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The Impact of Proximate Determinants on Fertility Decline in Botswana

TEBOGO LALETSANG

ID No: 9503244

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ABSTRACT

This study attempted to identify the proximate determinant of fertility that contributed most to fertility change in Botswana using the 1984, 1988 and 1996 Botswana Family Health Survey Data (BFHS). Also, the research attempted to establish the trend in contribution of each proximate determinant of fertility to fertility change. Furthermore, the study intended to asses the similarities/differences in the contribution of proximate determinants of fertility-to-fertility change in Botswana and in selected (Zambia, Zimbabwe, Zambia and Namibia) sub-Saharan countries.

The contribution of each of the proximate determinants of fertility to fertility change was decomposed using FAMPLAN computer program. FAMPLAN program is based on the Bongaarts framework of proximate determinants of fertility.

The results indicate that, among the principal proximate determinants of fertility, during BFHS I (1984), postpartum insusceptibility had the most fertility inhibiting effect. However, during BFHS II and BFHS II, the risk of exposure to pregnancy contributed most to fertility change. Postpartum insusceptibility had the second highest fertility inhibiting effect while contraception had a mild effect on fertility change. Moreover, the results show that Botswana differs from other sub-Saharan countries in that fertility change in Botswana was largely influenced by the risk of exposure to pregnancy, while in other countries, postpartum insusceptibility had more influence on fertility change.

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LIST OF ABBREVIATIONS

BFHS	Botswana Family Health Survey
DHS	Demographic Health Survey
CSO	Central Statistics Office
CPS	Contraceptive Prevalence Survey

CHAPTER 1

INTRODUCTION AND STATEMENT OF PROBLEM

1.1 Introduction

Bongaarts (1982) (cited from Bongaarts and Potter, 1983) writes that even in societies with high stable fertility, where there are no deliberate fertility control measures, fertility does not reach its natural potential maximum. This is mainly due to the operations of non-biological and un-intentional factors such as prolonged breast-feeding that lower fertility level from its potential biological maximum. Therefore, the level of fertility will always vary from society to society depending on the prevailing cultural practices. In order to account for all fertility variations that occur in a society, it is important to catalogue all the factors that have potential to affect reproduction, including the socio-economic variables such as religious affiliation as well as behavioural factors (e.g., coital frequency). Also, the factors that have potential to affect fertility may include physiological factors such as maternal nutritional status (it has effect on sperm viability).

According to Wood (1994), such cataloguing tells us little about which one of these variables is most important in explaining fertility variations. Therefore, demographers have compiled a shorter list of variables (proximate determinants) that must always operate at certain level to effect any fertility change. The concept of proximate determinants of fertility was first conceived by Davis and Blake in 1956. However, Bongaarts (1978, 1982) refined the original proximate determinants list and produced "principal" proximate determinants (factors affecting exposure, deliberate fertility control factors and natural marital fertility factors) of fertility. Bongaarts further developed a quantitative method of assessing the contribution of each of the proximate determinant of fertility to fertility change.

Although there are several other methods of decomposing the contribution of each of the proximate determinants, (Moreno, 1991: Reinis, 1992: Wood, 1994: Stover,

1998), this research uses the Bongaarts model of proximate determinants since it requires less complicated data and gives robust results.

1.1.1 Organisation of the paper

This paper is comprised of five chapters. Chapter one gives an introduction to the proximate determinants of fertility, problem statement, justification of the study and the study objectives. The second chapter is a review of literature of proximate determinants of fertility. Moreover, the third chapter outlines the methodology employed including the data used as well as variables used. Furthermore, the forth chapter is a presentation of the study findings while chapter five gives the discussion of the results and policy implications. The last part of chapter five outlines the overall limitations of study.

1.2 Background

The world population has experienced significant reductions in the fertility levels over the past years mainly due to fertility reductions in the developing world. The levels of fertility have reached very low levels in developed countries. According to Guengant (2001), it is estimated that 40 percent of the world population live in countries with total fertility rate of less than 2.1 children per woman. Furthermore, between 1970 and 1990, the average fertility level in developing countries dropped from 5.9 children per woman to 3.9 children per woman. Furthermore, the median fertility rate in the developing countries was 1.8 children per woman (Guegant, 2001). Also, a number of countries in the developed world reached below replacement fertility levels. Moreover, fertility decline occurred even in the countries which, experienced baby boom in the 1950s and 1960s. The median fertility reduction for developed countries was 0.8 children per woman between 1970 and 1990. According to World Fertility Report (2003), during the same period, about 14 of the developed countries had a total fertility rate of 1.3 children per woman, which is much lower than the replacement fertility level. All these remarkable declines in fertility were made possible by the major behavioural transformations and increase in the use of modern contraception (World fertility Report, 2003).

Although world fertility rates have declined and continue to decline, the world population continues to grow due population momentum and persistently high rate of growth in developing countries. The levels of fertility have remained high (5 children per woman) in some countries in the developing world (World Fertility Report, 2003).

Incidentally, the Sub-Saharan Africa population is growing at a higher rate than of any other population despite the high HIV/AIDS mortality. From 1975 and 2005, Sub-Saharan Africa population increased from 335 million to 750 million. And it is currently growing at an annual growth rate of 2.2 percent. According to the United Nations Population Division, the Sub-Saharan Africa population will reach 1.1 billion by 2025. Such unprecedented growth will result in a young population age structure. The high number of younger population will results in a large number of entrants into the labour force. Also, there will be a high number of child dependents per a working adult. As a result, a high percentage of personal incomes will be spent on immediate consumption needs of food, housing and clothing. This will further result in little or no personal and national income available for capital investment. Lack of capital investment will retard productivity of industry and this would make it difficult to expand job markets in order to cater for the burgeoning population.

1.3 Problem situation

The decline of fertility is not problem per se, however, despite the remarkable fertility decline experienced in Botswana in recent past, the level of fertility is still high. It is therefore necessary to effect further fertility reduction through policy intervention. And since the socio-economic factors of fertility are easier to manipulate through a policy, studies on fertility change tend to concentrate more on these factors. Guengant (1996) observed that the decline of fertility occurred in several sub-Saharan countries that were at different stages of economic development, this indicates that the level of economic development does not necessarily trigger the onset of fertility decline.

Although a number of studies on proximate determinants of fertility have been carried out in Botswana (Letamo, 1994, Gaisie, 1995), the results differed as to which proximate determinant is responsible for most fertility change. The study by Letamo (1994) pointed to postpartum infecundability as the proximate determinant

responsible for most fertility change. On the other hand, Gaisie (1995) attributed the reductions in fertility to the profound changes in the nuptiality patterns. While acknowledging that the differences in the conclusions from these studies may be due to the differences in the definition of variables or errors in the data, there is a need to investigate the role of proximate determinants of fertility in fertility change further using most recent data.

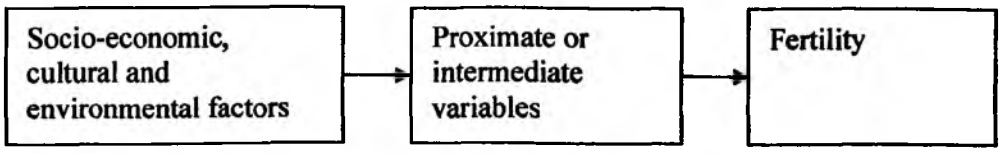
1.4 Justification of the study

The importance of the study of fertility cannot be over-emphasized. Although other population variables such as mortality and migration play an important role in the population age structure and population change, population dynamics tends to be strongly moulded by fertility. The study intends to analyse the contribution of each of the proximate determinants of fertility to the change in total fertility in Botswana. Botswana is one the three African countries in the sub-Saharan region that is experiencing incipient fertility decline. This fertility decline indicates that the sub-continent has entered the second stage of fertility transition (Gaisie, 1995). According Gaisie (1995), the bulk of this decline has been due to the changes in the proximate determinants over the past years. The proximate determinants play an important role in fertility change since they represent the mechanisms through which fertility reduction is effected. Proximate determinants of fertility are the biological and behavioural factors through which the socio-economic, cultural and environmental factors affect fertility (Bongaarts and Potter, 1983). While researches have documented the impact of socio-economic and cultural factors on fertility variations, little has been said about the effect of the intermediate variables on fertility variations. Therefore the impact of the intermediate variables on fertility change is relative unknown. The proximate determinants play an important role in fertility change since they impact directly on fertility. If any other factor has to affect fertility, it has to do so via its effects on one or more of the proximate determinants. For instance, the wife's educational background can only affect fertility if it affects one or more proximate determinants such as the frequency of sexual intercourse.

During the analysis of fertility data from the 2001 Population and Housing Census (Botswana), the overall decline of fertility levels was attributed to the socio-economic

and cultural factors, but the relative importance of each of the variables in fertility variation was not given. Furthermore, Wood (1994) noted that, although categorization of human populations can be used to explain fertility variations, it is however necessary to use a much more refined approach, such as the proximate determinants approach.

Figure 1: The relationship between different fertility influencing variables



Source: Bongaarts and Potter (1983)

It is therefore useful that, in order to fully understand the variations in fertility, proximate determinants of fertility are studied. These are the factors, which affect the reproductive life span, and they influence frequency of birth within that life span.

Most communities worldwide have cultural practises that limit their fertility from reaching its natural maximum. Generally, the factors, which inhibit fertility from reaching its maximum, include postponement of marriages, abstinence, dissolution of marriages or unions and spousal separation. Reproductive live span, defined as the period during which a woman is exposed to the risk of child bearing, it differs from one society to another. In traditional African societies, reproductive live span is longer because it starts very close to menarche. Thus the mean age at marriage is usually under 20 years while in European societies the mean age marriage is mid 20s or later. During reproductive live span, variations in fertility are caused by the intermediate variables such as postpartum infecundability, contraceptive, abortion and marriage. According to Bongaarts and Potter (1983), when there are no fertility inhibiting factors, assuming birth interval of one year and that births occur between ages 15-50, a woman can have 35 children. However, when looking at fertility of the Hutterites community, who have the highest ever-recorded fertility rate, their fertility averaged about 9 children per woman (Eaton and Mayer, 1953 cited in Bongaarts and Potter, 1983). This shows that, the Hutterites though have a very high fertility, they are far

from their potential biological maximam. The difference between the current fertility and biological potential maximum can be attributed to delayed marriage, the practice of breast feeding and high intra uterine mortality.

In order to understand the behaviour of fertility fully, it is necessary to study the factors which influences its change. The study of factors, which influence fertility variations (proximate determinant), is critical for policy considerations. It is also very important to know which of the factors that affect fertility can be manipulated through a policy since it can not be taken for granted that fertility will continue decline on its own to low levels currently prevailing in the developed countries. Furthermore it is necessary to study such factors and their effect on fertility since it is highly likely that the HIV/AIDS scourge may reverse mortality decline gains from the past decade, thereby delaying the completion of fertility transition.

Also, the study of contributions of the proximate determinants of fertility to fertility change is necessary for formulation of development objectives and to inform policy and programs such as the Millennium Development Goals and the related goals set at the International Conference on Population and Development (ICPD) in 1994 and the ICPD 10. Moreover, the study of proximate determinants is needed for providing the information necessary for monitoring and evaluation of demographic trends in Botswana.

1.5 Objectives of the Study

The study intends to assess the contribution of each of the principal proximate determinants of fertility-to-fertility decline in Botswana. The study will attempt to answer the research questions: 1) Which one of the four principal proximate determinant contributed most to fertility change in Botswana (between 1984 and 1996), 2) Are there any variations in the contribution of each of the proximate determinants of fertility over the period and 3) Are there any differences or similarities on the impact of proximate determinants of fertility in Botswana and in other selected African (Kenya, Zimbabwe, Namibia and Zambia).

1.5.1 Hypothesis

This research is premised on the findings of a study on the relative effects of the proximate determinants on fertility variations by Wood in 1994. Wood's model incorporated all the proximate determinants of fertility to compute a quantifiable measure of reproductive performance. In the model, a single proximate determinant was allowed to vary (to its known average) while other proximate determinants were held constant. The results showed that postpartum infecundability was responsible for most variations in fertility. The second most important proximate determinant was found to be age at marriage. Therefore, the hypothesis of the study is, among all the proximate determinants of fertility, postpartum infecuandability is responsible for most variations in fertility.

CHAPTER 2

LITERATURE REVIEW

2.1 Fertility Transition

This is a description of historical process of how traditional societies moved from pre-modern regime of high mortality and high fertility to present day regime of low mortality and low fertility. During demographic transition, population growth is rapid, mainly because the decline in mortality tends to occur before the decline in fertility. And because of further industrialisation and socio-economic development, the rapid population growth will then be followed by sustained fertility decline. This is the stage at which most sub-Saharan countries are in.

2.2 Fertility Change in sub-Saharan Africa

The current world population trends suggest that there has been remarkable decline in fertility over the past years. The decline in fertility is more evident in the developing countries, especially the Arab countries that were previously characterised by rapid population growth. The available literature shows that sub-Saharan Africa has the highest fertility rate than any other major region in world. And until recently, sub-Saharan Africa was the only major region in world that did not participate in the global fertility transition (Caldwell et al, 1992). As a result, there has been lot confusion as to whether fertility will eventually decline. According to the demographic transition theory, there was a substantial decline of mortality and fertility in the Latin America and Asia between 1965 and 1985. On the other hand, in Africa, only mortality declined while fertility remained stable, well above fertility replacement level (Cohen, 1993). This is resulted in rapid population growth. Though there are considerable differences in fertility levels in different countries, the average total fertility rate of sub-Saharan Africa is estimated be around 6.0 to 6.5 children per

women. According to Cohen (1993), some countries such as Rwanda had a total fertility rate as high as 8 children per woman in 1985.

However, it is worth noting that the uncertainty as to whether fertility in sub-Saharan Africa will ever decline was mainly due to the fact that, in the early 1980's, there was a critical shortage of accurate data. When data become available in the late 1980's and early 1990's mainly through the Demographic Health Surveys (DHS) program, it became evident that indeed birth rates have started to decline in sub-Saharan Africa. Caldwell and his colleagues (1992) noted that in Botswana, Zimbabwe and Kenya, the declines in the birth rates have actually exceeded substantially the 10 percent decline margin that has been accepted as an indication of irreversible fertility transition. This high rate of fertility decline in the three countries was attributed to the unique characteristics that were only found in these countries. According to Caldwell et al, (1992), the three countries exhibited infant mortality rates of below 70 deaths per 1000 live births. At that time, there was no other country in the region with less than 80 deaths per 1000 live births. Moreover, the three countries exhibited high levels of education, especially among the females. However, the high levels of education among the girls were also prevalent in other former British colonies, notably Lesotho and Swaziland. In addition to high education levels, the countries also had high levels of contraceptive use. The level of contraceptive use in three countries was high enough to account for the observed decline in fertility (van de Walle and Foster, 1990).

Furthermore, the dramatic fertility reductions were attributed to the relative low average desire to have more children and the higher median age at mirage among the women in the reproductive age groups.

2.3 Fertility Levels in Botswana

In Botswana, fertility transition started in the early eighties and continued into the 1990's. The 1971, 1981 census and the 1988 Botswana Family Health Survey (BFHS II) data shows that the total fertility rate (TFR) declined from 7.1 to 6.5 children per woman. The TFR declined further to 4.2 children per woman in 1991 to 3.3 children per woman in 2001. On the other hand, annual population growth rate declined from

4.2 percent to 3.5 percent between 1981 and 19991. The annual rate of growth experienced further reductions and dropped to 2.4 percent in 2001 (2001 Census Analytical Report). The decline of Botswana fertility rates, according to Rutenburg and Diamond (1983), represent the largest fertility decline in sub-Saharan Africa and one of the first examples of a sustained fertility transition in the region.

The decline in fertility was consistent with the levels of economic growth. Since the discovery of diamonds in the mid seventies, Botswana has experienced rapid economic growth. The gross domestic product (GDP) growth has averaged 9.2 percent per annum in real terms up to the beginning of the National Development Plan 8 (NDP 8, 1996). During the current National Development Plan (NDP 9), GDP is expected to grow at 6.4 percent per annum. The reduced growth is largely due to recurring droughts and poor performance of some sectors, especially agriculture. The overall good performance of the economy translates into the overall improved living conditions for most people. This in turn initiated reductions in the levels of fertility.

This decline of fertility becomes more pronounced in the age specific fertility rates (ASFR) between the census years, see Figure 2 below.

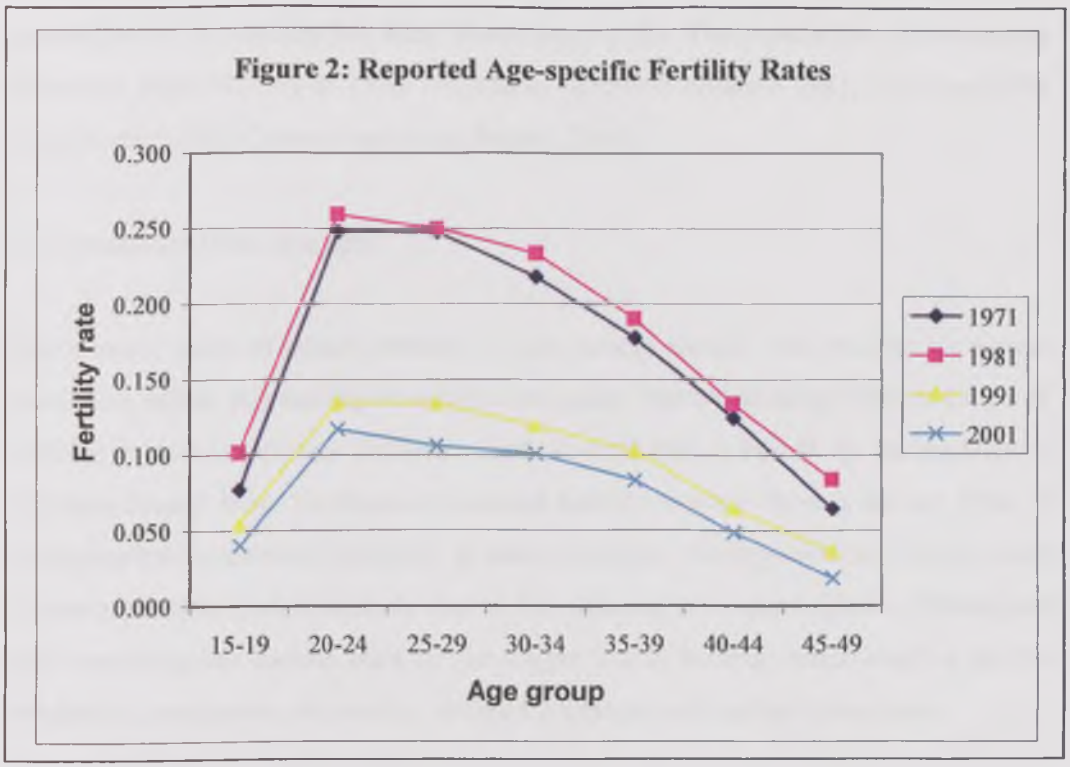


Figure 2 above shows that the average parities declined remarkably between the census years 1971 and 2001 especially for between the age groups 20-24 and 30-34.

According to Rutenburg and Diamond (1983), the fertility decline that occurred in Botswana in the mid 1980's was mainly due to the severe drought that ravaged the country during that period. The drought resulted in long periods of spousal separation. And the long spells of spouse separation lead to fertility decrease due to the reduced risk of sexual intercourse and pregnancy. During the drought, there is usually out-migration of men to cities and towns in search of employment. In Botswana for an instance, a large percentage of Batswana men migrated to work in South African mines in the mid 1980's. However, this proposition is doubtful since there is no evidence that at end of drought years when the economy was booming, there was any marked increase in the births rates. Moreover, it is also worth noting that the decline

of fertility was accompanied by the decline of mortality rates and by increased provision of integrated family planning programmes and health services.

While the rate of growth has been decreasing between the census periods, the overall population of the country has been increasing rapidly. The population of the country increased from 941 007 to 1326 796 and to 1680 863 between 1981, 1991 and 2001 respectively (2001 Census Analytical Report, 2004).

2.4 Proximate Determinants

The overall levels of natural fertility in any society usually first reaches its natural maximum before any fertility transition can occur. Natural fertility refers to levels of fertility in absence of any deliberate birth control that is bound by the number of children already born. Furthermore, natural fertility is when there is no any form of contraception or abortion practised. In many societies, fertility does not always reach its potential biological maximum due to the influence of a combination of biological and non-biological factors such as, prolonged breast feeding (breast-feeding inhibit ovulation), postpartum abstinence, delayed marriages and marital disruptions.

According to Bongaarts and Potter (1983), in any society, where there is no fertility inhibiting effects of delayed marriages, marital disruptions and breast-feeding, natural fertility will reach its biological maximum of about 15 to 17 children per woman. However, due to the influence of the intermediate variables, fertility is usually far much below its natural levels.

Initially, Bongaarts identified four principal fertility-inhibiting factors, these are: postpartum infecundability, use of contraceptives, induced abortion and the proportion married. However, during later revisions, Bongaarts added the fifth determinant, pathological sterility (Stover, 1998).

The intervals in fecundity due to breast-feeding have a strong inhibiting effect on fertility (depending on the length of breast-feeding). Literature of proximate determinants has shown that the majority of women worldwide usually spend almost half of their reproductive period in amenorrhoea state. Also related to the length of

breast-feeding is the postpartum infecundability. This is the period immediately after birth during which a woman does not ovulate and therefore is incapable of conceiving. In many African countries, longer breast feeding spell are encouraged as a way limiting the number of births. When breast-feeding is not practiced at all, the length of lactational amenorrhoea is shortened by approximately 1.5 to 2 months (Leridon, 1977 cited in Bongaarts and Potter 1983).

2.4.1 Effects of contraceptive use

The use of contraceptives has a direct impact on levels of fertility. Contraceptives can either prevent the sperm from reaching the ovary or prevent a fertilised egg from implanting itself. The use of contraceptives as measure of controlling fertility has increased tremendously in the recent years. A study by Guengant (1996) has shown that the use of contraceptives varies from 68 percent in developing countries to about 83 percent in developed countries. Furthermore, the recent sharp declines in fertility in countries such as Korea, Columbia and Indonesia were attributed mainly to effective use of contraceptives (Guengant, 1996).

2.4.2 Effects of Induced Abortion

Induced abortion also has a strong effect on the levels of fertility. However, due to inaccessibility of legal abortion systems in many countries, most abortions occur illegally. This results in a critical shortage of reliable abortion data. The problem of lack of abortion data is general to most countries. Normally abortion is allowed only on medical grounds, like when the woman's life is in danger or in case of a rape or incest. Therefore it is usually not possible to measure the impact of abortion on the levels of fertility.

2.4.3 Effects of Marriage

Marriage identifies the onset of the exposure to the risk of childbearing. The index of marriage is meant to express fertility reduction caused by women who choose not be sexually active during their reproductive period. This may however not be applicable in some societies, like in Botswana where it is not uncommon for a birth to occur

outside marriage union. So, in the studies of the impact of marriage on fertility, marriage is usually defined to include any stable sexual union. It is also important to consider the effects of age as it affects the length of exposure to risk of child bearing. In African societies, the age at first marriage tends to be lower than in developed countries. Some researches have however shown that marital fertility tends to be higher in societies where the age at first marriage is higher (Bongaarts and Potter, 1983).

The study of the impact of proximate determinant of fertility in sub-Saharan Africa by Guengant (1996) revealed that generally the most important proximate determinant of fertility is postpartum insusceptibility. This factor remains important regardless of the place of residence or education status of the woman. It was further revealed that the index of contraception is the second most important factor in fertility change while nuptiality has moderate effects on fertility change. The impact of abortion and sterility on fertility change have so far remained unknown due unavailability of reliable data.

The study of proximate determinants of fertility in Botswana was done by Letamo in 1994. The study was based on the data from Botswana Family Health Surveys (BFHS) of 1984 and 1988. According to Letamo (1994), the most important proximate determinant of fertility was postpartum infecundability followed by contraceptive use. It should be noted that there is possibility that the fertility inhibiting effect of marriage was under estimated since only the proportion of married women was used instead of using all women sexual unions (both with cohabitation and without cohabitation). Also, an assumption was made that marriage patterns have remained unchanged between the survey periods and therefore its effect on fertility will not change between BFHS I and BFHS II. The effect of unions without cohabitation on fertility change will be discussed later. Although the proximate determinants of fertility have a direct impact on fertility variations, they are however other factors which influence them. The proximate determinants are usually influenced by social, economic and cultural factors. The study of proximate determinants by Letamo was based on the BFHS data of 1984 and 1988. Since the socio-culture factors which influence the proximate determine are dynamic, it is necessary to study the proximate determinants based on a more recent data. Furthermore, the study by Letamo did not compare fertility variations in Botswana to

fertility variations in the neighbouring countries. However, fertility studies have shown that fertility behaviour of a country may be influenced fertility behaviour in a neighbouring country.

On the other hand, during the study of the determinants of fertility in Swaziland, Warren and others (1992) found that nuptiality had the second largest effect on fertility after postpartum infecundability. Furthermore, the use of contraceptives was found to have only moderate impact, though the prevalence level was increasing. This was in contrast to the Kenyan study, which revealed that the most important fertility inhibiting proximate determinant was postpartum infecundabilirty. The effect of contraceptive use was second most important while the naptiality had the least effect on fertility change (National Research Council, 1993).

The study of fertility transition in Yemen by Saxena and Jurdi (2002) indicated that, although the Arab countries that previously had high rates of population growth have now started fertility transition, Yemen fertility transition had actually stalled. In fact, in 1992 the total fertility was considered to be one of the highest in the world at 7.7 children per woman. The high fertility rate was attributed to early marriage, low celibacy, short birth intervals and a relatively long reproductive life span (Saxena and Jurdi, 2002). However, the Yemen TFR declined slightly to 6.5 children per woman in 1997. Saxena and Jurdi found that the drop in Yemen fertility could be explained by the index of postpartum infecundability (Ci) and the index of contraception (Cc), while marriage (Cm) did not play any significant role in fertility transition. The index of postpartum infecundability remained fairly unchanged between the study periods. Moreover, the index of contraceptive (Ci) exhibited significant increase between 1992 and 1997. The proportion the population currently using contraceptives increased from 7.7 percent to 19.6 percent. The Yemen study showed that postpartum infecundability impacted more on fertility than the other two proximate determinants of fertility. Furthermore, Yemen study shows that for a woman in marriage, if the marriage remained intact through out her reproductive period, she did not use any contraception, did not commit any abortion or practiced any breast-feeding, she would have had 16.8 children (estimated total fecundity rate). Thus the proximate determinants have contributed about 10.3-point decline in fertility in 1997 (Saxena and Jurdi, 2002).

CHAPTER 3

METHODOLOGY

3.1. Research Design

The data for Zambia, Kenya, Zimbabwe and Namibia were obtained from the respective country's Demographic Health Survey (DHS) data. The DHS project, now called MEASURE DHS, provides technical assistance to developing countries in the areas of health and population trends. Its main objective was to improve and institutionalise the collection and use of data by host countries for program monitoring and evaluation and for policy development decisions. The DHS project, which was initiated and funded by the United States Agency for International Development (USAID) was actually a follow up to the World Fertility Survey (WFS) and the Contraceptive Prevalence Survey (CPS).

Although DHS methodology may differ from country to country, generally, the DHS sample would be a nationally representative sample of about 5,000 to 30,000 households. Since the main objective of the surveys was to collect comparable data across countries, the DHS data were suppose to be collected every five years. This was however not possible due to resource limitations among participating countries. In all participating countries, a standard structured questionnaire was provided along with written description of certain questions or sections to be included (measuredhs.com).

For ease access of the data to analysts from different countries, MEASUREDHS has made data from participating countries available online. Furthermore, MEASUREDHS developed a computer program (STATCompiler), which provides customised tables online from DHS indicators.

For Botswana, data were sourced from Botswana Family Health Surveys (BFHS), which is an equivalent to DHS in other countries.

So far, three Botswana Family Health Surveys (BFHS) have been conducted, the last one being BFHS III that was conducted in 1996. The BFHS's were national samples surveys designed to collect and update information on mid decade goals, fertility, family planning, child health, nutritional status of children, breast-feeding, immunization etc.

3.1.1 Subject Selection

The BFHS surveys, as prescribed by DHS programme, were nationally representative sample surveys. BFHS samples were all selected from the master-sampling frames that are usually prepared after every population and housing census. The master sample frame usually consists of all blocks found in the three geographical areas (cities and towns, urban villages and rural villages) in Botswana. During the 1996 BFHS, the master sampling frame was made up of 2448 blocks (enumeration areas).

For BFHS II, total of 4,500 women were interviewed while BFHS III interviewed a total of 8,483 women aged 15-49. For both surveys, a two-stage probability sampling was used. In the first stage, the enumeration areas (EA's) were selected with probability proportional to size (PPS) in each of the selected strata. During the second stage, individual households were then selected with probability of selection inversely related to proportional to the size of the EA's size (http://www.cso.gov.bw).

For all the BFHS surveys, two questionnaires were used, a household questionnaire and individual questionnaire. As mentioned earlier, the questionnaire was adopted from DHS model questionnaires.

Generally, although an assessment of DHS data from all participating countries by DHS staff revealed a number of errors, the data were found to be fairly usable (Cohen, 1993). The data (especially from Southern Africa) were found to contain errors of age heaping on the digits ending in 0 and 5. Furthermore, it was found that women tend to omit early births or displace births of low parity forward, thus making children younger than their actual age (Cohen, 1993).

However, these errors were found not to have any significant impact on the indicators calculated from DHS data. It is however important to acknowledge that sample data will always contain errors and therefore such data should be used with caution.

3.1.2 Measures

Index of marriage

The index of marriage here is used to express fertility reduction caused by women who have chosen to celibate. It represents the risk of exposure to pregnancy. The index is estimated from the proportion of women in the age group 15-49 who are married. The proportion of married women in the reproductive age group was initially used as a proxy for sexual activity due unavailability of sexual data. However, data permitting, sexual activity should be used to measure the risk of exposure to pregnancy.

Index postpartum infecundability

Index of postpartum infecundability measures the effects of prolonged period of postpartum amenorrhoea on fertility. The index is estimated by combining the effects of both postpartum abstinence and lactational amenorrhoea. The resulting composite index is now referred to as postpartum insusceptibility.

Index of contraception

This index measures the fertility inhibiting effects due to contraceptive use. It is estimated from the proportion of women aged 15-49 who was using some form of contraception.

Index of Sterility and Abortion

Index of pathological sterility measures the fertility inhibiting effects due primary and secondary sterility. The index of abortion is estimated from the proportion women

aged 15-49 who are childless. (For detailed estimation procedure of the indices, see sub-section 3.2.2).

3.2 Data Analysis

The proximate determinants of fertility were analysed using FAMPLAN computer program developed by the Future Group International (Stover, 1997). The FAMPLAN program is based on the on the Bongaarts model (Bongaarts, 1978) of proximate determinants of fertility.

Bongaarts model can be used for a variety of purposes including, to decompose the contribution of each of the proximate determinant to the realisation of current total fertility levels and to analyse the contribution of changes in the proximate determinant to the changes in total fertility overtime. Furthermore, the model may be used to compare the differences in fertility between countries or regions on the basis of the differences in the proximate determinants, to estimate total abortion rates as the residual after the effects of all other proximate determinants have been removed and or to project the future levels of contraceptive prevalence that will be required to achieve the desired fertility levels given the expected changes in other proximate determinants of fertility (Stover, 1998).

Davis and Blake (1956) originally identified 11 proximate determinants or intermediate variables of fertility. The model of proximate determinants of fertility by Davis and Blake (1956) has not gained wide recognition because it cannot be easily incorporated into reproductive model. The original intermediate variables were later modified and reduced to five by Bongaarts in 1978. The Bongaarts model, although recently it has been criticised heavily (Moreno, 1991:Reinis, 1992:Wood, 1994:Stover, 1998), it remains the most important and widely used model for measuring the contribution of proximate determinants to fertility change. These other methods have their own purposes and weakness. For instance, the method proposed by Reinis (1992) uses complex mathematical simulations and relies heavily on too many assumptions, which may be unrealistic.

3.2.1 Original proximate determinants by Davis and Blake

A. Factors which affects exposure to intercourse

1) Age into sexual union

2) Permanent celibacy

3) Amount of reproductive period spent after or between unions

B. Factors governing exposure within a union

4) Voluntary abstinence

5) Involuntary abstinence (importance, illness, spousal separation etc)

6) Coital frequency

C. Factors affecting exposure to conception

7) Fecundity or infecundity as affected by involuntary causes

8) Use or non-use of contraceptives

9) Fecundity or infecundity as affected by voluntary causes (sterilization, medical treatment etc).

D. Factors affecting gestation and successful parturition

10) Foetal mortality from involuntary causes

11) Foetal mortality from voluntary causes

3.2.2 Bongaarts model of proximate determinants (revised)

The Bongaarts model (1978, 1982) on the other hand focuses on the five principal proximate determinants of fertility namely: marriage, induced abortion, contraceptive use, pathological sterility and postpartum infecundability (Bongaarts and Potter, 1983). The remaining proximate determinants (natural infecundability, spontaneous intra uterine mortality) were found to have insignificant impact on fertility variations. According to the Bongaarts Model, these principal factors are the reasons why fertility does not always to reach its biological maximum. Furthermore Bongaarts identified four different types of fertilities through which the proximate determinants operate. When fertility-inhibiting effects of delayed marriage and marital disruption are removed, and there is no change in the fertility schedule, fertility of a population will increase to the level of total marital fertility rate (TM). Furthermore, when the effects of the practise of lactation and postpartum abstinence are also removed, fertility will increase further to total fecundity rate (TF). It is worth noting that the fertility rates of TFR, TM and TN usually vary widely among different populations and is determined by different socio-cultural activities. Moreover, the TFs of most populations range between 13 and 17 births per woman (Bongaarts and Potter, 1983).

The model is given by;

$$TFR = Cm*Cc*Ca*Ci*Cp*TF$$

Where: Cm is the index of proportion married

Cc is the index of contraception

Ca is the index of induced abortion

Ci is the index postpartum infecundability

Cp is the index of pathological sterility

TF is the total fecundity rate

The index takes values ranging between zero and one. The index is one when there is fertility inhibiting effect of a particular proximate determinant of fertility. An index of zero means that a particular proximate variable has full effect on fertility.

Estimation of different fertility inhibiting factors

Estimation of Cm

$Cm = \sum m(a)g(a) / \sum g(a)$

Where m(a) = age specific proportions currently married (or in consensual unions) among the females

g(a) = the age specific marital fertility rate

Also, Cm = TFR/TM

Estimation of Cc

Cc is usually estimated from contraceptive prevalence and use

Cc = 1-1.08*u*e

Where, u = the proportion currently using contraceptive among married women of reproductive ages (including male contraceptives)

e = the average effectiveness of a particular contraception.

Estimation of Ca from total abortion rate

The average number of births averted per induced abortion, b, is given by:

b = 0.4(1+u)

Or use of total abortion rate TA (number of abortions per woman at the end of her reproductive period)

Then, Ca = TFR/TFR+TA = TFR/0,4(1+u)*TA

NB, computation of index of Ca requires estimates of TFR, TA and the prevalence of contraceptive use.

Estimation of Ci from the duration of postpartum infecundability

Ci = 20/(18.5+I)

Bongaarts defines Ci as the ratio of average birth interval with or without postpartum indefecundability. It is assumed that on average, birth interval and duration of postpartum infecundability is approximately 18.5 months (Bongaarts and Potter, 1983).

Estimation of Cp

Cp =(7.63-0.11*s)/7.3

Where s is the proportion women aged 45-49 who had no live birth

3.3 Definition of Concepts

Proximate Determinants of fertility: These are biological and behavioural factors through which the social, economic and cultural factors influence fertility.

Postpartum infecundability: period immediately after birth during which normal pattern of ovulation and menstruation is absent

Postpartum amenorrhea: temporary absence of menstruation after birth.

Natural fertility: fertility in absence of any deliberate measures of birth control.

CHAPTER 4

FINDINGS

4.1 Marriage levels and trends

In Botswana, a large proportion of children are born to unmarried women. Therefore, unlike in other African countries, the close association of marriage and fertility (exposure to intercourse) is very minimal. The available data from censuses show that between 1971 and 1992 censuses, marriage experienced a steady decline of over 14 percent (Mookodi, 2003). This decline has been largely attributed to large-scale entry of women into education and paid employment.

Furthermore, data from the three Botswana Family Health Surveys (BFHS I, BFHS II and BFHS II) also show that marriage was not very common during the survey periods. Table 1 shows that the proportion of women aged between 15-49 who were married or in union in 1984 was about 65 percent. The proportion then declined sharply to 38 percent in 1988 and to 36 percent in 1996. During the same period, the proportion of women who were never in union increased from 29 percent in 1984 to 52.9 percent in 1988 and 58.3 percent in 1996 (see Table1 on the next page). It is further shown through Table1 that the proportion of women with secondary/tertiary education increased from 16 percent in 1984 to 54 percent in 1996.

According Gaisie (1995), in addition to the rising education levels among women, naptuality patterns in Botswana were also shaped by abandonment of poligyny, labour migrations and a change in the legal rights to property. These changes have given more socio-economic, moral and behavioural choices to women. As a result, the status of unmarried mothers has been legitimised.

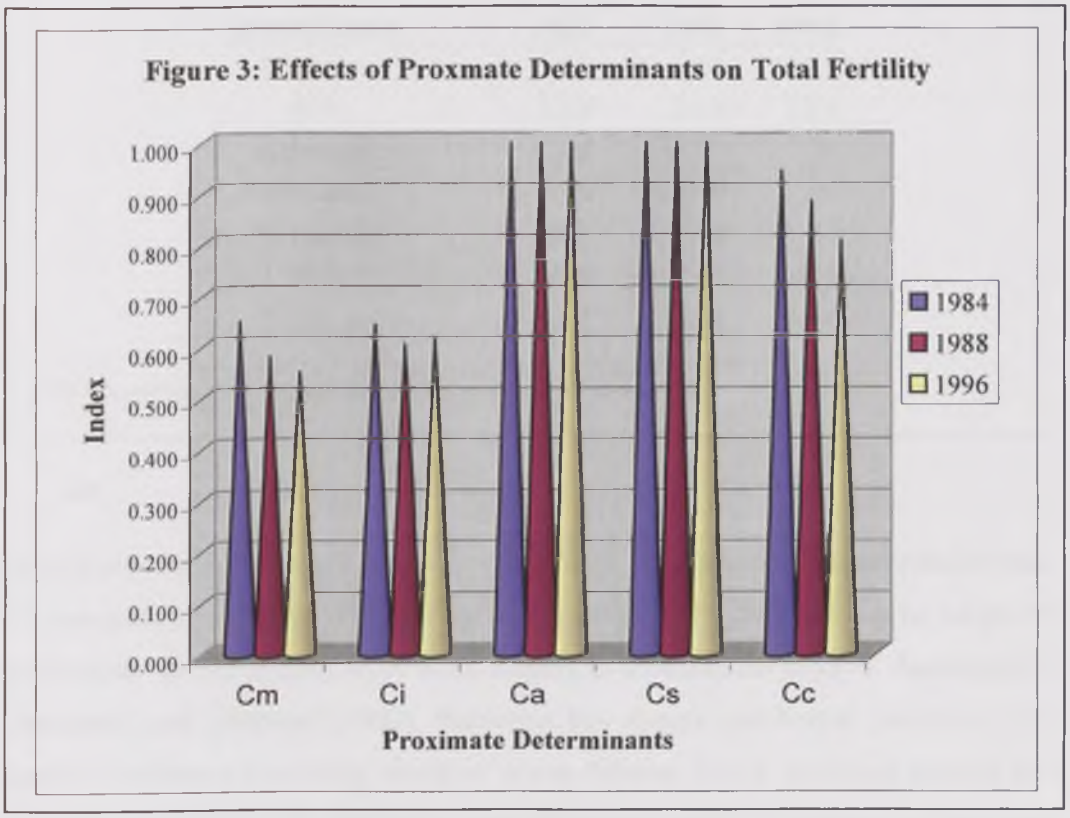
Table 1: Percentage Distribution of Women aged 15-49 by Background Characteristics

Background Characteristics	1984 BFHS I	1988 BFHS II	1996 BFHS III
Age			
15-19	19.5	21.6	22.6
20-24	22.0	21.1	21.5
25-29	18.3	19.4	16.9
30-34	13.8	114.9	14.0
35-39	11.3	10.7	11.6
40-44	9.0	6.7	8.7
45-49	6.1	5.7	4.7
Marital Status			
Never in union	29.0	52.9	58.3
Currently in Union	65.1	39.0	38.7
Formerly in Union	5.9	8.0	3.0
Level of Education			
None	30.8	24.0	12.8
Primary	53.3	50.1	34.1
Secondary/higher	16.0	25.9	54.5
Residence			
Urban	23.6	30.1	45.2
Rural	76.4	69.9	54.8

Source: BFHS II

4.1.1 Effects of Marriage (exposure to intercourse) on fertility (Cm)

It is shown through Figure 3 that in 1984 postpartum insusceptibility (Ci) had the largest effect on fertility change in Botswana. However, the situation changed during BFHS II and BFHS III. The proportion of women in union dropped dramatically and this had a negative effect on fertility. The fertility inhibiting effect of proportion married surpassed that of postpartum insusceptibility to become the most important proximate determinant of fertility. The indices are 0.65, 0.0.58 and 0.0.55 for 1984, 1988 and 1996 respectively as shown through Figure 3 below.



4.2 Postpartum Insusceptibility (Ci)

Postpartum insusceptibility affects fertility through its effect on the birth interval. Bongaarts (1978) observed that in a society were breast-feeding is not practised, births interval will average 20 months. The birth interval varies widely across different populations depending on the prevailing cultural practices.

Table 2: Estimated Proximate Determinants, Botswana

Proximate Determinant	1984	1988	1996
In Union	65	39	38.7
PPI	12.6	14.6	13.8
Abortion	0	0	0
Sterility	0	0	2.9
Prevalence	27.8	33	47
TFR	6.5	5	4.3
TF	15.7	15.5	15.7

PPI- duration of post partum insusceptibility (in months)

It is shown through Table 2 above that the length of postpartum insusceptibility was 12.6 months in 1984. In 1988, the duration increased to 14.6 months. The length of postpartum insusceptibility went down slightly to 13.8 months in 1996. According to Rutenburg and Diamond (1983), Botswana has always had longer period of post partum abstinence than other countries in sub-Saharan Africa. Although initially the long period of post birth abstinence was influenced largely by absence of men who were working in South African mines, it is also influenced by cultural expectation that a woman should abstain from sex for at least six months after birth. The recent decline in the duration of postpartum insusceptibility may be influenced by increased participation of women in paid employment activities and the relaxation of some cultural taboos.

4.2.1 Impact on total fertility

It shown through Figure 3 that in Botswana, the duration of postpartum insusceptibility, together with exposure to sexual intercourse (proportion in union) accounts for the most of the fertility changes. In 1984, postpartum insusceptibility had the largest influence on fertility change. During this period, contraceptive prevalence was still very low and therefore most fertility change occurred through postpartum infecundability. In 1988, due to the changing union patterns, the exposure to intercourse began to have more influence on fertility change. It must be noted that, over the three survey periods, the effect of postpartum insusceptibility did not really change much. It is only that there were significant changes on the union patterns, which brought considerable changes on fertility. The indices are, 0.643, 0.604 and 6.19 for 1984, 1988 and 1996 respectively as shown in Table 4.

4.3 Contraception use (Cc)

Consistent use of effective contraception can have impact on fertility since contraceptives can directly prevent conception or implantation of a fertilised egg. The data from the BFHS I to BFHS III show that the use of contraceptives in Botswana has increased steadily over the years. In 1984, contraceptive prevalence was 27.8 percent, contraceptive prevalence increased to 33 percent in 1988. The use of contraceptives increased further to 47 percent in 1996 (see Table 3 on the next page). Despite the remarkable increases in the contraceptive use, there was still persistent use of traditional methods of contraception. However, traditional contraceptives may not add much to the overall contribution of contraceptive use to fertility change, as they are highly ineffective.

Table 3: Percentage Distribution of women aged 15-49 by current contraceptive use, 1984,1988 and 1996

Method	1984	1988	1996
Pill	8.5	17.7	17.7
IUD	4.1	9.5	3.1
Injection	1.1	3.2	5.7
Condom	1	1.3	11.3
Female sterilization	1.2	2.2	2.4
Male sterilization	0	0.1	0
Traditional	7.5	0.8	0.3
Norplant	0	0	0.3
Other	0.1	0	0.9
Prevalence			
all women	**23.5**	**29.7**	**41.7**
women in union	**27.8**	**33**	**47.6**

Source: BFHS III

From the above Table 3, it is shown that the most commonly used method of contraception among the women aged 15-49 has been the pill. However, in 1984, a sizeable number (7.5 percent) of women were still using the traditional methods of contraception. In 1988, the pill was the most common (17.7 percent) method of contraception. However, the IUD surpassed the use traditional methods to become the second most popular contraceptive method at 9.5 percent. Moreover, the pill remained the commonly used method at 17.7 percent. Again, IUD was relegated by condom and injection to fourth position. The percentages are, 11.3 percent, 5.7 percent and 3.1 percent for condom, injection and IUD respectively.

4.3.1 Effects of contraceptive use on fertility

Despite the relatively high contraceptive prevalence in Botswana, the Bongaarts Model of proximate shows that, in reality, contraceptive use has very little effect on

fertility change. For three survey periods, the indices are close to one, which basically means that, the contraceptive methods that were used in Botswana were not very effective in influencing fertility change. The indices, as shown in Figure 4 are 0.9441 for BFHS I, 0.885 for BFHS II and 0.808 for BFHS III.

4.4 Effects of Abortion and Sterility

Induced abortion can affect fertility in that a woman who has had an abortion will most probably resume ovulation much sooner than a woman who has under gone the full pregnancy period (Bongaarts and Potter, 1983). However, for this study the impact of induced abortion could not be established due to unavailability of abortion data. Furthermore, the fertility inhibiting effects of permanent sterility could also not be established. Although the level of sterility was estimated from the 1996 survey data (BFHS III), the results did not show any impact on fertility change. This perhaps explains why initially Bongaarts left out sterility, waiting time to conception, and the risk of intrauterine mortality from the original fertility model. According to Bongaarts (1978), variations in the three factors generally have very little impact on fertility change.

4.5 Comparing Impact of proximate determinants of fertility in Botswana and the impact of proximate determinants on fertility in selected African countries (Kenya, Zambia, Zimbabwe and Namibia)

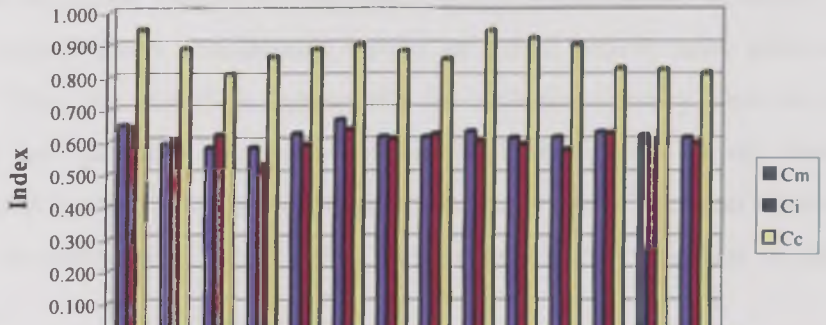
Although the timing of the DHS (BFHS in Botswana) program differs from country to country, the results are still comparable since in all the countries, the data were collected under the main objective of providing data for monitoring and evaluation indicators in the areas of population, health and nutrition. Moreover, although survey methodologies may vary slightly, the DHS program provided guidance, schedules and standard procedure to ensure that the data produced is comparable across countries.

When comparing the impact of proximate determinants of fertility in Botswana and in other sub-Saharan African countries, initially, in 1984, Botswana was consistent with other countries in that postpartum insusceptibility had most influence on fertility

change. However, between 1988 and 1996, Botswana became completely different from all other countries under study as now the exposure to sexual intercourse (proportion in union) become the most influential proximate determinant of fertility change. In other four sub-Saharan African countries, the most influential determinant of fertility change was postpartum insusceptibility. Furthermore, in all the four countries, exposure to sexual intercourse was the second most influential proximate determinant of fertility. However Kenya shows a slightly different pattern in 1998 where the influence of the exposure to intercourse goes above that of postpartum insusceptibility. This may be attributed to reporting errors since in 1993 and 1998, the index of marriage (exposure to intercourse) remained unchanged at 0.614 (see Figure 4 below and Table 5 in the appendices).

Generally, the five countries (Botswana included) display similar patterns in that, the indices of the two most influential proximate determinants of fertility are very close. Thus although the marriage or postpartum insusceptibility may be having most impact on fertility change, their influence is more or less same (the indices range between 0.5 and 0.6). On the other hand, for all countries, contraception has very little effect on fertility change. The indices are very close one, (above 0.8 in all countries).

Figure 4: Effects of Proximate Determinants on Total Fertility, Botswana, Namibia, Kenya, Zambia and Zimbabwe



	Bot-84	Bot-88	Bot-96	Nm-92	Nm-00	Ken-89	Ken-93	Ken-98	Zam-92	Zam-96	Zam-01/0	Zim-88	Zim-94	Zim-99
Cm	0.65	0.59	0.58	0.58	0.62	0.66	0.61	0.61	0.63	0.61	0.61	0.62	0.61	0.61
Ci	0.64	0.60	0.61	0.52	0.59	0.63	0.60	0.62	0.60	0.59	0.57	0.62	0.59	0.59
Cc	0.94	0.88	0.80	0.86	0.88	0.89	0.87	0.85	0.94	0.91	0.89	0.82	0.82	0.81

Proximate Determinant

CHAPTER 5

DISCUSSION, POLICY IMPLICATIONS, CONCLUSIONS AND STUDY LIMITATIONS

5.1 Discussion of the results

The Bongaarts framework of proximate determinants has been revised and modified in order to improve accuracy of the indices (Reinis, 1992;Wood, 1994; Stover, 1998). All these revisions have their purposes and usefulness. Despite availability of these new versions, Bongaarts model remains the most commonly used method mainly due to unavailability of requisite data to apply other models. The revised model by Stover for instance, is premised on the understanding that, over the years, a wealth of new data has become available and therefore estimation of proximate determinants can be improved with the newly available data. However, it should be noted that Stover's revised model is the same as the original Bongaarts model except that Stover modified the definitions of the indices. Stover (1998) however cautioned that, the extent that these new definitions of the proximate determinants indices are better measures of the actual fertility inhibiting effects, the accuracy of the model should be improved. However, accuracy will be compromised if the new definitions require use of less accurate data. Stover (1998) suggested the conditions under which his model may be applied. He suggested that the revised model might be appropriate in country where there is evidence that a considerable amount of sexual activity takes place outside marriage. Also, the model is appropriate in situation whereby there is a high prevalence of sexually transmitted diseases. Further, the Stover model is recommended in societies where a considerable proportion of men and women have chosen to be sterilised (Stover, 1998). For Botswana, only the first condition is applicable.

In the Stover model, instead using marriage as a proxy for sexual activity, coital frequency is used. The index is now estimated by using the proportion of women aged 15-49 who have been sexually active in last four weeks. Since the model uses the

proportion of sexually active women, this means that all other indices will be estimated based on this proportion of women instead of the proportion married.

For this study, since the available information is not sufficient to apply the revised model (Stover), the Bongaarts model has been used. It should however be noted that for estimation of the index of postpartum infecundability, the mean duration of breast-feeding (instead of median) was used. Furthermore, as suggested by Bongaarts in his revised model (1983), the effects of lactation and postpartum abstinence have been combined. Therefore, the index is now referred to as postpartum insusceptibility. The results show a different picture from the literature of proximate determinants in Southern Africa and from the study by Letamo in 1994. The major difference is that in this study, unlike the previous studies, the index of marriage was found to have most effect on fertility. Previously, due to problems of definition of marriage patterns, it was assumed that marriage does not have strong influence on fertility change. It was also assumed that its impact on fertility had remained unchanged between the two survey periods (BFHS I and BFHS II).

However, in Botswana, past studies on nuptiality have revealed that a large of proportion of women remain unmarried. This has lead to formation of other patterns of sexual unions (Mookodi, 2004). It has been suggested that, for such countries where large proportions of births occur outside marriage, the proportion in unions should be used (all unions with or without cohabitation). The unions without cohabitation (visiting unions) are usually unstable and probably irregular, in the absence of contraceptive use, the visiting unions are likely to be less fertile like stable unions. Therefore, it has been suggested that, when calculating the index of marriage in the Bongaarts model, the unstable unions should be estimated as half of the stable unions (Guengant, 1996). This is because, if the data does not include all the unstable unions, the lowering impact of marriage on fertility will be overestimated (thus, Cm in the Bongaarts model will be lower than it should be). On the other hand, if all unstable unions are well accounted for, but they have been considered as stable unions, the lowering impact of marriage on fertility will be underestimated (the index of Cm will be higher than it should be).

So, in order to account for this, for Botswana, the proportion in union was adjusted for the unstable union, but only for 1988 and 1996. This was prompted by the fact that from 1984 to 1988, the proportion in union dropped remarkably from 65 percent to 37 percent. Though under reporting of marriage cannot be ruled out, studies on nuptiality in Botswana have noted that marriage has declined and is being replaced by other forms of consensual unions. Marriage decline has been largely attributed to the changes in values and morality brought about changing socio-economic status of women (Mookodi, 2004). Moreover, the decline of marriage is due to the large-scale entry of women into education and paid employment.

Therefore, based on the assumption that, all births occurred within these unions and that TFR is accurately estimated the results show that, in Botswana, between BFHS II, BFHS III, fertility change was mainly influenced by the degree to which women of reproductive ages were exposed to risk of becoming pregnant. However, since between the BFHS surveys the degree of exposure (proportion in union) has been relatively low, it is logical to conclude that fertility declined due to the low risk of exposure. This finding is however in contrast to the literature of proximate determinants in sub-Saharan Africa. The literature identifies postpartum insusceptibility as the proximate determinant that has most effect on fertility. This was further confirmed by Letamo (1994) using the 1984 and 1988 BFHS data. On the other hand, a study on demographic change in sub-Saharan Africa by Jolly and Gribble (1993) revealed that in Botswana, fertility reduction is mainly due to the fact that, a large proportion of women are not in any union. The study further revealed that, age at marriage was relatively high in Botswana. Although the age at first birth was low (19 years), for the three BFHS data, mean age at child bearing has remained unchanged at 30 years. Also, this conclusion is consistent with the findings of the study by Rutenberg and Diamond in 1983. They concluded that fertility decline was mainly due to the disintegration of marriage unions caused by labour migrations.

BFHS I results show that postpartum insusceptibility (Ci) was the most important proximate of fertility, while the proportion in union was the second most influential determinant of fertility change. This however changed during BFHS II as the fertility inhibiting effect of the proportion in union surpassed that of postpartum insusceptibility. According to the literature of proximate determinant of fertility in

sub-Saharan Africa, the relative large fertility inhibiting effect of postpartum insusceptibility in mainly due to the long periods of breast-feeding. A study by van de Walle and Omideyi (1988) (cited in Jolly and Gribble, 1993), in sub-Saharan Africa revealed that the usually the period of breast-feeding ranges from 17.5 months to 23.9 months. In Botswana however, the average breast-feeding during the three surveys averaged 13.8 months.

Although the study shows a slightly different picture from the literature of proximate determinants in sub-Saharan Africa, it important to note that the deviation is quite marginal. Jolly and Gribble (1993) found that the average index of postpartum insusceptibility (Ci) for sub-Saharan Africa was about 0.56 or less. Furthermore, for Botswana, Zimbabwe and Kenya, the only three sub-Saharan countries that have started incipient fertility decline, the index of postpartum insusceptibility was slightly greater than 0.6.

As regard the index of contraception the results for all the five countries under study show that on average, the index was above 0.8. Since the index of contraception was close to one in all the countries under study, it is clear that the methods of contraception used were traditional methods, which are less effective than the modern contraceptives. It is however encouraging that, in Botswana, the effect of contraceptive use on fertility has been increasing, though the index is still high. The previous study (Letamo, 1994) of proximate determinants of fertility has predicted that contraception is likely to be most influential proximate determinant of fertility in future in Botswana, this has not happened, at least by the time of BFHS III. This means that contraceptive prevalence has not grown at the rate that it should have, or rather the use of traditional ineffective method was still prevalent.

The data for abortion and sterility were not available for the countries under study. However, for Botswana, the proportion of women aged 45-49 childless was estimated for BFHS III. The proportion is close to the expected maximum (2.9 percent) of 3 percent.

However, as mentioned earlier, when this proportion is included in the Bongaarts model of proximate determinant, it does not seem to have any effect on fertility

change. Therefore, both the indices of sterility and abortion are assumed to be one. This does not mean that sterility and abortion do not have any effect on fertility. A study by Johnston and Hill (1996) indicated that sterility was quite high in sub-Saharan Africa mainly due the prevalence of sexually transmitted diseases. Moreover, there has been evidence of increased cases of abortion in sub-Saharan Africa (Johnston and Hill, 1996).

5.2 Policy Implications

In order for the government to achieve the development objective of influencing population growth trends in the desired direction, efforts should be aimed at directly influencing one or more of the proximate determinants of fertility. However, it is important to have thorough understanding of the fertility inhibiting effects of each of the proximate determinant. It is also important to take cognisance of the fact that such a factor can be manipulated or not.

In Botswana, both postpartum insusceptibility and the exposure to intercourse (proportion in union) are the most important proximate determinants of fertility change. However, the two are probably most difficult intermediate variables of fertility to manipulate. The union patterns are a result of complex social process, therefore it would not be easy to predict the future patterns. However, it is clear that the evolution of more unstable unions have a negative impact on fertility. Fertility through such unions can only controlled by encouraging women to postpone or delay entering such unions. Further, policy should be aimed at encouraging family to have smaller family sizes.

As for postpartum insusceptibility, there is a possibility that its effect on fertility will continue to decline. Although the study on proximate determinants of fertility by Jolly and Gribble (1993) revealed the length of postpartum insusceptibility is not affected by the rising education levels of women, there is a possibility that increased participation of women in the labour force will greatly affect breast-feeding period. Therefore, it would be necessary to continue encourage women to continue to breast-feed their children for longer periods. However, breast-feeding is likely to play a less important role in fertility change in future, especially with advent of HIV/AIDS. It is

therefore important that policy aimed at reducing fertility should emphasise more on the other proximate determinants of fertility.

Contraceptive use is perhaps the proximate determinant that can be easily manipulated through a policy and can have most effect on fertility change. Although the fertility inhibiting effect of contraception was very low during the survey periods, there is a likelihood the situation has now changed since the last survey (BFHS III) was conducted more than a decade ago (1996). Therefore, family planning programmes should concentrate more on improving the effectiveness of contraceptives used. Emphasis should be on the use of effective modern contraceptives notably condoms and other barrier methods. And such contraceptive should be made available to all members of the society so that the contraceptive use can increase to the level that will make significant impact on fertility change. Another method contraception that can be considered for future is abortion. In the study of abortion in sub-Saharan Africa by Johnston and Hill in 1996, abortion was found to inhibit fertility more than contraception. However, since abortions are normally performed illegally in most countries, it was found to have adverse side effects such as increased maternal mortality and secondary sterility. Therefore, abortion can only be considered as a fertility control measure if it is performed legally by a qualified medical personnel.

5.3 Summary and Conclusions

The main purpose of this study was to apply the Bongaarts Framework of proximate determinants to find out which proximate determinant has the largest fertility inhibiting effect on fertility in Botswana. Furthermore, the study intended to determine the variations or changes in the fertility inhibiting effect of each of the principal proximate determinants of fertility. And finally, to compare the contribution of each of the proximate determinants of fertility change in Botswana and fertility change in four other sub-Saharan countries (Kenya, Zambia, Zimbabwe and Namibia).

The estimated total fecundity rate for Botswana for BFHS I, BFHS II and BFHS II are 15,74, 15,46 and 15.72 respectively (see Table 4). This means that, on average, according to the three surveys, a Motswana woman who is fecund, who remains

married through out her reproductive period, does not use any contraception or abortion and does not breastfeed, on average has a potential to have 15 children. However, due to the fertility inhibiting effects of the proximate determinants, fertility was reduced from its potential maximum to actual level (TFR). From BFHS I in 1984, the joint effect of the proximate determinants of fertility reduced fertility from 15.74 to about 6.5 during BFHS II in 1988 (representing fertility reduction of about 7.4 births per woman). During BFHS III the effect of proximate determinant was even greater, potential fertility was reduced from 15.72 to actual fertility (TFR) of about 4.30 births per woman (see Table 4).

The results indicate that for all countries under study, only two proximate determinants of fertility are responsible for most fertility change that has occurred. These two proximate determinants are postpartum insusceptibility (Ci) and the exposure to intercourse (Cm). Also, in all the countries, indices of the proximate determinants are close to each other, ranging between 0.5 and 0.6. The only slight difference is that, for Botswana, postpartum insusceptibility had largest effect on fertility only in 1984, however, both in 1988 and 1996, exposure to intercourse (Cm) surpassed postpartum insusceptibility as the proximate determinant with the largest fertility inhibiting effect. In Botswana therefore, fertility change is mainly influenced by evolution from stable unions to less stable union, which have a negative effect on fertility.

Furthermore, in all five countries under study, effect of contraceptive use on fertility has remained fairly marginal over the different survey periods. For all the countries, the indices are all above 0.8. This is consistent with the findings of the study by Rutenberg and Diamond (1983) that, in sub-Saharan Africa, contraceptive prevalence rates are generally low when compared with other major regions in the world. Moreover, Rutenberg and Diamond (1983) concluded that, in sub-Saharan Africa, there is substantial use of traditional contraceptive method, which are not as effective as modern contraception in preventing pregnancy. It is however worth noting that, in all countries, the effect of contraceptive use has been increasing, an indication that slowly, people are moving from less effective traditional methods to more reliable modern contraceptive methods.

5.4 Limitations of the Study

The use secondary data is a very serious handicap for any researcher. Notwithstanding that the study is focused on Botswana, Botswana DHS data were not available except for BFHS III, which was conducted in 1996. But even then, there were some instances where some sections of the data were completely missing. An enquiry from Central Statistics Office (CSO) revealed that some data sets were lost sometime back when their main server crushed, including the BHFS I and BFHS II data sets. As a result therefore, the study relied mainly on available records and reports.

As for data from other countries, the data were sourced online from MEASUREDHS program. The data set were however not useful as MEASUREDHS provided raw data with no data dictionary for each country. MEASUREDHS however do have another online program called STATcompilier. STATcompiler provides various pre-calculated indicators in tabular form. These indicators are complied from DHS data from different countries that subscribe to the MEASUREDHS. Again, the use indicator from STATcompiler is very limiting as one only gets what has been pre-calculated. And because of these data limitations, it was not possible to do any cross tabulations to see how the proximate determinants themselves are affected by various socio-economic variables.

It was also not possible to carry out a proper assessment of the quality of data. Therefore, the results may be biased by the fact that all sample survey data suffer from both coverage and content errors. Jolly and Gribble (1993) noted that in more than half of the DHS surveys in sub-Saharan Africa, less than 50 percent of the women interviewed were able to give their date of birth.

Furthermore, due to the fact that it is very difficult to accurately measure the risk of exposure to intercourse, a lot of assumptions were made, and therefore, there is a possibility that the assumptions made could have distorted the final results. According to Reinis (1992), the method produces good estimates under the assumption that contraceptive use is random. This assumption may not hold since in most situations, contraceptive use is depended on family building plans. Moreover, Reinis (1992) found that the estimates produced by the model, except for Ci, are generally less

accurate. The method generally performs poorly when contraception is used to stop rather than space births.

Moreover, unavailability of abortion and sterility can distort the overall contribution of the proximate determinants to fertility change. That is, exclusion of the indices of abortion and sterility underestimate the contribution of proximate determinants to fertility change. According to Coeytaux (1988) cited in Jolly and Gribble (1993), notes on early studies conducted in the 1980's and early 1990's revealed rising hospital admissions for complications related to abortions. Therefore, despite the unavailability of abortion data, abortion is widely practised and it inhibits fertility.

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APPENDIX TABLES

Table 4: Effects of Proximate Determinants on Total Fertility, Botswana

Index	1984	1988	1996
Cm	0.650	0.580	0.550
Ci	0.643	0.604	0.619
Ca	1.000	1.000	1.000
Cs	1.000	1.000	1.000
Cc	0.944	0.885	0.808
TR	**15.7**	**15.5**	**15.7**
TFR	**6.5**	**4.7**	**4.3**

Table 5: Effects of Proximate Determinants on Total Fertility, Botswana, Zimbabwe, Kenya and Zambia

Index	Cm	Ci	Ca	Cs	Cc	TR	TFR
Botswana							
1984	0.650	0.643	1.000	1.000	0.944	15.7	6.5
1984	0.580	0.604	1.000	1.000	0.885	15.5	4.7
1996	0.580	0.619	1.000	1.000	0.808	15.7	4.3
Zimbabwe							
1988	0.629	0.625	1.000	1.000	0.826	15.9	5.4
1994	0.618	0.599	1.000	1.000	0.822	13.5	4.3
1999	0.611	0.595	1.000	1.000	0.811	13.0	3.5
Kenya							
1989	0.667	0.637	1.000	1.000	0.898	16.8	6.7
1993	0.614	0.608	1.000	1.000	0.879	15.8	5.4
1998	0.614	0.623	1.000	1.000	0.855	13.7	4.7
Zambia							
1992	0.631	0.602	1.000	1.000	0.943	17.3	6.5
1996	0.611	0.592	1.000	1.000	0.919	17.6	6.1
2001/02	0.613	0.575	1.000	1.000	0.899	17.8	5.8
Namibia							
1992	0.580	5.528	1.000	1.000	0.860	22.9	4.2
2000	0.620	0.592	1.000	1.000	0.884	23.7	5.4