	0.5
Liberia	1986	2007	21	0.2	0.0	0.2
Mali	1987	2006	19	0.3	-0.1	0.2
Mauritania	1981	2000/1	20	0.3	0.1	0.4
Niger	1992	2006	14	0.2	0.3	0.5
Nigeria	1981/2	2008	27	0.3	0.0	0.3
Senegal	1986	2005	19	0.4	-0.4	0.0
Togo	1988	2000	12	0.5	0.3	0.8
MIDDLE AFRICA						
Angola	1996	2001	5	0.1	-0.5	-0.4
Central African Rep.	1994/5	2000	6	0.7	0.9	1.5
Cameroon	1978	2004	26	0.5	0.4	0.9
Chad	1996/7	2004	8	0.1	-0.3	-0.2
D. R. of the Congo	1991	2007	16	0.2	0.6	0.8
EASTERN AFRICA						
Burundi	1987	2000	13	0.7	-0.3	0.4
Comoros	1996	2000	4	2.0	-1.2	0.8
Eritrea	1995	2002	7	0.2	-0.5	-0.3
Ethiopia	1990	2005	15	0.7	-0.1	0.7
Kenya	1977/8	2008/9	32	1.1	0.1	1.2
Madagascar	1992	2008/9	17	1.4	0.0	1.4
Malawi	1984	2004	20	1.3	0.0	1.3
Mauritius	1975	1991	16	1.2	0.6	1.8
Mozambique	1997	2003	6	2.6	0.7	3.3
Rwanda	1983	2007/8	25	1.0	0.0	1.0
Tanzania	1991/2	2004/5	13	1.0	0.2	1.2
Uganda	1998/9	2006	18	0.9	0.2	1.1
Zambia	1992	2007	15	0.9	0.2	1.1
Zimbabwe	1979	2005/6	27	2.0	-0.3	1.7
SOUTHERN AFRICA						
Botswana	1984	2000	16	1.3	-0.5	0.8
Lesotho	1977	2004	23	1.2	-0.1	1.1
Namibia	1992	2006/7	15	1.9	-0.1	1.8
South Africa	1975/6	1998	23	0.9	0.0	0.9
Swaziland	1988	2006	19	0.5	-0.1	0.4

NOTE: Breastfeeding and MAMA not included in the method used.

Sources: United Nations (2005). World Contraceptive Use 2005. Database maintained by the Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat and data from MEASURE DHS, STATcompiler (2009) Available from http://www.statcompiler.com (accessed 4 November 2009)

TABLE 8: EVOLUTION OF THE ANNUAL PERCENTAGE POINT INCREASES IN CONTRACEPTIVE PREVALENCE AMONG WOMEN IN UNION IN 16 SUB-SAHARAN AFRICAN COUNTRIES WITH AT LEAST THREE SURVEYS

Country and sub-region	*Year of the Demographic and Health Surveys (DHS)*	Difference in percentage of women in union using a contraceptive method , in percentage point per year between successive surveys from the first survey (D1) to the most recent one (D3, D4, or D5)				
		Percentage point per year difference between				
		DHS 2 - - DHS 1	*DHS 3 - DHS 2*	*DHS 4 - DHS 3*	*DHS 5 - DHS 4*	*The first and last survey*
		A. Modern methods				
WESTERN	AFRICA					
Benin	1996, 2001, 2006	0.68	-0.20			0.24
Burkina Faso	1992-93, 1998-99, 2003, 2006(1)	0.12	0.80	1.60		0.67
Ghana	1988, 1993, 1998, 2003, 2008	1.16	0.54	1.14	-0.40	0.61
Mali	1987,1995-96, 2001, 2006	0.38	0.24	0.10		0.26
Niger	1992, 1998, 2006	0.38	0.04			0.19
Nigeria	1990, 1999, 2003, 2008	0.57	-0.48	0.28		0.26
Senegal	1988, 1993, 1998, 2003 2008	0.31	0.97	0.24		0.40
Cameroon	1986, 1992-93, 1997, 2005	0.40	0.88			0.62
			Average Western Africa, Cameroon			0.41
EASTERN	AFRICA					
Kenya	1989, 1993, 1998, 2003, 2008-09	2.38	0.80	0.02	1.26	1.08
Madagascar	1992, 1997, 2003-04, 2008-09	0.96	1.05	2.32		1.41
Malawi	1992, 2000, 2004	2.29	0.63			1.73
Rwanda	1992, 2000, 2005, 2007-08	-0.94	1.04	6.76		0.88
Tanzania	1992, 1996, 1999, 2004	1.70	1.17	0.54		1.08
Uganda	1988, 1995, 2001-02, 2006	0.76	1.13	0.69		0.85
Zambia	1992, 1996, 2001-02, 2007	1.33	1.55	0.79		1.19
Zimbabwe	1988, 1994, 1999, 2005-06	1.03	1.44	1.38		1.28
			Average	*Eastern*	*Africa*	1.19
		B. Any method				
WESTERN	AFRICA					
Benin	1996, 2001, 2006	0.36	-0.32			0.02
Burkina Faso	1992-93, 1998-99, 2003, 2006(1)	0.67	0.36	0.93		0.62
Ghana	1988, 1993, 1998, 2003, 2008	1.44	0.26	0.90	-0.52	0.52
Mali	1987,1995-96, 2001, 2006	0.24	0.04	0.16		0.16
Niger	1992, 1998, 2006	0.62	0.38			0.48
Nigeria	1990, 1999, 2003, 2008	1.03	-1.05	0.38		0.39
Senegal	1988, 1993, 1998, 2003 2008	-0.52	1.57	-0.18		0.01
Cameroon	1986, 1992-93, 1997, 2005	0.44	1.02			0.71
			Average Western Africa, Cameroon			0.36
EASTERN	AFRICA					
Kenya	1989, 1993, 1998, 2003, 2008-09	1.45	1.26	0.06	0.96	0.93
Madagascar	1992, 1997, 2003-04, 2008-09	0.54	0.94	2.68		1.35
Malawi	1992, 2000, 2004	2.15	0.58			1.63
Rwanda	1992, 2000, 2005, 2007-08	-1.04	0.96	7.52		0.92
Tanzania	1992, 1996, 1999, 2004	2.00	2.33	0.10		1.29
Uganda	1988, 1995, 2001-02, 2006	1.41	0.69	0.93		1.04
Zambia	1992, 1996, 2001-02, 2007	2.68	1.02	0.61		1.29
Zimbabwe	1988, 1994, 1999, 2005-06	0.83	0.90	1.17		0.98
			Average	*Eastern*	*Africa*	1.18

NOTE*:* Breastfeeding and MAMA not included in the method used.

Source: data from MEASURE DHS, STATcompiler (2009) Available from http://www.statcompiler.com (accessed 4 November 2009). (1) Data from the 2006 Burkina Faso Multiple Indicator Cluster Survey

TABLE 9: PARAMETERS USED FOR RUNNING THE FAMPLAN MODEL

Country	*Burkina Faso*	*Ghana*	*Niger*	*Nigeria*
Total fertility rate 2010	5.75	4.16	7.01	5.06
Contraceptive prevalence rate 2000				
- Any method……	18.3	24.3	13.2	13.5
- Modern methods……	15.0	17.5	6.6	8.4
Percentage of modern methods	82	72	50	62
Method mix 2006 (Burkina Faso and Niger) 2008 (Ghana and Nigeria)				
- Sterilization (Female)	0.6	6.8	2.7	3.1
- Pill……..	28.2	20.1	26.8	13.1
- Injectables……..	30.7	26.5	13.4	20.0
- I U D……..	0.6	0.9	0.9	7.7
- Implant	12.3	3.8	0.0	0.0
- Condoms……	8.6	10.3	0.0	18.5
- Vaginal barrier methods…….	0.6	1.7	0.0	0.0
- Traditional, folk and other methods..	18.4	29.9	56.3	37.7
Total……...	100.0	100.0	100.0	100.0
Average effectiveness ……..	87	81	70	76
Other proximate determinants				
- Percentage of women in union……	73.3	57.5	85.1	69.8
- Postpartum insusceptibility (in months)	19.0	14.9	16.0	14.4
- Total abortion rate……..	0	0	0	0
- Sterility (percentage)……...	3	3	3	3

TABLE 10: RESULTS OF THE FAMPLAN MODEL: LEVELS OF CONTRACEPTIVE PREVALENCE AND ASSOCIATED PERCENTAGE POINT INCREASES PER YEAR REQUIRED FOR BURKINA FASO, GHANA, NIGER, AND NIGERIA TO REACH THE TOTAL FERTILITY RATES PROJECTED BY THE UNITED NATIONS UNDER THE LOW, MEDIUM, AND HIGH VARIANTS OF THE 2008 REVISION

Country, year	*Contraceptive prevalence required to meet the United Nations fertility variants:*			*Country, period*	*Percentage point increases per year required to meet the United Nations fertility variants*		
	Low variant	*Medium variant*	*High variant*		*Low variant*	*Medium variant*	*High variant*
BURKINA FASO				*BURKINA FASO*			
2010	18.3	18.3	18.3				
2015	27.6	24.3	21.2	2010-2015	1.9	1.2	0.6
2020	36.6	31.2	25.9	2015-2020	1.8	1.4	1.0
2025	44.7	38.3	32.1	2020-2025	1.6	1.4	1.2
2030	51.4	44.8	38.4	2025-2030	1.3	1.3	1.3
2035	57.1	50.4	43.8	2030-2035	1.2	1.1	1.1
2040	61.7	54.7	48.0	2035-2040	0.9	0.9	0.8
2045	65.1	58.0	51.2	2040-2045	0.7	0.7	0.6
2050	66.6	59.6	52.5	2045-2050	0.3	0.3	0.3
GHANA				*GHANA*			
2010	24.3	24.3	24.3				
2015	35.7	31.2	26.9	2010-2015	2.3	1.4	0.5
2020	44.9	37.6	30.6	2015-2020	1.8	1.3	0.7
2025	51.2	42.7	34.6	2020-2025	1.3	1.0	0.8
2030	55.3	46.7	38.6	2025-2030	0.8	0.8	0.8
2035	58.9	50.2	42.3	2030-2035	0.7	0.7	0.7
2040	61.4	53.0	44.9	2035-2040	0.5	0.6	0.5
2045	63.3	54.9	46.9	2040-2045	0.4	0.4	0.4
2050	65.3	56.3	48.8	2045-2050	0.4	0.3	0.4
NIGER				*NIGER*			
2010	13.2	13.2	13.2				
2015	21.0	17.9	14.5	2010-2015	1.6	0.9	0.3
2020	28.1	22.9	17.7	2015-2020	1.4	1.0	0.6
2025	34.1	28.2	22.3	2020-2025	1.2	1.1	0.9
2030	39.7	33.8	28.0	2025-2030	1.1	1.1	1.1
2035	45.5	39.6	33.9	2030-2035	1.2	1.2	1.2
2040	51.3	45.5	39.7	2035-2040	1.2	1.2	1.2
2045	56.8	51.0	45.3	2040-2045	1.1	1.1	1.1
2050	62.1	56.3	50.6	2045-2050	1.1	1.1	1.1
NIGERIA				*NIGERIA*			
2010	13.5	13.5	13.5				
2015	28.3	23.7	19.2	2010-2015	3.0	2.0	1.2
2020	41.3	33.7	26.3	2015-2020	2.6	2.0	1.4
2025	50.4	41.5	33.0	2020-2025	1.8	1.6	1.3
2030	56.3	47.2	38.5	2025-2030	1.2	1.1	1.1
2035	60.0	50.8	41.9	2030-2035	0.7	0.7	0.7
2040	62.6	53.3	44.3	2035-2040	0.5	0.5	0.5
2045	64.1	54.7	45.6	2040-2045	0.3	0.3	0.3
2050	65.0	55.5	46.4	2045-2050	0.2	0.2	0.2

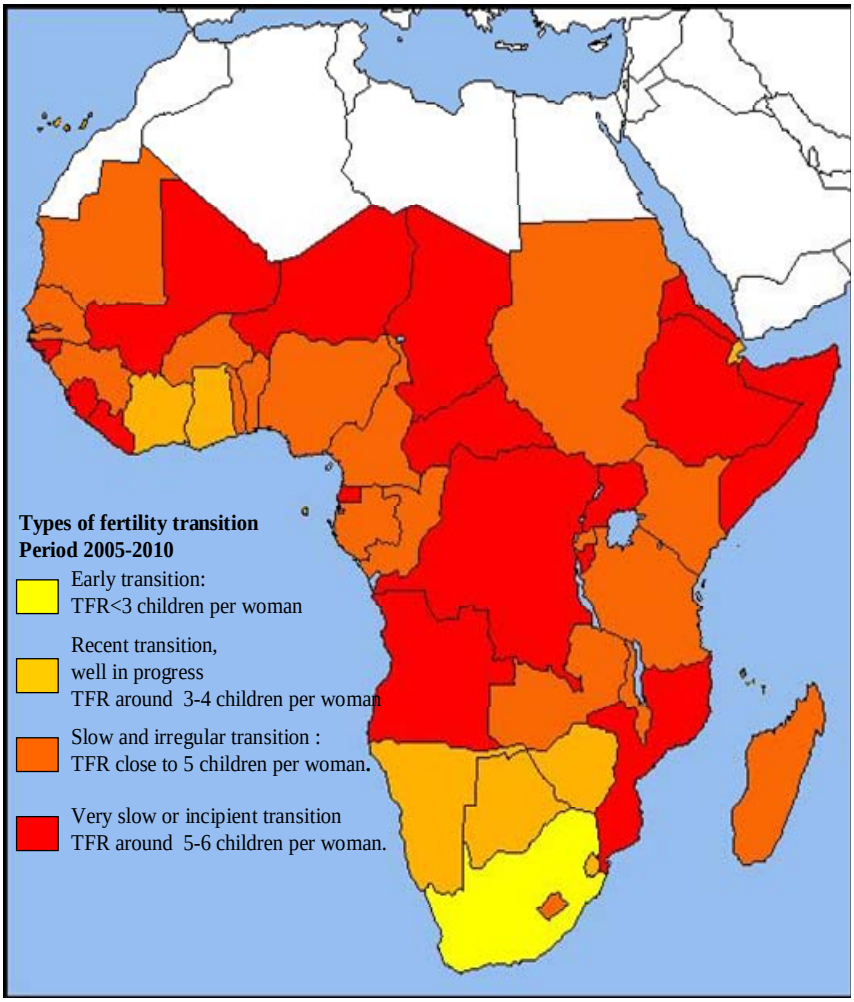
TABLE 11: PROJECTED TOTAL FERTILITY RATES BY 2050, ACCORDING TO VARIOUS ASSUMPTIONS ON THE PROXIMATE DETERMINANTS OF FERTILITY, USING THE FAMPLAN MODEL

Country *Percentage point increases in contraceptive prevalence and contraceptive by country in 2010 and 2050*	*Projections variant of the proximate determinants* *A. Impact of increase in contraceptive prevalence only*	*B. Impact of Impact of increase in contraceptive prevalence and more efficient method mix*	*C. Impact of increase in contraceptive prevalence, more efficient method mix, reduced percentage of women in union and duration of postpartum insusceptibility*	*D. Impact of increase in contraceptive prevalence, more efficient method mix, reduced percentage of women in union and duration of postpartum insusceptibility, and moderate abortion rate*
BURKINA FASO				
Total Fertility Rate in 2010:				
5.75		*A. Estimated Total Fertility Rate by FamPlan*		
0.5 point per year				
2010: 18.3. 2050: 38.3	4.45	4.34	4.01	3.91
1.0 point per year				
2010: 18.3. 2050: 58.3	3.14	2.98	2.76	2.57
1.5 point per year				
2010: 18.3. 2050: 65.8	2.65	2.48	2.29	2.06
		B. Difference between the FamPlan variants		
Between the 1.0 and 0.5 point				
per year assumptions	-1.31	-1.36	-1.25	-1.34
Between the 1.5 and 0.5 point				
per year assumptions	-1.80	-1.86	-1.72	-1.85
		C. Difference with the United Nations 2008 fertility variant in 2050		
0.5 point per year				
- High Variant : 3.19	1.26	1.15	0.82	0.72
1.0 point per year				
- Medium Variant : 2.69	0.45	0.29	0.07	-0.12
1.5 point per year				
- Low Variant : 2.19	0.46	0.29	0.10	-0.13
GHANA				
Total Fertility Rate in 2010:				
4.28		*A. Estimated Total Fertility Rate by FamPlan*		
0.5 point per year				
2010: 24.3. 2050: 44.3	3.31	3.11	3.15	3.05
1.0 point per year				
2010: 24.3. 2050: 64.3	2.35	2.05	2.08	1.88
1.5 point per year				
2010: 24.3. 2050: 71.8	1.99	1.65	1.67	1.44
		B. Difference between the FamPlan variants		
Between the 1.0 and 0.5 point				
per year assumptions	-0.96	-1.06	-1.07	-1.17
Between the 1.5 and 0.5 point				
per year assumptions	-1.32	-1.46	-1.48	-1.61
		C. Difference with the United Nations 2008 fertility variant in 2050		
0.5 point per year				
- High Variant : 2.93	0.38	0.18	0.22	0.12
1.0 point per year				
- Medium Variant : 2.43	-0.08	-0.38	-0.35	-0.55
1.5 point per year				
- Low Variant : 1.93	0.06	-0.28	-0.26	-0.49

TABLE 11: PROJECTED TOTAL FERTILITY RATES BY 2050, ACCORDING TO VARIOUS ASSUMPTIONS ON THE PROXIMATE DETERMINANTS OF FERTILITY, USING THE FAMPLAN MODEL (*continued*)

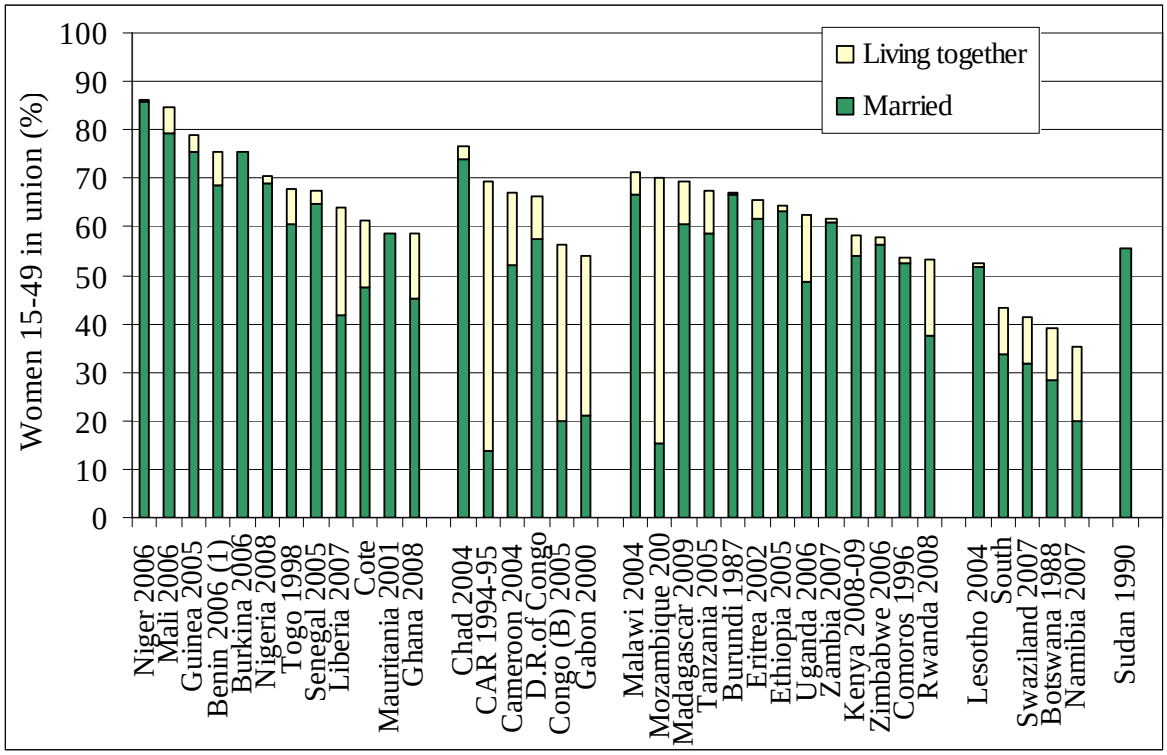
Projections variant of the proximate determinants				
Country *Percentage point increases in contraceptive prevalence and contraceptive by country in 2010 and 2050*	*A. Impact of increase in contraceptive prevalence only*	*B. Impact of Impact of increase in contraceptive prevalence and more efficient method mix*	*C. Impact of increase in contraceptive prevalence, more efficient method mix, reduced percentage of women in union and duration of postpartum insusceptibility*	*D. Impact of increase in contraceptive prevalence, more efficient method mix, reduced percentage of women in union and duration of postpartum insusceptibility, and moderate abortion rate*
NIGER				
Total Fertility Rate in 2010: 7.01		*A.* Estimated *Total Fertility Rate by FamPlan*		
0.5 point per year 2010: 13.2. 2050: 33.2	5.79	5.28	5.27	5.18
1.0 point per year 2010: 13.2. 2050: 53.2	4.56	3.75	3.75	3.57
1.5 point per year 2010: 13.2. 2050: 60.7	4.10	3.18	3.17	2.96
		B. Difference between the FamPlan variants		
Between the 1.0 and 0.5 point per year assumptions	-0.55	0.26	0.26	0.44
Between the 1.5 and 0.5 point per year assumptions	-1.69	-2.10	-2.10	-2.22
		C. Difference with the United Nations 2008 fertility variant in 2050		
0.5 point per year - High Variant : 4.01	1.78	1.27	1.26	1.17
1.0 point per year - Medium Variant : 3.51	1.05	0.24	0.24	0.06
1.5 point per year - Low Variant : 3.01	1.09	0.17	0.16	-0.05
NIGERIA				
Total Fertility Rate in 2010: 5.06		*A. Estimated Total Fertility Rate by FamPlan*		
0.5 point per year 2010: 13.5. 2050: 33.5	4.12	3.88	3.40	3.30
1.0 point per year 2010: 13.5. 2050: 53.5	3.19	2.80	2.46	2.27
1.5 point per year 2010: 13.5. 2050: 61.0	2.84	2.39	2.10	1.88
		B. Difference between the FamPlan variants		
Between the 1.0 and 0.5 point per year assumptions	-0.93	-1.08	-0.94	-1.03
Between the 1.5 and 0.5 point per year assumptions	-1.28	-1.49	-1.30	-1.42
		C. Difference with the United Nations 2008 fertility variant in 2050		
0.5 point per year - High Variant : 2.86	1.26	1.02	0.54	0.44
1.0 point per year - Medium Variant : 2.36	0.83	0.44	0.10	-0.09
1.5 point per year - Low Variant : 1.86	0.98	0.53	0.24	0.02

Figure 1: Types of fertility transitions, 2005-2010



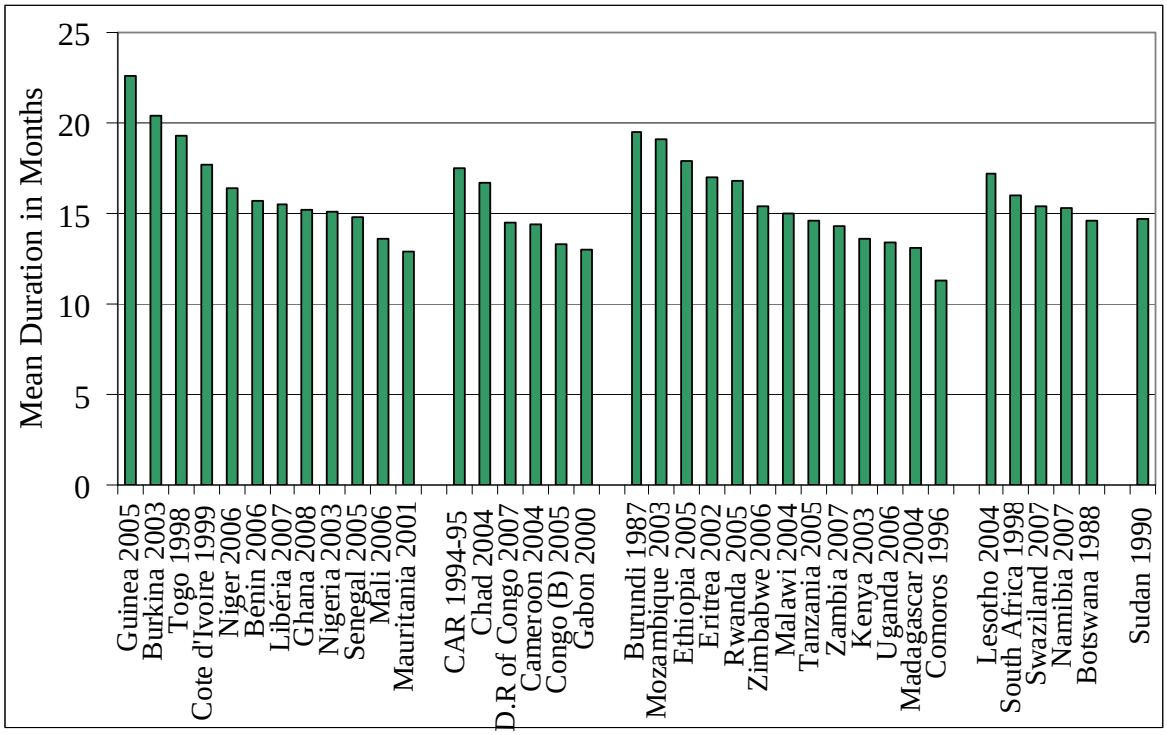
Source: Data compiled from *World Population Prospects: The 2008 Revision* Population Data base. Available from http://esa.un.org/unpp/index.asp (accessed 5 November 2009)

Figure 2. Percentage of women of reproductive age in union by country classified for each sub-region by the decreasing ranking of percentage of women in union



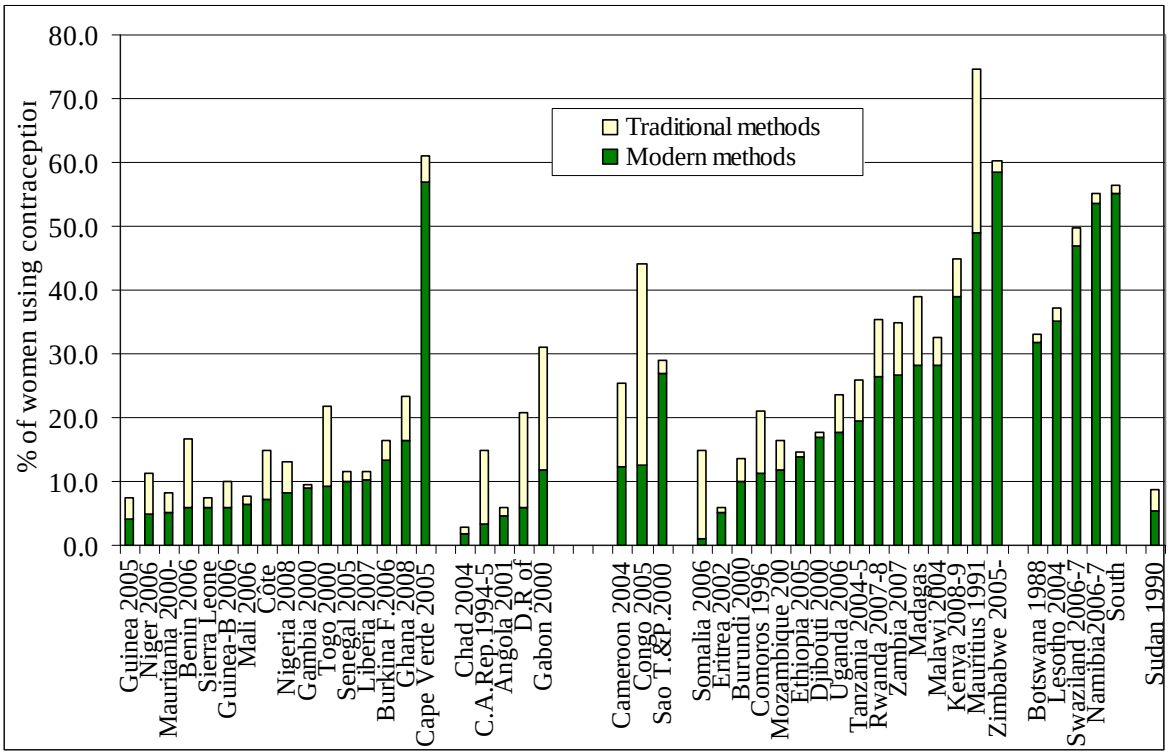
Source: Data from MEASURE DHS, STATcompiler (2009) Available from http://www.statcompiler.com (accessed 4 November 2009) (1) Data from the 2006 Burkina Faso Multiple Indicator Cluster Survey

Figure 3. Mean duration of postpartum insusceptibility (months) by country classified for each sub-region by the decreasing ranking of mean duration of postpartum insusceptibility



Source: Data from MEASURE DHS, STATcompiler (2009) Available from http://www.statcompiler.com (accessed 4 November 2009)

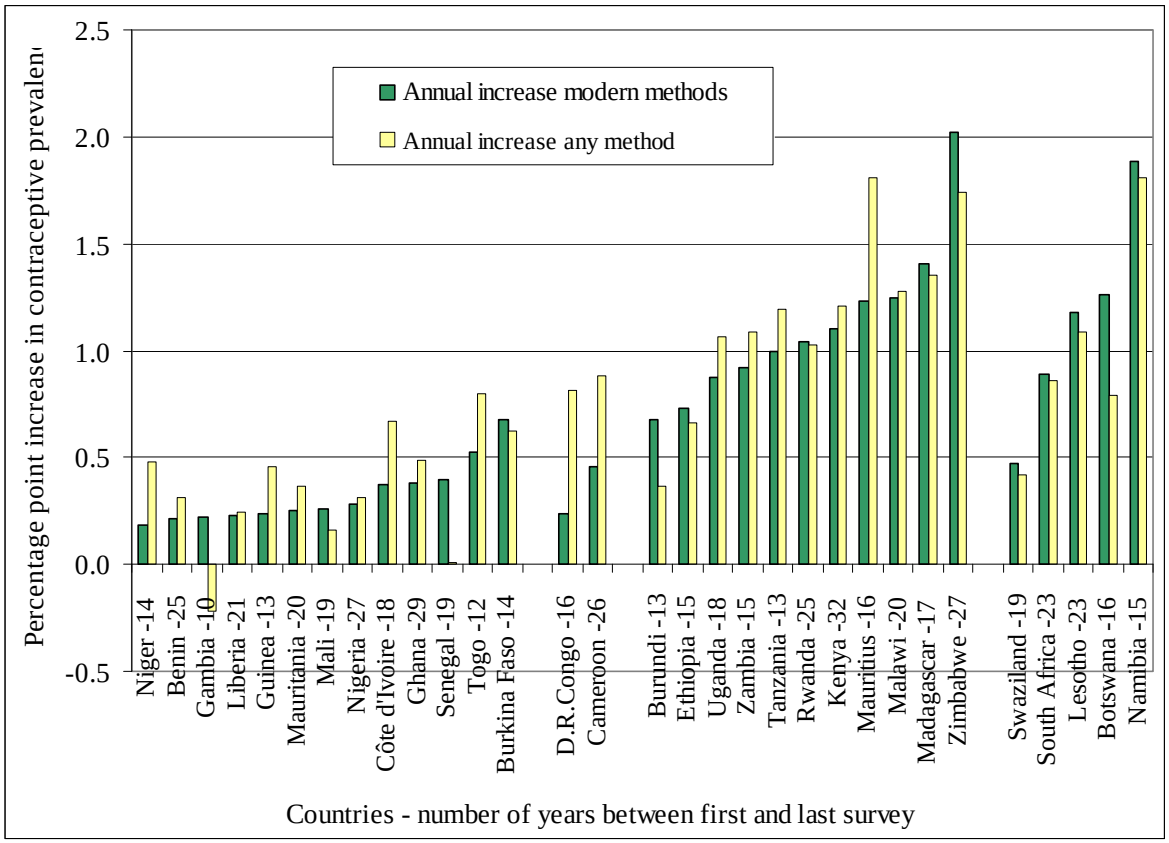
Figure 4. Contraceptive prevalence among women of reproductive age in union by country classified for each sub-region by increasing ranking of the percentage of modern methods users



NOTE: Breastfeeding and MAMA not included in the method used

Source: Data from MEASURE DHS, STATcompiler (2009) Available from http://www.statcompiler.com (accessed 4 November 2009) and UN Population Division Policy Brief No. 2009/1

Figure 5. Annual percentage point increase in contraceptive prevalence by sub-region and by percentage point increase in modern method use



NOTE: Breastfeeding and MAMA not included in the method used. Only countries with at least 10 years between first and last survey are included in this figure.

Sources: United Nations (2005). *World Contraceptive Use 2005*. Database maintained by the Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat and data from MEASURE DHS, STATcompiler (2009) Available from http://www.statcompiler.com (accessed 4 November 2009)