An analysis of the proximate determinants of fertility between Kenya and Senegal

Keita Ohashi, United Nations Population Fund

Abstract

This comparative study reviews population policy implementation between Senegal and Kenya. Senegal was the first Francophone country in sub-Saharan Africa to adopt its national population policy in 1988, whereas Kenya was the first Anglophone country to do so in 1967. Senegal started its fertility decline in late 1990s, while Kenya had already started it in mid 1980s. Kenya experienced some stall in fertility decline between 1998 and 2003 but resumed its fertility decline since then. This study examined their population policy implementation patterns with an emphasis on Francophone and Anglophone cultural comparison. Colonial influence on proximate determinants of fertility was analyzed with the use of Demographic and Health Survey data for the period between 2000 and 2023. A revised Bongaarts model on proximate determinants of fertility showed age-specific differences between the two countries. Strong contraceptive use orientation by Kenya was further reinforced in recent decades while that of Senegal remained modest by keeping its recourse to birth spacing. Marriage patterns showed similar progress with later marriage and declining marriage rates due to increased female education and employment. Abortion increased its fertility inhibiting effects in Kenya but its effect remained weak in Senegal in the last two decades.

Keywords: fertility transition, Kenya, population policy, proximate determinant of fertility, Senegal.

Introduction

This comparative study reviews population policy implementation between Senegal and Kenya. Senegal was the first Francophone country in sub-Saharan Africa to adopt its national population policy in 1988, whereas Kenya was the first Anglophone country to do so in 1967. Senegal started its fertility decline in late 1990s, while Kenya had already started it in mid 1980s. Kenya experienced some stall in fertility decline between 1998 and 2003 but resumed its fertility decline since then. This study examined their population policy implementation patterns with an emphasis on Francophone and Anglophone cultural comparison. Colonial influence on proximate determinants of fertility was analyzed with the use of Demographic and Health Survey data for the period between 2000 and 2023. A revised Bongaarts model on proximate determinants of fertility showed age-specific differences between the two countries. Strong contraceptive use orientation by Kenya was further reinforced in recent decades while that of Senegal remained modest by keeping its recourse to birth spacing. Marriage patterns showed similar progress with later marriage and declining marriage rates due to increased female education and employment. Abortion increased its fertility inhibiting effects in Kenya but its effect remained weak in Senegal in the last two decades.

Conceptual Framework: The Proximate Determinants of Fertility Model

Analytical framework for the variation of fertility

Davis and Blake (1956) developed the foundation of analytic framework that any socioeconomic and cultural factors will affect fertility through the changes of intermediate variables. The model explained that three intermediary variables – intercourse, conception (inception of pregnancy), and gestation (pregnancy) – will be influenced by socioeconomic and cultural effects to change. And then, those intermediate variables will in turn influence the variation of fertility. The intercourse variable talked about marriage (age, celibacy,

reproductive period without disruption by divorce and death of spouse) and sexual intercourse (voluntary and involuntary abstinence with sterility, coital frequency). The conception variable talked about fecundity (voluntary or involuntary) and contraceptive use. The gestational variable talked about voluntary or involuntary foetal mortality. For example, marriage pattern is subject to cultural norms of a society. If a marriage is expected before the age of 25 for a woman as in the past, the reproductive life span is from 25 to 40 years old. Today, a woman in Europe and other developed countries get married after 25, 30 and even after 35. Therefore, the duration of reproductive cycle has shifted to from 35 to 45 years, much shorter and later compared with the past. Naturally, this will have greater inhibitor effect on fertility.

Proximate determinants of fertility: Bongaarts model

Bongaarts (1978) refined the analytical framework of Davis and Blake and conceptualized proximate determinants of framework model with the re-specification of the two classes of fertility determinants: (1) proximate variables, and (2) socioeconomic and environmental background variables. The proximate variables were regrouped with three broad categories (exposure factors, deliberate marital fertility control factors, natural marital fertility factors) and were reduced from eleven to eight:

1. Proportions married;
2. Contraception;
3. Induced abortion;
4. Lactational infecundability;
5. Frequency of intercourse;
6. Sterility;
7. Spontaneous intrauterine mortality;

8. Duration of the fertility period.

And the socioeconomic and environmental background variables include social, cultural, economic, institutional, psychological, health, and environmental variables. The proximate determinants consist of all biological and behavioral factors throughout which the background variables must operate to affect fertility.

Figure. Bongaarts framework for analyzing the proximate determinants of fertility (Bongaarts 1978)

Marriage was modeled with the use of the proportion of the marriage of woman. At the time, most of the reproduction was expected after the marriage, thus it was reasonable to use this variable. Contraception was modeled with the use of the current use of modern contraceptive methods. Postpartum insusceptibility was modeled with the use of lactational amenorrhea and postpartum abstinence. Sterility was modeled in consideration with primary and secondary infertility.

Bongaarts and Potter (1983) later revised the model by adding abortion as an additional component for the model. This includes both voluntary and involuntary abortion. The proximate determinants were restructured and became nine as a result:

1. Proportion of women married or in sexual union;
2. Frequency of intercourse;
3. Postpartum abstinence;
4. Lactational amenorrhea;
5. Contraception;
6. Induced abortion;
7. Spontaneous intrauterine mortality;

8. Natural sterility;
9. Pathological sterility.

Bogaarts model has been widely used for the analysis of fertility change and to understand the importance and mechanism how each proximate determinant will interact with fertility. Increased availability of population census and DHS from the 1980s are major contributors to allow the use of the proximate determinants model. The basic model was specified as:

$$TFR = C_m \times C_c \times C_i \times C_a \times TF$$

Where $TFR = Observed\ total\ fertility\ rate$

$C_m = Marriage\ index$

$C_c = Contraception\ index$

$C_i = Postpartum\ infecundability\ index$

$C_a = Abortion\ index$

$TF = Total\ fecundity\ rate$

Stover model

Stover (1998) proposed to modify Bongaarts model with some proposals to change specifications. For the component of marriage, Stover proposed: 1) to use sexually active women without fertility inhibiting effects instead of the proportion of married women as a proxy for sexual intercourse variable. Because if the data are available, it is more accurate to get sexual activity data both from sexually active married and single women; 2) to revise the sterility index to measure infecundity from all causes; 3) to use the index of contraception that

accounts for the fact that users of sterilization may become infecund before age 49; and 4) to revise the definition and estimate of total fecundity.

The increased availability of new data presented the opportunity to refine the proximate determinants indexes. Stover proposed the following model:

$$TFR = C_x \times C_i \times C_a \times C_f \times C_u \times Pf$$

where Cx is the proportion of women aged 15-49 who are sexually active, Ci is the mean duration (in months) of postpartum insusceptibility, Ca is the index of abortion, Cf is the proportion of sexually active women who are infecund, Cu is the proportion of sexually active, fecund women using contraceptives that does not overlap with that experiencing postpartum amenorrhea, taking into account the average effectiveness of contraception, and Pf is the index of potential fertility.

Revised Bongaarts model

Bongaarts (2015) proposed revised equations for the age-specific proximate determinants model in taking account of Stover's proposals and in improving some other elements with updated global situation and methodology:

$$f(a) = C_m^*(a) \times C_c^*(a) \times C_i^*(a) \times C_a^*(a) \times f_f^*(a)$$

Where $f(a) = Fertility\ rate$

$C_m^*(\mathrm{a}) = Sexual\ exposure\ index$

$C_c^*(\mathrm{a}) = Contraception\ index$

$C_i(\mathrm{a}) = Postpartum\ infecundability\ index$

$C_a^*(\mathrm{a}) = Abortion\ index$

$f_f^*(a) = Revised\ fecundity\ rate$

The calculation of these indexes requires the following age-specific variables:

m(a)= proportion married/in union

ex(a)= extramarital sexual exposure

u(a)= contraceptive prevalence (among sexually active women)

o(a)= contraceptive prevalence that overlaps with postpartum infecundability

e(a)= average contraceptive effectiveness

r(a)= fecundity adjustment

i(a)= average duration of postpartum infecundability

f(a)= fertility rate

fm(a)=f(a)/{m(a)+ex(a)} = fertility rate among sexually exposed women

ab(a)= abortion rate.

All but two of these variables can be estimated from DHS surveys. The exceptions are r(a), and ab(a). Sterility index was not included in the revised model based on the assumption that beginning in the 1990s, the role of sterility variations appears to have become small enough to be ignored (with the disappearance of high pathological sterility until the 1980s especially in sub-Saharan African context).

Then, the revised aggregate model will be calculated. The aggregate indexes are weighted versions of the age-specific indexes, with the weights varying by index. As a result, the aggregate and age-specific models are completely consistent with one another:

$$TFR = \sum C_m^*(a) \times C_c^*(a) \times C_i^*(a) \times C_a^*(a) \times f_f^*(a) = C_m^* \times C_c^* \times C_i^* \times C_a^* \times TF^*$$

Where

$$TF^{*} = Revised\ total\ fecundity\ rate$$

Sexual exposure index

The assumption in the original proximate determinants model that sexual activity or childbearing only take place within marriages or consensual unions was an issue with increasing extramarital sexual exposure in many populations. The name of the index of marriage was changed to the more accurate index of sexual exposure. Stover (1998) and Bongaarts (2015: 542) agree on the need to take into account sexual activity outside formal unions and to exclude overlap between contraceptive use and postpartum infecundability. The revised Bongaarts model adopts the latter approach which assumes that all women who are married or in a union are exposed to the risk of pregnancy, and includes all women (regardless of their marital status) who have had sex in the last month or are pregnant or abstaining postpartum or are contraceptive users. This slightly more inclusive definition of exposure is based on the assumption that most women who are in union and have sex less than once per month still should be considered at risk of pregnancy. It also seems plausible to assume that most contraceptive users are sexually active, even if they have not had sex in the past month.

$$C_m^*(a) = m(a) + ex(a)$$

Where m(a) = proportion married/union

ex(a) = extramarital exposure

The aggregate sexual exposure index is:

$$C_m^* = \sum C_m^*(a) \times W_m(a)$$

Where $W_m(a) = \frac{f_m^*(a)}{\sum f_m^*(a)}$

Where $f_m^*(a) = C_c^*(a) \times C_i^*(a) \times C_a^*(a) \times f_f^*(a)$

Where $f_m^*(a)$ is fertility rate, exposed women.

Alternatively, $C_m^*$is calculated as follows:

$$C_m^* = \frac{TFR}{TMFR} = \frac{\sum f(a)}{\sum f(a)/m(a)}$$

Where TFR is total fertility rate, TMFR is total marital fertility rate, f(a) is age-specific fertility rates, and m(a) is the proportion currently married among females (Bongaarts 1982).

Contraception index

Stover and Bongaarts agree on the need to address the overlap between postpartum amenorrhea and contraceptive use. As the use of contraception has risen over time, the proportion of use that overlaps with postpartum infecundability has become significant in societies with long periods of breastfeeding or abstinence (Stover 1998). Thus, Bongaarts' revised model proposed to exclude overlap between contraceptive use and postpartum infecundability, which may be due to either breastfeeding or abstinence (Bongaarts 2015: 542). Then, this model also uses the age-specific proximate determinants model instead of the aggregate model in order to be consistent with the fact that other indexes are not affected by the age distribution of the population of women in unions (age weighting of contraceptive prevalence in the index of contraception). Lastly, this revised age-specific model integrates variation in contraceptive effectiveness by age and method, compared with the original aggregate model which took account of variations in the average level of effectiveness by method type.

Cc is calculated from the proportion of all sexually active women of reproductive age currently using specific methods of modern and traditional forms of contraception. These proportions are then weighted by each method's use effectiveness as stated here:

$$C_C^*(a) = 1 - r^*(a)\{(u^*(a) - o(a)\}e^*(a)$$

Where $u^*(a) = Conraceptive\ prevalence\ (exposed\ women)$

$o(a) = Overlap\ with\ postpartum\ infecundability$

$e^*(a) = Average\ effectiveness$

$r^*(a) = Fecundity\ adjustment$

The aggregate contraception index is:

$$C_C^* = \sum C_C^*\, W_C(a)$$

Where

$$W_C(a) = \frac{f_n^*(a)}{\sum f_n^*(a)} \approx \frac{f_f^*(a)}{\sum f_f^*(a)}$$

Where $f_f^*(a) = Natural\ exposed\ fertility$

$f_n(a) = C_i^*(a) \times C_a^*(a) \times f_f^*(a)$

The contraceptive use effectiveness rates were obtained from previous studies as follows: sterilization (0.99), oral pill (0.91), IUD (0.99), injectable (0.94), implants (0.99), male condom (0.82), rhythm/periodic abstinence (0.76), withdrawal (0.78), lactational amenorrhea and folk method (0.70) (Bongaats 1982; Shallo 2020).

Postpartum infecundability index

No revision was needed for Bongaarts' revised age-specific proximate determinants model compared with its original specification (the model takes into account the average 27-month delay between a change in postpartum infecundability and its impact on fertility). Ci is calculated as the ratio of the mean birth interval without postpartum insusceptibility to that with postpartum insusceptibility.

$$C_i^*(a) = \frac{20}{18.5 + i(a)}$$

Where $i(a) = Average\ duration\ of\ postpartum\ infecundability$

The aggregate postpartum infecundability index is:

$$C_i^* = \sum C_i^*(a) \times W_i(a) \approx C_i$$

Twenty (20) months is considered to be the mean birth interval without PPI derived from estimates of the postpartum infecundable period (1.5 months for lactational amenorrhea), waiting time for conception, time associated with spontaneous miscarriage and the nine months associated with gestation. Therefore, 18.5 represents the average birth interval with breastfeeding.

Abortion index

Ca represents the most challenging of calculations as abortion, in general, stands as one of the toughest indicators to directly measure or observe. Induced abortion tends to be greatly underreported, particularly in lower- and middle-income countries where the legal

status of abortion may be restricted. Indeed, in most developing countries, reliable data for the prevalence of induced abortion is virtually impossible to acquire. The revised proximate determinants model of Bongaarts employs a more accurate equation for the number of births averted per abortion based on the research by Bongaarts and Westoff (2000).

$$C_a^*(a) = \frac{f(a)}{f(a) + b^* ab(a)}$$

Where $ab(a) = Abortion\ rate$

$$b^* = \frac{14}{18.5 + i(a)}$$

In developed countries with reasonably accurate abortion statistics, abortion rates by age have an inverted U graph-shape, with peak rates between ages 20 and 29 (Sedgh et al. 2012). Bongaarts assumes that the countries in developing countries also have an inverted U graph-shape. And he further assumes that this shape is the same as that of the age-specific fertility rates. With this assumption, the ratio of age-specific abortion rates to age-specific fertility rates is equal to TAR/TFR at all ages. Estimates of TAR are calculated as 30 times the abortion rate per 1,000 women aged 15–45 (divided by 1,000). The abortion rate for individual countries is obtained by assigning each country the abortion rate of its world sub-region as estimated by Bankole et al. (2020).

The aggregate abortion index is:

$$C_a^* = \sum C_a^*(a) \times W_a(a) \approx \frac{TFR}{TFR + b^* TAR}$$

Where $TAR = Total\ abortion\ rate$

Language and cultural influence on fertility

The majority of Sub-Saharan African countries were colonized by European countries in the past. France and the United Kingdom were major colonizers. They themselves had distinctive fertility transition experiences in the past. France was the first European country to start fertility decline in early 18th century, but its fertility transition took long time until the early 20th century. France has had long tradition of pronatalist attitudes and the position against the ideas of contraception and abortion in the area of fertility regulation. Therefore, its fertility transition, even if it started much earlier than many other European countries, took long period to attain the replacement level of fertility, i.e. the end of fertility transition.

On the other hand, the fertility decline of the United Kingdom started much later in the late 19th century. However, they were liberal in adopting new ideas and in particular neo-Malthusian idea of fertility regulation by the use of contraception. The recourse to abortion was less restrictive. The fertility attained the replacement level by the early 20th century and it took much shorter in terms of the duration of the fertility transition.

Both France and the United Kingdom influenced their postcolonial period population policy formulation in sub-Saharan Africa. When the international community mainly led by the United States started to intervene the post-World War II development assistance to developing countries, the population data collection and population policy formulation were encouraged for the majority of the sub-Saharan African countries by the 1960s. The British and American influenced Anglophone countries were largely influenced for neo-Malthusian ideas of fertility regulation to curb too rapid population growth compared with stagnant economic development. The means of the fertility regulation were the use of increasingly available modern contraceptive methods, artificial sterilization and depending on the context the recourse to induced abortion. The establishment of family planning programme has been encouraged.

On the other hand, Francophone culture was much reluctant to the adoption of the neo-Malthusian policy orientation. French influence was felt in former colonies as the latter imported French laws into theirs including that of prohibiting the use of contraception and abortion. These laws were effective in most of the countries until the 1970s. Therefore, former French colonies were reluctant to the promotion as well as the establishment of the national family planning programme. This cultural influence has continued most likely until the 1990s. In many Francophone countries, the use of modern contraceptive methods for fertility limitation has not been still supported socially, even if it is largely allowed for spacing births for the sake of the health of mothers and children.

This two major division in population policy formulation and implementation will recall us the comparison with historical fertility transition experiences in major regions of the world. The Princeton European Fertility Project was the first to compare fertility transitions in major regions of the Europe during the 19th and early 20th centuries and one of the key findings was that fertility transition occurred among the group where people shared the same culture and language controlling for economic and social development levels. Countries with British descendants with English-speaking culture, such as Australia, Canada, New Zealand, and the United States, experienced equally fertility transitions largely around the same time. In Asia, countries and regions with Chinese descents, such as Hong Kong, Singapore, and Taiwan, experienced fertility transitions around the same time. In Latin America where they share Latin culture of Spain and Portugal experienced fertility transitions around the same time. In Middle East, Arabic speaking countries experienced fertility transition around the same time.

There are variations inside countries in fertility transition. Canada experienced two distinct fertility transitions period between francophone population, mostly Catholic and reside in Quebec, and Anglophone population, mostly Protestant and reside in the rest of Canada. Compared with Anglophone, Francophone fertility remained high historically for

decades prior to the start of their fertility decline in the 1960s with Quiet Revolution. The modernization of socioeconomic situations in the French-speaking province was attributed as a main reason for this later transformation (Krull and Trovato 2003). French culture and Catholicism were considered as major factors for the delay in the onset of the fertility decline for Francophone populations (Beaujot 2000). The differences in fertility and contraceptive use between the two groups eventually disappeared by the 1970s – there was a conversion of reproductive behavior (Balakrishnan et al. 1985; Barrington-Leigh 2013; Gauvreau and Laplante 2016).

Belgium experienced equally two distinctive fertility transitions periods between the Dutch-speaking Flemish who live in the northern part of the country and the French-speaking Walloons who live in the southern part. Fertility transition took place much earlier with the Walloons in the 1880s, 30 years earlier than the Felimish. Lesthaghe linked the timing of fertility decline to language rather than levels of socioeconomic modernization in Belgium by showing the difference of fertility transitions between the Flemish and the Walloons. The language border between the two groups exhibited a marked differential. The findings alerted the profession about the significance of cultural factors over and beyond socio-economic ones. (Lesthaeghe 1977). The theory of diffusion considers that new ideas spread across societies much faster and easier among the people who are culturally closer to each other, such as ethnicity and language.

In sum, we consider that cultural and language difference between Francophone and Anglophone countries in sub-Saharan Africa created a division in the formulation and implementation of the population policy until the 1980s. This trend might have started to change since the 1990s. In particular, after the International Conference on Population and Development which held in Cairo in 1994, a paradigm shift occurred in the area of population and development agenda by focusing on individual rights, namely on sexual and reproductive

rights and gender equality. These policy reformulation has been gradually penetrating and modifying the perception and attitude of sub-Saharan African countries all over. Together with the globalization of the world economy, population policy has been reemphasizing family planning programme with a new focus on choice. Increasing liberalization of the use of contraception and for the recourse to abortion might be a new trend.

Data

We use data from the Demographic and Health Surveys for both Senegal and Kenya between 2000 and 2023 and conduct the proximate determinants analysis with the revised Bongaarts model and corresponding standardization and decomposition. All DHS are nationally representative household surveys, but have adequate sample sizes to conduct analyses of urban-rural differentials as well as of capital and other major cities. The DHS uses a stratified, two-stage cluster design.

Study Population in light of the population policy implementation context

Kenya

Kenya is situated in East Africa and is comprised of 54.0 million of population in 2022. The population is young with 46% (21.9 million) of total population below the age of 18 years with those in the ages of 10-19 (adolescents) constituting 11.6 million (National Council for Population and Development 2024). The country experienced a rapid increase in population since its independence in 1963 from the UK due to mortality decline and the high level of fertility. Kenya attracted strong attention of the international community, in particular that of the United States, on support for population policy implementation since the 1960s. This is because of the high level of fertility in the country, the total fertility rate remained as 8.1 children per woman until 1977-78. Kenya is one of the former British colonies and the

country was relatively open to advice on population policy implementation, including the neo-Malthusian approach to the use of modern contraception to curb its population growth. Kenya declared its national population policy in 1967, the first sub-Saharan African country to do so. The national family planning programme of Kenya was established in 1968 to operationalize the national population policy implementation.

Figure. Map of Kenya

Until the early 1990s, researchers were skeptical about Kenya's onset of fertility transition as its family planning programme implementation was considered to be a failure (Caldwell and Caldwell 1987; Frank and McNicoll 1987). But their fertility had already started to decline in the 1980s and Kenya's fertility transition started in the late 1980s (Kirk and Piller 1998; Robinson 1992). An increase in modern CPR accompanied by a decrease in desired number of children was a major cause for the start of the fertility decline in Kenya. After a short period of the stall in fertility decline between 1998 and 2003, fertility resumed its decline. The stagnation of the fertility decline (as well as of the modern CPR increase) during that period was due to the shift of public health attention from family planning to HIV/AIDS response (Askew et al. 2017). But later there was a resumption of fertility decline as well as CPR increase due to this time increasing domestic efforts, in particular budgetary, to support family planning programme in addition for the international community to coming back to population policy support. Today, Kenya's TFR stands at 3.2 (www.statista.com). Kenya showed much stronger effect of contraception on fertility decline compared with the delayed marriage and subsequent first pregnancy. The infant mortality rate declined to 29.7 for 1,000 live births by 2023 (www.macrotrends.net) and life expectancy at birth increased to 66.2 years old in 2015-2020 (United Nations, 2020). The mortality started to decline in the

1970s with the improvement on health and hygienic conditions and it was one of the reasons for Kenya to have experienced a rapid population growth. Kenya has revised its national population policy in 2000. Those revisions were mainly to integrate the results of new policy orientation with the establishment of the Programme of Action of the International Conference on Population and Development in 1994. The integration of reproductive health and that of gender as new terminologies and concepts into policies were necessary.

Senegal

Senegal is situated in West Africa and is comprised of 17.3 million of population in 2022. The country has young population and 41.1% of them were aged 0 to 14 in 2023 (www.statista.com). The country experienced a rapid increase in population since its independence in 1960 from France due to mortality decline and the high level of fertility. Senegal has also attracted the attention of the international community on support for population policy implementation since the 1970s. The country is open to policy advice on economic development from external experts. Senegal declared its national population policy in 1988, the first Francophone African country to do so. Senegal established the national family planning programme in 1991. Senegal has revised its national population policy in 2002. However, compared with the case of Kenya, the country was timid in accepting the limitation of births as a policy measure. Senegal is one of the former French colonies and attitudes towards manmade or artificial intervention in the area of procreation had been rather conservative due to predominant Catholic doctrine of France (Krull and Trovato 2003) together with pronatal Islamic doctrine (Mahmoud 2012) of Senegal.

Figure. Map of Senegal

Senegal entered fertility transition much later in the late 1990s (Randall and LeGrand 2003). The major cause of its fertility decline was not modern CPR but the delayed marriage with increasing female education. Reinforced birth spacing for married women was another contributing factor. Millogo (2020) reaffirmed this observation in his study for three capital cities in Africa (Dakar, Nairobi, Ouagadogou) that the fertility decline of Nairobi was strongly led by modern CPR increase, whereas the abstinence was a major contributing factor for fertility declines in Dakar and Ouagadougou. Then, delayed marriage was a major factor for all the three capital cities. Today, TFR of Senegal shows at 4.0 in 2023 (DHS Senegal), steady decline but the pace is much slower compared with Kenya. The infant mortality rate declined to 33 for 1,000 live births and life expectancy at birth increased to 67.5 years old in 2015-2020 (United Nations, 2020).

Comparison between the two countries in fertility outcomes

The TFR of Kenya and Senegal evolved between 1960-2021 as shown in figure (www.datacommons.org). In the late 1980s, the level of TFRs in Kenya was 6.7 while in Senegal it was 6.4, approximately the same level. As Kenya had started its fertility decline earlier, the fertility decline continued until 1998 when it reached 4.7 (DHS Kenya). Then, demographic literature reported the stagnation of fertility decline due to the shift of attention and funding by the international community from family planning programme support to HIV/AIDS response period between 1998 and 2003 in sub-Saharan Africa (Bongaarts 2006, 2008; Garenne 2008; Shapiro and Gebreselassie 2008). Kenya was one of the countries frequently cited as stagnant fertility decline and witnessed a slight increase of its fertility to 4.9 (DHS Kenya). The trends in modern CPR prevalence during the period showed a stagnation of its prevalence for currently married women age 15-49 as the rate remained the

same as 31.5% between 1998 and 2003. The rate for all women declined from 23.6% to 22.7%, whereas the rate for sexually active women increased from 36.2% to 38.0% (DHS Kenya). However, after the repositioning trend of family planning programme starting from the second half of the 2000s, the TFR decline and modern CPR increase resumed. Kenya's TFR declined from 4.6 in 2008-09 to 3.4 by 2022 (Kenya DHS). The modern CPR increased from 31.5% to 56.9% for currently married women age 15-49 during the same period. If we focus the period between the 2000s and the 2010s, the resumption of the fertility decline and of the modern CPR increase in Kenya has been significantly high. Its TFR declined by 26% between 2003 and 2022 in 19 years.

In Senegal, in contrast, the TFR decline was 25% between 2005 and 2023 in 18 years (Senegal DHS). Senegal's TFR declined from 5.3 in 2005 to 4.0 by 2023. The modern CPR increased from 10.3% to 25.6% for currently married women age 15-49 during the same period. The fertility level has been steadily declining but with much slower pace compared with Kenya. Modern CPR has increased but with much slower and modest pace as well.

Figure. Total fertility rates in Kenya and Senegal, 1960 - 2021

Results and discussion

Of the four proximate determinants of fertility, contraception contributed the highest fertility inhibiting effect in Kenya. While postpartum infecundity, sexual exposure and abortion had a relatively constant effect on fertility over the last two decades, the fertility inhibiting effect of contraceptive use significantly increased. On the other hand, postpartum infecundity remained the highest fertility inhibiting effect in Senegal. Sexual exposure contributed significantly after the postpartum infecundity. Contraception and abortion remained with limited contribution over the years considering the fact that they are still

socially inacceptable in most parts with the sociocultural context. Table presents the results of the proximate determinants analysis for Kenya and Senegal with available data.

Tables Estimated index of proximate determinants of fertility in Senegal and Kenya

Following section describes some data and analysis in relation with each proximate determinant related area.

Sexual exposure

The prevalence of premarital sexual engagement is considered to be increasing markedly in both Senegal and Kenya. It is estimated that the number of induced abortions is on increase accordingly. Tables show the evolution of sexual exposure by age specific groups for Senegal and Kenya, respectively. Senegal showed that the proportion of sexually active women aged15-19 decreased from 16.7% in 2005 to 10.8% in 2023. Kenya equally showed a similar tendency. Its proportion of sexually active women aged 15-19 decreased from 16.9% in 2005 to 9.6% in 2022. These declines in sexual activity by teenage girls are due to delayed age at marriage, and increased schooling opportunities for girls.

Tables. Proportion of sexually active women by age, recent sexual activity in last 4 weeks

Tables show the mean age at first marriage for both women and men in Senegal and Kenya between the two reference periods. In Senegal, the mean age for all the women aged 25-49 increased from 18.3 years old in 2005 to 20.4 years in 2023. Over the last two decades, the mean age at first marriage for all the women increased by two years. The mean age at first marriage for men also increased but smaller compared with that of women. As for Kenya,

overall mean age at first marriage for women aged 25-49 increased from 19.7 years old in 2003 to 21.0 years old in 2022. The generational change is also confirmed. The age group 45-49 experienced the mean age of marriage as 18.9 years old but young generation for the age group 25-29 experienced the mean age of marriage as 20.3 years old. By 2022, increases were observed for all age groups, and the age group 30-34 increased to 21.6 years old and the age group 45-49 increased to 20.4 years old.

Tables. Mean age at first marriage

Female education has made tremendous progress in both countries during the last two decades. Table shows the comparison between the two countries. In Senegal, the proportion of educated (attendance with some schooling) women increased from 39.1% in 2005 to 56.4% in 2019 (44% increase). The increase in secondary education attendance, often cited as having greater inhibiting factor to reduce fertility because of the expected age of attendance is remarkable from 8.3% to 30.5% (267% increase). As for Kenya, the proportion of educated women increased from 76.71% in 2003 to 94.5% in 2022, approaching to universal education for girls (23% increase). The increase in secondary education attendance was from 13.5% to 38.4% (284% increase).

Table. Female education

Contraception

Table shows the data on contraceptive prevalence in Senegal between 2005 and 2023. Senegal has made a good progress in the use of modern CPR. For married women aged 15-49, the rate increased from 10.3% to 25.6%. The increased rates were more than double for most

age groups except for the age group 15-19. As to the prevalence for sexually active unmarried women aged 15-49, it decreased slightly from 43.3% to 40.1%. We will look into the possible causes of this change with raw data. On the other hand, Kenya had already started its fertility decline with an increased use of contraception by the 1990s. After some stall in family planning programme investment in the late 1990s and the early 2000s due to the shift to HIV/AIDS response by international community, we expected a resumption of the increase in contraceptive prevalence during the period in study because since the late 2000s population policy programmes have been getting a refocus by major family planning donors' attention. As expected, table shows a strong increase in the use of modern contraceptive methods in Kenya. In 2003, the modern contraceptive prevalence rate (CPR) for the married women aged 15-49 was 31.5% but it increased to 56.9% by 2022. The substantial increases in modern CPR were observed for all age groups from 15-19 to 45-49. As for unmarried sexually active women aged 15-49, the data showed that it decreased slightly from 60.9% in 2003 to 59.2% in 2022. We will need to reinvestigate the data on this but young age groups (15-19, 20-24) are apparently showing substantial increases in the use of modern CPR from 37.1% to 43.8%, and 42.0% to 62.9%, for respective age groups. That is, the resumption of family planning programme investment seems to have shown effective positive changes for all groups of women, regardless of age group or marital status.

Tables. Current use of contraception

A big contrast for the use of contraception between Senegal and Kenya is related with the changing motivation for the use of contraception. Tables compare the major motivation for family planning between spacing and limitation in terms of unmet need in the two countries. Total demand for family planning is composed of unmet need for family planning

and met need (currently using contraception) for family planning. The tables show the unmet needs for modern methods for currently married women and sexually active unmarried women. Further, the comparison has been made for young age group 15-24 between currently married young women and sexually active unmarried young women.

For married women, unmet need for spacing is larger than that of limiting in both countries. But we notice that unmet need for limiting is about the same level as spacing in Kenya. But unmet need decreased from 2003 to 2022 indicating more satisfied needs on family planning. In 2003, the unmet need for limiting was 16.6% compared with that for spacing as 18.5%. In 2022, the unmet needs for limiting was reduced to 6.4% and the unmet needs for spacing was reduced to 7.6%. This could mean that Kenyan married women had more unmet need for limiting in the past it was increasingly satisfied over the years and ended up with lower fertility outcome. For Senegal, the unmet needs for spacing and limiting for married women were reduced only slightly. In 2005, spacing needs and limiting needs were 17.6% and 5.7%, respectively. By 2023, they were reduced to 14.1% and 5.0%, respectively. This could indicate that unmet needs are still less pronounced for married women in Senegal, especially for the limitation of births.

Tables. Unmet needs for modern methods of family planning

For sexually active unmarried women, the two countries have different tendencies. The unmet need for spacing is greater than that of limiting for both countries, but the time change shows different directions. In Senegal, the level of the unmet need for spacing remained at the same level from 41.8% in 2005 to 40.2% in 2022. This could indicate that that family planning programme remains weak and may not be friendly for unmarried women. There is sharp contrast with the situation of Kenya where the unmet need for spacing largely

decreased from 30.2% in 2003 to 14.2% in 2022. This could be interpreted as Kenya's increased satisfaction with more available family planning products for sexually active unmarried women.

Postpartum insusceptibility

Table shows the trends in postpartum insusceptibility by women age 15-49 for both amenorrhea and abstention. Senegal and Kenya have similar trends in the last two decades. The mean duration of postpartum amenorrhea and the mean duration of postpartum abstaining both were shortened in both countries over the two decades. In Senegal, postpartum amenorrhea declined from 12.5 months in 2005 to 11.7 months in 2023. Postpartum abstaining declined from 7.4 months to 2.8 months in the same period. In Kenya, postpartum amenorrhea declined from 9.3 months in 2003 to 4.5 month in 2022. Postpartum abstaining declined from 6.9 months to 3.7 months in the same period.

Table. Postpartum insusceptibility

Table shows the change in birth intervals in Senegal and Kenya for the last two decades. Both countries experienced the birth intervals becoming longer for all the women age 15-49. In Senegal, the interval increased from 33.4 months to 37.6 months between 2003 and 2023, whereas in Kenya it increased from 32.6 to 42.1 months between 2005 and 2022. In general, birth intervals tend to be shorter with young mothers, but longer if they are educated, living in urban areas and belong to rich households. But, we expect this tendency to advance with increasing educational and employment opportunities for women in both Senegal and Kenya contexts. As stated above, both countries have been extending birth intervals periods and this seems to be led by younger generation of mothers.

Table. Birth interval

Abortion

Sexually active unmarried adolescents have far higher rates of abortion than do all women of reproductive age. The global abortion rate is estimated at 40 per 1,000 women. The rate for sub-Saharan Africa is estimated at 33 per 1,000 women. Besides, restricting abortion makes no difference in how often it occurs, where abortion is prohibited and where it is broadly legal (Bankole et al. 2020). Abortion rates for Senegal and Kenya come from the estimates of various studies (Bankole et al. 2020; Ministry of Health (Kenya) 2013; Sedgh et al. 2015). As the table shows, the rates for Senegal, 16-17 per 1,000 women between 2005-2023, is one of the lowest in sub-Saharan Africa, whereas those of Kenya, 48 per 1,000 women between 2003-2022, is one of the highest in the region.

Table. Abortion

Conclusion

The type of proximate determinants of fertility analysis has been evolved over the years. Until the 1990s, abortion was less important in terms of contribution factor for fertility inhibition and also its data were not easily available. Therefore, some research with the use of the proximate determinants of model omitted this index. Instead, those research tried to estimate pathological sterility or primary sterility as its prevalence had been higher in many part of the sub-Saharan Africa and in particular for Central African sub-region. Nowadays, however, the importance of this index has become less significant, as most countries in sub-Saharan Africa improved sanitary and hygiene conditions and STI prevalence has become less

impactful for fertility inhibition effects. The revised Bongaarts Model, thus, did not include this sterility index anymore. The abortion index, however, increased its importance on fertility inhibiting effects. Many countries in sub-Saharan Africa have advanced towards the liberalization of induced abortion, especially since the 2000s with the adoption of the Maputo Protocol in 2003, which was facilitated by the African Union, to promote new reproductive health policy in the continent. The liberalization of the abortion has started with its legal relaxation in terms of restriction in some countries and has been spreading to other countries. Some country, like Benin, adopted a bold fully liberalized abortion law in 2021, allowing women to recourse to induced abortion with socioeconomic reason. Besides, new round of DHS started collecting abortion data as part of its questionnaire module. Kenya and Tanzania were among the first to implement the recent round of the DHS with the integration of abortion questions. In sum, it is evident that the importance of abortion index has increased and at the same time data availability and better estimating methods for the prevalence of abortion have also increased. With those changing trends in mind, this study is part of the efforts to apply the revised Bongaarts model for the proximate determinants of fertility analysis in some country contexts.

In both Kenya and Senegal, the age at marriage is increasing; however, the age at which sexual exposure first occurs is becoming earlier. In general, the trends of fertility and the effects of proximate determinants of fertility observed in both countries were similar to the other Sub-Saharan African Countries. We however reaffirmed that the contribution of contraception index in Kenya became much stronger to reduce fertility in the past two decades. At the same time, we confirmed that the contribution of sexual exposure index was important for both countries. The third important contributing factor was abortion. It is becoming important especially in the context of Kenya where sexual exposure prior to marriage is increasing. In sum, Kenya exhibited increasingly stronger effects of contraception,

sexual exposure, and abortion over the years. Senegal exhibited increasingly stronger effects of sexual exposure but the effects of contraception and abortion remained weak. It confirms that social norms against the control of procreation by the use of contraception and abortion remain strong in Senegal. Finally, postpartum infecundability remained the significant contributor for fertility inhibiting effects in both countries but their proportions were slightly reduced with the shortening duration of postpartum insusceptibility.

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