Université de Montréal

"The Fertility Transition in Kenya: Patterns and Determinants"

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Cette thèse intitulée:

“The Fertility Transition in Kenya: Patterns and Determinants”

Présentée par:

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Abstract

In spite of considerable research on Kenya's fertility, questions remain. This dissertation examines three of these issues - the national and sub-national trend patterns in the country's fertility and related proximate determinants, factors in the transitions to second and third conceptions, and the determinants of contraceptive use. Results, presented below, are based upon data which comprised five sample surveys conducted between 1977 and 2003 among women of reproductive age, as well as a community and health facility survey implemented in 1999.

First, an exploratory analysis of trends in fertility and its proximate determinants shows that a pattern of later family formation and of a higher level of fertility control is associated with the more modernized and developed regions (urban areas and rural Central Province). Secondly, using survival analysis, the relative hazards of transition to the second and third conceptions for the 12-year periods during which fertility fell rapidly (1977-1989) and the pace of decline reduced (1991-2003) are compared. Among the findings, although child survival has significant effects during both periods, its influence is more pronounced during the recent period. Thirdly, multivariate analysis of the determinants of contraceptive use shows that motivation for fertility control is significant, while access to family planning services is not. That proximity to family planning services might nevertheless be important is shown by the significance of exposure to family planning messages, many of which are often communicated from the health facilities.

This dissertation makes contributions in three areas. One, it confirms the dichotomy in the pattern of fertility change and its proximate determinants in the country, not so much along the usual rural-urban separation, but rather between urban areas and rural Central versus the rest of rural Kenya. Two, it shows that the decreased pace of the fertility transition in Kenya, including constant fertility over 1998-2003, might be associated with the rise in infant and child mortality since the 1990s. Three, it shows the significance of education, motivation for fertility control, and exposure to media messages about family planning in contraceptive use, thereby pointing out where policy and program effort should be directed in order to sustain the fertility transition.

Key words:
Kenya, Transition, Proximate determinants, Fertility control, Motivation, Access, Demographic techniques, Cox regression, Probit

Résumé

Malgré de nombreuses études consacrées à la problématique de la transition de fécondité au Kenya, des questions subsistent. Cette thèse traite de trois d'entre elles : les tendances de la fécondité et ses déterminants proches, les facteurs liés au passage à la deuxième et à la troisième grossesse, et les déterminants de l'utilisation de la contraception. Les données proviennent de cinq enquêtes menées dans ce pays entre 1977 et 2003, auprès de femmes d'âge reproductif, ainsi que d'une étude, conduite en 1999, au niveau communautaire et de centres de santé.

Les résultats montrent d'abord une tendance au mariage tardif et à un niveau plus élevé de contrôle de la fécondité dans les régions les plus modernisées et les plus développées (les villes et les zones rurales de la région de la Province Central). Deuxièmement, dans la comparaison des 12 années durant lesquelles la fécondité, mesurée par l'indice de fécondité, s'est réduite (1977-1989) et celles où le pas de sa baisse a ralenti (1991-2003), on note une augmentation des effets relatifs de la mortalité infantile pendant la deuxième période. Troisièmement, la régression multi variée utilisée pour l'analyse des déterminants proches de l'utilisation de la contraception fait ressortir le rôle important de la motivation pour le contrôle de la fécondité. Bien que l'accès aux services de planification familiale ne constitue pas un facteur significatif en soi, il pourrait jouer néanmoins un rôle dans la mesure où les résultats montrent que l'exposition aux messages de planification familiale (généralement offerts dans les centres de santé) a un effet significatif.

La contribution de cette thèse s'articule autour de trois aspects. Premièrement, elle montre une opposition dans les changements de la fécondité et de ses déterminants entre 1977 et 2003, non pas entre les zones urbaines et rurales comme d'habitude, mais plutôt entre zones urbaines et partie rurale de la Province Central d'une part et le reste du Kenya d'autre part. Deuxièmement, le ralentissement de la baisse de la fécondité, y compris le niveau stable observé entre 1998 et 2003, est probablement lié à la hausse, depuis les années quatre-vingt dix, de la mortalité infantile. Troisièmement, cette thèse confirme le rôle significatif de la scolarisation, de la motivation pour le contrôle des naissances, et de l'effet positif des messages sur l'usage des méthodes de planification familiale, montrant ainsi les domaines dans lesquels doivent intervenir les politiques et programmes afin de maintenir la transition de fécondité.

Mots clés:

Kenya, Transition de la fécondité, déterminants, Contrôle de la fécondité, Motivation, Accès, Méthodes démographiques, régression de Cox, Probit.

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Acronyms and Abbreviations

AFSSA: Afrique Francophone Sub-saharienne
AIDS: Acquired Immune Deficiency Syndrome
ASFR: Age Specific Fertility Rate
CBD: Community Based Distributor
CBR: Crude Birth Rate
CBS: Central Bureau of Statistics
CDHS: Cameroon Demographic and Health Survey
CDR: Crude Death Rate
CEB: Children Ever Born
CHWs: Community Health Workers
CPS: Contraceptive Prevalence Survey
DHS: Demographic and Health Survey
DOs: District Officers
EAs: Enumeration Areas
FBOs: Faith Based Organizations
FIML: Full Information Maximum Likelihood
FP: Family Planning
FPAK: Family Planning Association of Kenya
GDP: Gross Domestic Product
GIS: Geographic Information System
GLLAMM: Generalized Linear and Latent Mixed Model
HEs: Health Educators
HF: Hazard Function
HIV/AIDS: Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
ICPD: International Conference on Population
IEC: Information, Education, and Communication
ILRI: International Livestock Research Institute
IQR: Inter Quartile Range
IUDs: Intrauterine Devices
IV: Instrumental Variable
KAP: Knowledge Attitude and Practice
KBC: Kenya Broadcasting Corporation
KCS: Kenya Community Survey
KDHS: Kenya Demographic and Health Survey
KEM: Kikuyu, Embu, Meru
KFS: Kenya Fertility Survey
KSPA: Kenya Service Provision Assessment
MOH : Ministry of Health
NASSEP: National Sample Survey and Evaluation Program
NCAPD: National Coordinating Agency for Population and Development
NCPD: National Council for Population and Development
NGO: Non Governmental Organization
NISP: National Integrated Sample Survey
NRC: National Research Council
OLS: Ordinary Least Squares

PPRs: Parity Progression Ratios
PRB: Population Reference Bureau
SDPs: Service Delivery Points
SPSS: Statistical Package for Social Scientists
STATA: Statistical/Data Analysis
STDs: Sexually Transmitted Diseases
TBAs: Traditional Birth Attendants
TFR: Total Fertility Rate
UN: United Nations
USA: United States of America
WFS: World Fertility Survey

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CHAPTER 1: GENERAL INTRODUCTION TO THE ISSUE OF FERTILITY TRANSITION IN KENYA

1.1 Scope of the Dissertation

The title of this doctoral dissertation is, "*The Fertility Transition in Kenya: Patterns and Determinants*". Its scope, and justification for the choice of Kenya, can be illustrated by the evolution of fertility over time in the country. In the late 1970s, following the results of the World Fertility Survey (WFS) conducted in Kenya, the country was recorded as having one of the highest fertility rates in the world of 8.2 births per woman (CBS 1980). The series of Demographic and Health Surveys (DHS) carried out thereafter tracked further changes in fertility. While current fertility significantly declined to 4.7 by 1998, it levelled off thereafter – between 1998 and 2003. These two changes, the transition from higher to lower fertility and then the stabilization, are the focus of this thesis. Unlike the many studies on the population dynamics of Kenya which have dwelt on the aggregate national level, this work also examines the factors associated with the changes in fertility at the sub-national level.

Taking the cue from concerns about the effects of high population growth, the Kenyan Government enacted a number of policy measures that were to guide the management of population growth. In 1967, three years after the country attained political independence, the population program was officially launched and integrated into the Maternal and Child Health Division in the Ministry of Health. Concern about population growth was further reflected in the enactment of two population policy documents. In 1984, the population policy guidelines - Sessional Paper no. 4 - were ratified by parliament and the National Council for Population and Development (NCPD), now renamed National Coordinating Agency for Population and Development (NCAPD), was created to coordinate population activities in the country. Sixteen years later, in 2000, the guidelines were revised and renamed the population policy on sustainable development. To date, the policies have culminated in the setting up of a comprehensive family planning program that spans a number of service delivery outlets operated by the Government, non-Governmental (NGO), and private providers, as well as services provided by community-based distributors (CBDs).

The development of policy guidelines and implementation of population programmes notwithstanding, debate has however persisted on the reasons why fertility changes. These discussions, which have been both international and national in nature, have implications for the Kenyan context, as for many other developing countries. One argument, the fertility-demand hypothesis, posits that fertility will decline with economic development, as couples are motivated to have fewer children. Others, supporting what has come to be known as the supply-side argument, maintain that development is not a necessary condition – fertility will decline even when only access to fertility control is assured (Casterline and Sinding 2000; Feyisetan and Casterline 2000).

Critics of the supply-side argument have however pointed out that some of the measures used in family planning programmes might not be valid and reliable. For example, it is argued that unmet need for family planning is not really measuring the need for family planning, as it misses a number of other needs, such as satisfaction with the method used (Dixon-Mueller and Germain 1992), and is sometimes confused with total demand for family planning (Pritchett 1994). In addition, the assumption that an oft-used measure of fertility demand – intentions for more children in the future – helps to predict actual behaviour has been contested (Westoff and Ryder 1977; Hermalin et al. 1979; Westoff 1990; Silva 1991; Bankole and Westoff 1998). The existence of a relatively large body of demographic data on Kenya that has accumulated over the last five decades, since the 1960s, is an opportunity to test out these arguments and ripostes.

The intellectual debate that has marked the arguments about fertility demand and supply is etched out in the development of the concepts related to family planning. In the 1960s, following the Knowledge, Attitude, and Practice (KAP) surveys, a discrepancy was noted between the fertility preferences of some women and their fertility behaviour (Mauldin 1965). This measure, then named the KAP-gap, was subsequently refined, based upon data from the World Fertility Surveys (WFS) and Contraceptive Prevalence Surveys (CPS), and renamed the unmet need for family planning. The Demographic and Health surveys conducted from the 1980s helped to improve this measure.

Concern about world population has been a priority agenda at the international level: the 1974, 1984, and 1994 world population conferences held in Bucharest, Mexico, and Cairo (United-Nations 1994) attest. That the last conference significantly shifted the emphasis of population programs is not in doubt. From a world agenda that was dominated by focus on demographic targets, the International Conference on Population and Development (ICPD) held in Cairo led to a shift of emphasis on the reproductive health of the individual woman and the couple, with implications for the place and role of family planning.

In searching for explanations as to why Kenyan fertility has evolved over the last forty or so years the way it has, this thesis goes beyond the above policy and program factors. This dissertation leans on several explanations or narratives that have been proposed to explain the changes in fertility. One of these is the theory of the demographic transition (Easterlin and Crimmins 1985). It posits that changes in urbanization and industrialization which occurred during the industrial revolution in England might be the same mechanisms that spur the changes in social organisation leading to a decline in fertility in other countries, including developing-world countries such as Kenya. Other arguments have been advanced, the gist of which are expounded later on in the thesis.

Based on these ideas, this thesis examines the forces behind the changes in Kenyan fertility, and its presentation is as follows. In chapter one – introduction - the research problem is stated following a review of the context. Chapter two reviews the literature on the fertility transition in Africa in general and Kenya in particular. In chapter three, the strengths and limits of the various datasets used are discussed; in chapter four the methods of data analysis are presented. The next three chapters – five, six, and seven - can be considered as the body of this thesis. They address in turn, the patterns associated with fertility change at the sub-national level, the factors associated with the transition to the second and third births, and the determinants of choosing a method of family planning. In chapter 8, the thesis concludes by discussing and synthesizing the research findings into an explanation for the initial rapid fall, and more recent levelling off, in Kenyan fertility as well as an outlook on prospects for further fertility decline.

1.2 The National Context

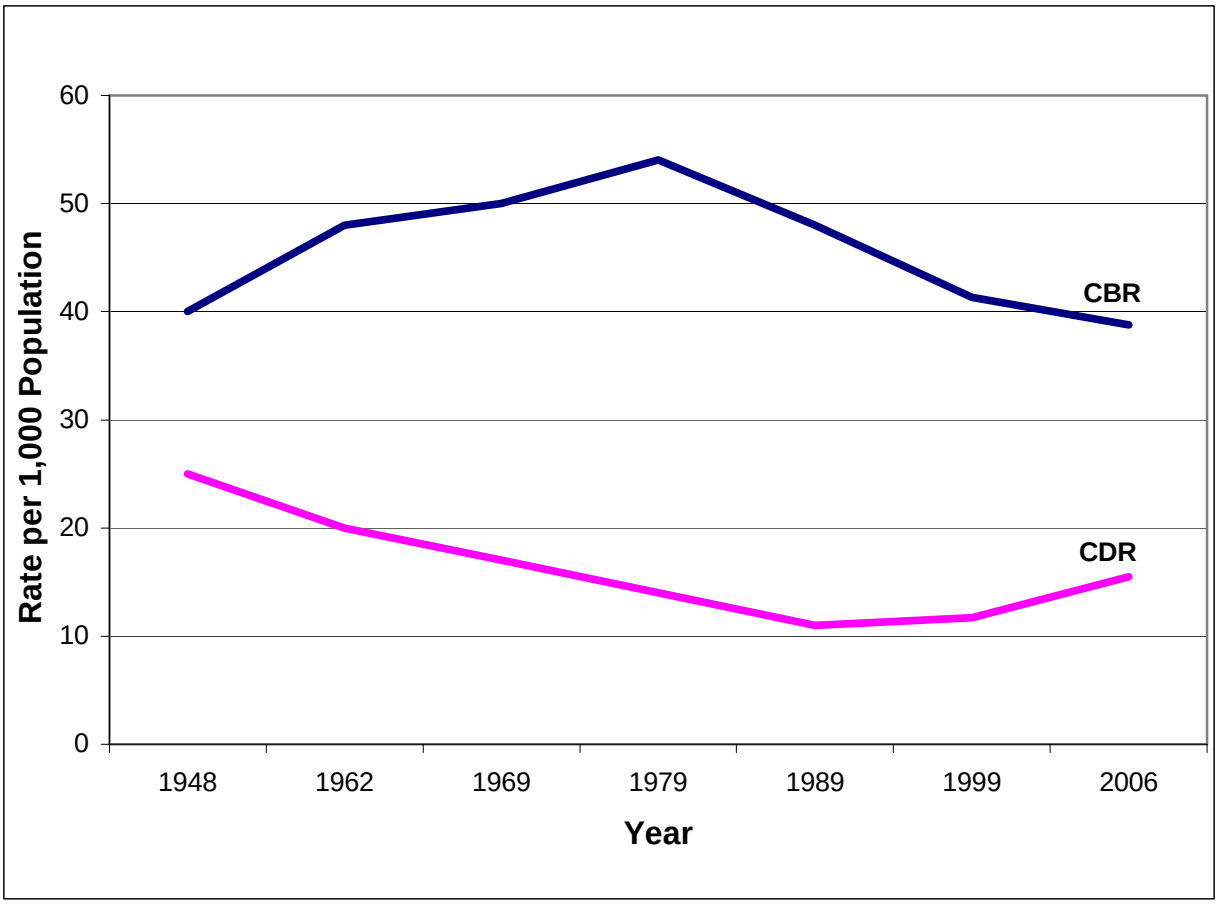
The context under which fertility dynamics, like all social processes, operate in Kenya is illustrated by several background factors. They include the physical environment, administrative set-up, and the economy which are presented below, as are the trends in major population variables. The physical environment ultimately translates into land and agriculture. Located in Eastern Africa, Kenya is a rather small country by African standards. With a land area of 582,646 square kilometres, Kenya is ranked number 22 in size among sub-Saharan African countries (Brass and Jolly 1993). The population was estimated at 33.6 million inhabitants in 2005, with about 20% of the land being arable. High population densities and consequent land fragmentation in these high agricultural potential areas has often been the basis of advocacy and information, education, and communication (IEC) campaigns for family planning, based on the so called "demographic" rationale (NCPD 2000).

The second background factor, the administrative set-up, is related to the country's history and ethnic composition – a triple heritage of the influence of African, European, and Arab cultures. A former British colony, Kenya reverted to multi-party democracy upon the 2002 general elections. Appendix 1, which is a map of the administrative set-up of the country, shows that Kenya is divided into eight provinces including Nairobi, the capital city. There are at least 41 ethnicities in the country, divided into Bantu-speaking, Nilotes, Nilo-hamitic, and Cushitic groups (Brass and Jolly 1993; Bauni et al. 2000; Weinreb 2001; CBS et al. 2004). The major ethnic groups are the Kikuyu (Bantu), Luo (Nilotes), Kalenjin (Nilo-hamitic), Luhya (Bantu), Kamba (Bantu), Kisii (Bantu), Mijikenda (Bantu), Somalia (Cushitic), and the Meru (Bantu). English and Swahili are the official and national languages respectively. The main religions are Christianity and Islam. All government programs at the sub-national level, including the population program, are implemented through the "provincial administration", which comprises a hierarchy of administrative offices in charge of the various levels of the province, right down to the village-level. In this regard, District Officers (DOs), Chiefs, and Assistant Chiefs underwent a series of population seminars in the late 1980s to enable them effectively implement the Government policy on population.

The economic setting reflects the changing fortunes in the lives of the Kenyan people, with possible effects on fertility, and it is useful to highlight the economic trends in the country; detailed social and economic indicators being presented in appendix 2 for further reference. During the first decade following political independence in 1963, the Kenyan economy, measured by the Gross Domestic Product (GDP), grew at an impressive rate of 6.6% per annum. This was achieved by supporting public investment, small-holder agricultural production, and private industrial investment. However, between 1974 and 1990, the country's economic performance declined, due to poor agricultural policies, inward looking import substitution policies, and rising oil prices. Economic performance was at its lowest between 1991 and 1993 when growth in GDP stagnated. Although the Government commenced a program of economic reform and liberalization in 1994, in 1997 the economy stagnated again, due in part to adverse weather conditions and reduced economic activities prior to political elections in 1997. In the same year, the World Bank suspended financial lending to the country for three years. Since the new Government was elected in 2002 however, the economy is on the recovery path and was reported to have grown at 6.1 per annum in 2006 (KNBS 2007).

The population dynamics of Kenya have evolved significantly over the years, and specific demographic indicators for the country are provided in appendix 3. Following predictions by population experts that fertility would persist at high levels in Kenya (Robinson 1992), the fertility transition nevertheless commenced in the country in the late 1970s (Kelley and C. E. Nobbe 1990; Brass and Jolly 1993). These trends are captured by the changes in the Crude Birth Rate (CBR) and the Crude Death Rate (CDR) shown in Figure 1 below. In spite of this earlier decline in fertility however, the most recent KDHS results (CBS et al. 2004) indicate a levelling off in current fertility between 1998 and 2003 at 4.8 births per woman.

Figure 1: Crude Birth Rate (CBR) and Crude Death Rate (CDR) in Kenya, 1948-2006



Note: x-axis not to scale; Sources: Kenya Demographic and Health Survey, 2003; Economic Commission for Africa (ECA), "African Statistical Yearbook 2006".

1.3 Identification of Priority Issues

To arrive at the priority issues to be addressed in this thesis, a number of factors were taken into consideration. During the initial stages of preparing for this dissertation - the development of the research proposal - it became evident that the issues relating to the fertility transition in Kenya in general and specific areas such as fertility preferences and contraceptive use have been comprehensively covered. The initial and limited review of the existing literature on the subject of the fertility transition in Kenya at that stage, and the more comprehensive review undertaken later and detailed in chapter two turned out to be useful in identifying gaps in research. In conjunction, a wealth of sample survey data has accumulated in the country, enabling analysis over a longer period of time and consequently getting better insights into the causes of transitions (Mason, 1997). To these strengths should be added the existence of the 1999 Kenya Service

Provision Assessment (KSPA) community and health-facility dataset, alongside the 1998 Kenya DHS survey. The two surveys provide an opportunity to link the community and individual levels, and hence enable a multi-level analysis of the problem of fertility preferences and family planning use.

A number of constraints however limited the scope for choosing the specific area of research. First, most of the data are cross-sectional rather than longitudinal in nature. Thus, only a limited amount of time series or panel analysis, an ideal method for evaluating program impact, can be carried out using those aspects of the transversal data that can be turned longitudinal, in combination with data based on health facilities. Secondly, the available data are secondary rather than primary. They consequently become limiting in the sense that it is now a question of adjusting into the dictates of the available information rather than the research objectives directing the type of information to be gathered. This is particularly important in the study of demographic processes whereby different approaches such as event history analysis, and different types of data collection methods such as qualitative methods would be appropriate in certain cases.

Existing statistical methods and the related software present both opportunities and challenges in this work. On the one hand, advances in statistical and econometric methodology now permit the solution of otherwise sophisticated models – for example the solution of estimation problems in panel versus cross-sectional analysis, non-linearity, and unobserved heterogeneity. Nevertheless, a number of the methods, including multi-level analysis and evaluation of programs, require application of sophisticated mathematical, statistical, and computing methodology. In this dissertation, models that can be easily handled by general statistical software and packages such as STATA will be preferred.

1.4 Problem Statement

The broad question of the fertility transition in Kenya is the subject of this thesis. Within this transition, the thesis examines the patterns and determinants of not only the rapid fall in fertility experienced earlier, but equally the constant trend in that decline observed more recently. Within this broader problem, this dissertation identifies and addresses three specific research issues.

First, in contrast to various national-level demographic sample statistics and population parameters that give the impression of uniformity, there are striking variations in fertility and mortality by region in Kenya (Kelley and C. E. Nobbe 1990; Brass and Jolly 1993). The eight regions in the country can each be associated with contextual issues unique to that province. Dense population distribution in regions of high agricultural potential, elevated infant mortality, modernization, and rural-urban migration constitute some of these issues. What might be the association between these sub-national contexts and the respective trends in fertility? The idea of the age pattern of fertility decline, often used to analyse fertility trends over time, comes to mind.

According to the classic idea of the age pattern of fertility, there are fundamental differences in patterns, by parity and hence age, between populations in natural and controlled fertility regimes: in natural fertility populations fertility declines slowly with age and only starts to drop sharply after age group 35-39 as the population of women who remain fecund reduces rapidly (Knodel 1977). In a controlled fertility regime on the other hand, fertility reduces more rapidly during the early years of childbearing (as many women have already achieved the family size that they desire and are in effect stopping further childbearing) so that by their thirties, fertility is already very low and there is no scope for further fertility reductions beyond these ages. On the one hand, some studies have suggested that the African fertility transition is different from that in other parts of the world such as that which took place in historical Europe or Asia in that it is marked at all ages (Caldwell et al. 1992). This is in contrast with the idea of parity-specific fertility control, which hypothesizes that fertility declines in a specific pattern above the age of around 20 years (Coale and Trussell 1974; Knodel 1977). These two positions represent divergences in views concerning the age pattern of fertility decline among all women in general in Kenya, and among young women in particular.

Secondly, while the transition to lower fertility in Kenya has been amply studied (Kelley and C. E. Nobbe 1990; Robinson 1992), much remains to be understood about constant fertility in the country that was experienced between 1998 and 2003. Two recent studies serve as useful benchmarks for further examination of this levelling off in fertility. The first, an aggregate-level study based on data from 38 developing countries (Bongaarts 2006) concludes that lack of socio-

economic development in Ghana and Kenya might be responsible for the stall in these countries. The second notes that rising child mortality, possibly due to HIV/AIDS and other childhood diseases, is associated with the rise in desire for additional children in Kenya (Westoff and Cross 2006). A comprehensive explanation is however lacking. There is need to bring the socio-economic explanation from the aggregate to the micro level in Kenya and combine it with the child mortality explanations. Linking up with the idea of parity-specific fertility control mentioned above, a question that arises is, "what factors determine the transition in fertility among young women in Kenya?"

Thirdly, for women of reproductive age, fertility and contraceptive use in Kenya changed significantly from a natural to a controlled fertility regime from the mid-1970s to the 1990s. While only 4.3% of married women aged 15 to 49 years were using a modern method of family planning in 1977/78, this proportion had increased to 31.6% in 1998 and to 33.4% in 2003. In 1998 for example, the most commonly used methods were injectables (used by 12% of married women of reproductive age), pill (9%), female sterilization (6%), periodic abstinence (6%), IUDs (3%), condoms (1%), and implants (1%). Use of modern methods was higher in urban areas compared to rural areas, but the reverse was true for natural methods (NCPD 1999; Magadi and Curtis 2003). The source of methods also varied: Government health facilities were the most widely used source then, supplying 58% of all contraceptives. Private and NGO health facilities distributed 33%, other private sources such as shops (5%), while Community Based Distributors (CBDs) supplied 3%. Relative to many other African countries, this level of prevalence and distribution is high. Where data availability permits, it would be useful to respond to the question, "what role did increased motivation for fertility control, and what part did the family planning program, particularly access to services, play in these increased levels of contraceptive use?"

1.5 Conceptual Framework

These three research questions can be situated within a number of theories (frameworks for describing social phenomena), and in chapter two - which is devoted to a review of the literature - they are presented in greater detail. This thesis borrows from these and other theories and comes up with a blend of existing and new concepts (ideas) that attempt to explain the

phenomenon of the fertility transition in Kenya. In particular, the linkages between the three research problems stated above - fertility patterns, reproductive cycle, fertility demand and supply - and the fertility transition are explained through a number of ideas.

First and foremost is the idea of fertility change: unlike in the classical theories of the fertility transition, here it refers both to the phase of declining fertility, as well as to the constant fertility recently witnessed in the country. Secondly, in contrast to many models that treat change in fertility as being fixed or cross-sectional, the idea of dynamic fertility is pertinent in this thesis. The term dynamic in this case refers to the level of cumulated fertility at any particular stage in the reproductive cycle. Thirdly, the idea of context is important, as the theories can be broadly grouped into micro-level (household and individual) or contextual (institutional) explanations for fertility change. In this dissertation, both levels are considered. Fourth is the idea of desire and ability in fertility decisions; the key issue here being identification of new and emerging determinants of this fertility demand. The conceptual framework built from these four ideas, and the linkages between them, is shown in Figure 2 below. The framework is inspired by that on child mortality in the urban and rural Sahel (Lalou and LeGrand 1997); on the micro determinants of fertility (Entwisle and Mason 1985); and on the dynamic model of fertility (Newman 1988).

First, the trend patterns in fertility and its proximate determinants at the national (aggregate) level may mask important differences at the sub-national level; the task is to account for residual variations at the sub-national level. Thus, at the sub-national level, the factors that bring about change in fertility may first operate at the two broad strata of Kenyan society - the urban place and rural areas. Demographically, urban areas are distinct in the intensity and variety of economic activity and consequent greater female labor-force participation, the heterogeneity of the communities, and above all, the proximity to information and health services. The levels of these measures further varies when the urban agglomeration is sub-divided into the capital city of Nairobi and, to an extent, the second largest city of Mombasa harbor, and the secondary towns. In contrast to the scenario in the urban areas, the population living in each of the rural provinces is differentiated by their ethnic homogeneity, the effects of environmental endowments on mortality and fertility, and the political capital that each region wields.

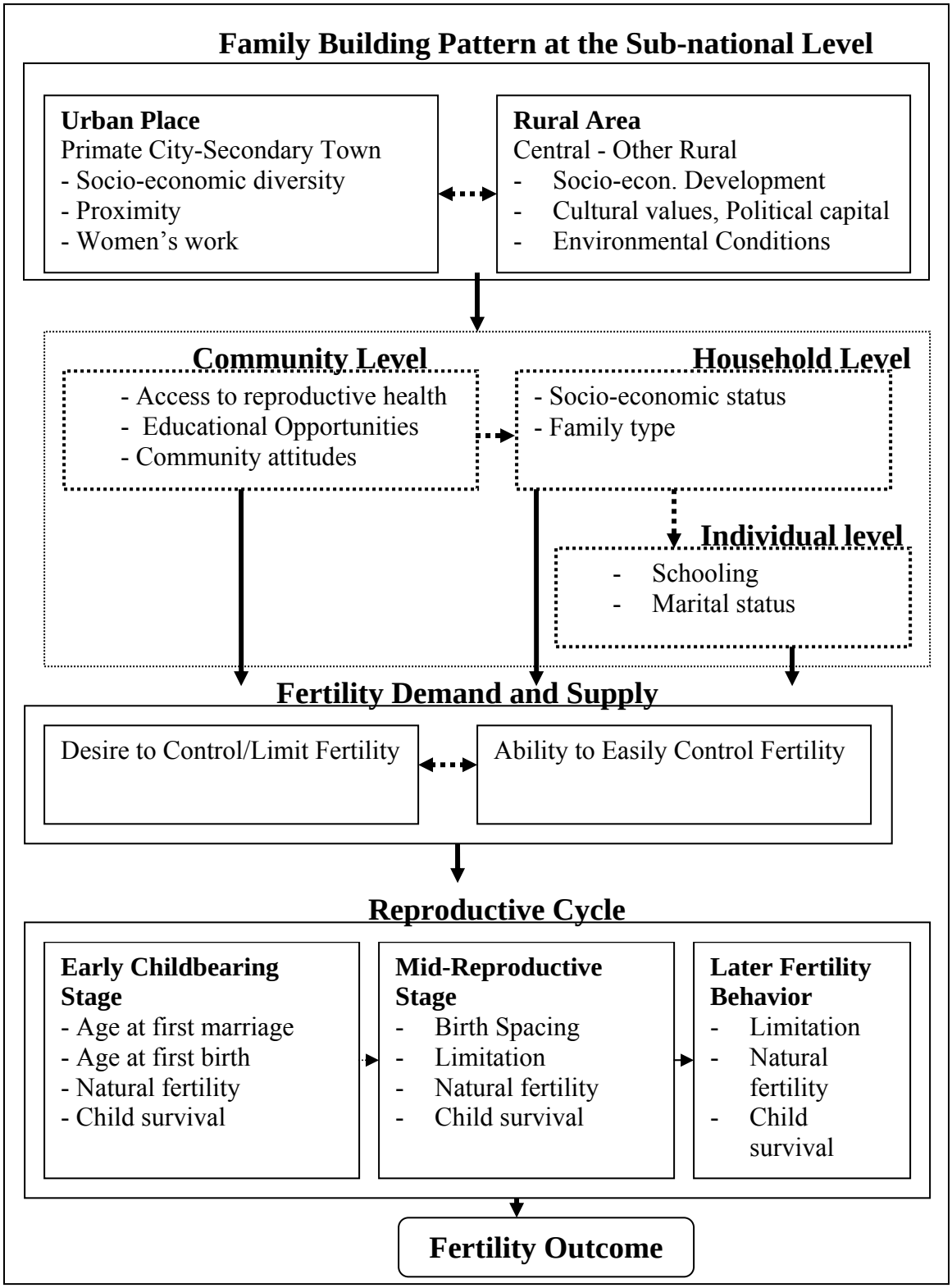
Secondly, the patterns in fertility and its intermediate variables are manifested in the reproductive stage that individual women and couples find themselves in. During the beginning of childbearing, fertility is determined by the age at first marriage and at first birth. Where there is fertility control, such regulation is for delaying the onset of childbearing or for spacing births: desired fertility has not yet been achieved. During the mid-reproductive stage, motivation for fertility control picks up, with a possibility of spacing methods for a longer term being adopted. During the late reproductive stage, permanent methods of family planning may be adopted as couples seek to stop childbearing, since they may have attained the desired family size. This however is true in a regime of fertility control, such as would prevail in the more modernized regions of the country. In other rural settings, a regime of natural fertility may exist even at this late stage of reproduction; in this case closely-spaced births may be the norm, only constrained by natural fecundity which diminishes with age.

Thirdly, the fertility patterns and determinants act at three levels – those of the community, the household, and the individual. At the community or village level, it is access to development infrastructure and services and, in particular, the proximity to health services that affects fertility. For the family on the other hand, social and economic standing (wealth) is a significant factor affecting the resultant fertility. In addition, the idea of the quality-quantity trade-off (Randall and LeGrand 2003) whereby parents decide to have a smaller number of children in order to better invest in their education for example, is also important, particularly within urban households. Over the years since the 1970s, the health, social and economic situation in Kenya first improved and then deteriorated in the 1990s; it will be interesting to examine how these changes have affected the value of investing in child quality versus quantity. Ultimately, for the individual woman, her characteristics, such as educational level, age, and disposition towards bearing many or few children will affect the total number of children ever born and fertility.

Lastly, an important aspect that affects the fertility transition is the desire for fertility control and the availability (access) of facilities for this control. These factors may operate at the level of the individual woman, the household, and the community as well. Taken together, the ideas elucidated in the framework (Figure two) finally determine the fertility outcome – a birth or no birth at a particular point in time; this dynamic outcome being measured by a number of period

and cohort indicators such as children ever born, completed fertility, age specific fertility rates (ASFRs) and the total fertility rate (TFR).

Figure 2: Conceptual Framework for Analysis of Change in Fertility in Kenya



1.6 Research Objectives

The problem statement and conceptual framework stated above outline the focus of this dissertation. The ultimate goal of this work is to contribute to a better understanding of the dynamics associated with the fertility transition, which includes the levelling off in fertility, in Kenya over the period 1977 to 2003.

Specifically, the dissertation seeks to achieve the following objectives:

1. Explore the trend patterns in Kenyan fertility at the national and sub-national levels with data collected over the period 1977-2003 (which also provides retrospective fertility for the pre-1977 period), and compare them with corresponding changes in proximate determinants, as well as stopping and spacing behaviour.
2. Determine the factors related to the rapid fall (1977-1989) and reduced speed of decline (1991-2003) in the Kenyan fertility transition by analysing the covariates of the duration of the second and third birth intervals. This will be accomplished by focussing on the early reproductive behaviour and based on the 1988/89 and 2003 KDHS datasets.
3. Assess the effects of fertility preferences and access to family planning services on the choice of methods of family planning, and thereby the fertility transition in Kenya, using the 1998 KDHS and the 1999 KSPA surveys.

1.7 Justification for the Study

1.7.1 Concern about Population Prospects

From a programs point of view, the subject of this dissertation - patterns in the fertility transition and its determinants in Kenya - and its general objective are important for at least two reasons. First, examining the factors related to the decline in fertility might help in determining whether fertility declined because of the efficiency and effectiveness of programmes or due to increased motivation among couples to control their fertility. This is important as it would provide information on where to place program emphasis - on creating more demand for family planning services or on satisfying already-existing demand. Secondly, the recent levelling off in fertility is of concern to the Government and other stakeholders. If fertility remains at current levels or

reverts to an increase, this would jeopardise the Government's plan of managing population growth.

1.7.2 Sub-national Patterns Insufficiently Examined

The specific components of this dissertation, which comprise the three short-term objectives, are justified on several grounds. The first objective, on the trend patterns of fertility at the sub-national level, is interesting as it might illuminate several important issues. First, there has been a rapid decline in fertility in the country from one of the highest in the world in the late 1970s to relatively low levels for Africa in 1998, and then through at least to 2003, constant fertility in decline (Brass and Jolly 1993; CBS et al. 2004; Westoff and Cross 2006). Secondly the recent levelling off or marginal increase in fertility has implications for future population size.

While considerable work has been carried out on Kenyan fertility in the past, for example (Henin et al. 1982; Mosley et al. 1982; Kelley and C. E. Nobbe 1990; Robinson 1992; Brass and Jolly 1993), most of it was at the national level and employed multi-variate techniques. Under the first objective of this dissertation, an original contribution is made. Based on data collected over the 1977-2003 period, comparisons are made (using exploratory techniques and descriptive statistics) between the national and sub-national trend patterns in fertility; the sub-national levels being more uniform and between them exhibiting different fertility patterns across time, perhaps illustrating the temporal effects of factors overlooked in multivariate statistical studies.

1.7.3 Momentum of Youthful Population

Similarly, the second specific objective for this dissertation – the examination of factors associated with the reduced pace of the fertility decline - is relevant for a number of reasons. The recent levelling off in fertility is of interest to many stakeholders, and in particular the Kenyan government. This is because of the policy to match population growth with the country's development goals. The constant fertility has rekindled concerns about high population growth that could compromise the country's development agenda and gains (CBS et al. 2004). By examining the determinants of the transition to the second and third births, this part of the dissertation focuses on changes in fertility in the early reproductive stage, which spans the age

groups 15-24. Since it represents the start of family formation and consists of the youth who form a significant proportion of the Kenyan population of reproductive age, this stage is also apt as a focus of study. Likewise, by choosing to examine the transitions to second and third births, the influence of the characteristics and survival of first births, which are considered to be particularly important in African and Kenyan culture (Kuaté Defo 1998; Gyimah and Fernando 2004) is taken into account.

1.7.4 Changes in Child Mortality and Socio-Economic Conditions

As with the first and the second areas of focus in this study, the third - on the different roles of increased motivation for fertility control and improved access to family planning services - was chosen for specific reasons. A number of studies carried out in the past have attempted to answer the question about the relationship between these demand-side and supply-side factors of contraceptive use. On the one hand, two studies (Njogu 1991; Feyisetan and Casterline 2000) arrived at two conclusions. The first was that a condition for fertility decline in Africa in general and Kenya in particular is change in fertility demand, this change being primarily driven by variations in socio-economic conditions. The second was that it is nevertheless possible for increase in contraceptive prevalence to take place through satisfaction of unmet demand without corresponding changes in fertility preferences and socio-economic factors.

Other studies carried out at the community level or within the catchment of health facilities indicated that access matters. For example, using results of the 1988/89 KDHS that were linked to a community survey, the Kenya Community Survey (KCS) carried soon thereafter (Hammerslough 1992), it was concluded that, while at the beginning of the 1980s only 26% of the Kenyan rural population could reach a source of family planning services within three hours, this had increased to 87% by 1989. Similarly, a study conducted in the catchment of the Chogoria Methodist Mission Hospital in the Mount Kenya region (Goldberg et al. 1989) showed that the family planning program operating in the area was possibly responsible for the fertility decline experienced in the region. Among the factors cited for the effectiveness of the program included the setting up of many clinics providing health services including family planning in the catchment area, thus providing easy access, and the presence of Health Educators (HEs) as well as Community Health Workers (CHWs) in the community.

In spite of the merits of these earlier studies, a number of relatively new issues related to contraceptive use in sub-Saharan Africa have come to the forefront. First, recent evidence from Tanzania (Ainsworth et al. 1998) and Kenya (Hill 2004) suggests that the roles of rising infant and child mortality, and the changes in socio-economic conditions of households may be important in affecting fertility behaviour. Secondly, as concluded in a study in Zimbabwe (Guilkey and Jayne 1997), contraceptive use is determined by both individual characteristics and community variables. There is therefore need to provide a more complete picture of the factors related to fertility demand, supply, and access that jointly determine changes in contraceptive use and, ultimately, fertility.

To the extent that this dissertation includes these recent developments - in child mortality and household socio-economic status - the old question of fertility demand and access to family planning services is viewed from a new perspective. Secondly, from an evaluation point of view, the question of contraceptive use is a current and relevant population policy and program issue. In particular, it would be interesting to know what program strategies and modalities that address fertility intentions and family planning access are most effective.

Qualitative research carried out in the Matlab experimental site in rural Bangladesh (Simmons 1996) however contests the extent to which demand and supply effects can be separated from each other. The study showed that the women who were participating in the program, and whose ages ranged from the teens to the forties, were aware of their changing social and economic situations and had an interest in limiting family size. The study concluded that neither demand-side factors alone, nor supply-side aspects explained this fertility transition in Bangladesh that was on-going through 1990s. Rather, a simultaneous combination of the two - small changes in social and economic circumstances in addition to a strong community-based family planning program – brought about major changes in attitudes and behaviour that resulted in increased contraceptive use and formation of smaller families. In the interpretation of results, these conclusions will be borne in mind, particularly given the implication that supply initiatives can also promote changes in demand.

Lastly, choice of the reference year for this part of the dissertation deserves to be justified. The year 1998 is significant because it represents the height of the fertility transition in Kenya before the stagnation and so it is a vantage point from which to look back.

1.8 The Possible Linkages within Research Issues

Research Questions

Prior to presenting the hypotheses to be tested in this dissertation, it is useful to outline the possible relationships between the various variables implied in each of the three research objectives. The hypotheses to be tested in this dissertation, and the research objectives, flow from the main problem to be addressed by the thesis. This problem can be restated as one that is focused on the demographic patterns - and determinants - of the fertility transition in general and within this fertility decline, the recent constant fertility. This was further broken down into three research issues, namely:

1. The association between sub-national contexts and the respective trends in fertility;
2. Transitions to second and third parities among young women in Kenya; and
3. The role of motivation for fertility control and of access to family planning services in the observed increase in contraceptive use in the country.

Timing of Births during the Early Stage of Reproduction

Some of the differences between the regions in the country, which might be associated with specific trends in fertility, have been outlined in sub-section 1.7.2 above. It is worth passing on to the two other research issues. Under the second research question outlined above, transitions to the second and third birth are analysed, implying the concept of birth interval. There is a linkage between birth intervals and the fertility transition. Change in the length of birth intervals is related to the fertility transition, including the recent levelling off in fertility, through the components of the birth interval, namely the periods of post-partum infecundability, waiting time to conception, and gestation (Bongaarts 1978; Bongaarts 1978; Trussell et al. 1985). Time due to spontaneous intra-uterine mortality would also need to be factored in, but this particular aspect is not addressed in this dissertation as there is no information on it. The length of post-partum infecundability and the waiting time can in turn be varied by breastfeeding and contraceptive use. It is assumed that variations in post-partum infecundability, gestation, and the effects of

spontaneous uterine mortality are randomly distributed in the data. Although these and other factors change with time, the variations are presumed to be small and thus not to affect the results of the analysis. The focus of the analysis under the second research question of this thesis is thus the waiting time to conception, and the inter-birth interval is used but as a proxy for that measure. Socio-economic factors and child survival form part of the determinants of this waiting time, and each of these two is presented below in turn.

The effect of changing socio-economic conditions on fertility can be viewed from an economic perspective. Fluctuations in economic conditions can affect fertility through changes in the local environment, domestic policy, and also movements in the external (world) economy (Hill 1993). These in turn translate into increased costs associated with bringing up children and, in particular costs for children's education. In 1985, the Government of Kenya introduced the 8-4-4 system of education which, as the numbers indicate, comprises eight years of primary education, four of secondary, and four at the university. The philosophy of the 8-4-4 system is to build self-reliant individuals and in pursuit of this goal, more subjects were introduced in the primary school curriculum to provide for the needs for children who would continue on to secondary school as well as those who would terminate studies during the primary level. One effect of this has been to increase the costs of education that are shouldered by households. Free primary education was introduced in the country in 2003 and this reduced somewhat the proportion of educational costs that households have to pay – for example the abolition of primary school fees, levies imposed on parents, and provision of learning materials including textbooks. As a whole however household budgets have been fixed if not declining in the country and under such conditions, the opportunity cost of childrearing is expected to be greatest among poor households. Households with higher incomes would however invest more in the quality of their children, thereby leading to reduced fertility. Fluctuations in economic conditions can also affect fertility through the idea of household production of health. For example, the introduction of user fees could reduce access to health services especially for the poorest groups, and this could lead to an increase in fertility.

Recent work on the linkages between child mortality and fertility cautions about the complexity of the issues and difficulties of measuring the relationships involved (LeGrand and Sandberg 2006). These issues include endogeneity in terms of reverse causality and simultaneity, indirect

effects of mortality on fertility, as well as a re-examination of other pathways of influence. This advice, of not narrowly focussing on just one causal mechanism, will be taken heed of in this dissertation. Turning to the focus of the second objective of this dissertation however – the factors in the transitions to the second and third births - the death of a child can lead to shorter birth intervals through the physiological and supply effects (Lloyd and Ivanov 1988). In the physiological effect, child loss interrupts the breastfeeding cycle and, given the contraceptive effect of lactation, reduces the waiting time to conception. The supply effect is a combination of replacement strategy, i.e. replacing child death with additional births, and insurance strategy which consists of setting up extra fertility goals in expectation of child deaths. The advent of HIV/AIDS renders the relationship between child loss and length of the birth interval more complex, a fact that should be borne in mind when studying mortality-fertility relationships in Kenya. On the one hand, as found in neighbouring Tanzania (Ainsworth et al. 1998), child loss to HIV/AIDS implies a shorter birth interval. However, child mortality is already high in Africa, and so the relationship would be weak. On the other hand, adult mortality due to HIV/AIDS is negatively associated with the risk of having the next baby. This is because of both behavioural effects and biological responses ascribable to reduced fecundity. Thirdly, in Zimbabwe, contrary to the idea of the insurance strategy, participants interviewed during qualitative interviews indicated that they would have fewer children as a result of the reported increase in child mortality (Grieser et al. 2001). They were also hesitant to continue childbearing after the death of a child, but expressed desire to limit reproduction for fear of their own mortality.

Demand for Fertility Control and Access to Family Planning Services

Underlying the third research issue in this thesis – the role of fertility desires, on the one hand, and that of access factors on the other on contraceptive method choice - is the fertility demand and supply framework (Easterlin and Crimmins 1985). In the framework, changes in contraceptive use are considered to take place through variations in motivation to control fertility as well as through improved access (regulation costs) to family planning services. Motivation for fertility control is in turn determined by the demand and supply for surviving children. Motivation for fertility control has traditionally been measured by a number of indicators. These include the ideal family size, fertility intentions (often measured in DHS surveys in terms of whether couples want a child soon, want to delay their next birth, or do not want any more

children in the future), and the wanted total fertility rate (Bongaarts 1990). Each of these measures has their strengths and limitations which will be taken into consideration when finally deciding which one to use for measuring motivation for fertility control.

Motivation for fertility control depends on a number of factors, one of which is the chance of child survival (Bulatao and Lee 1983). Mortality for children under five years of age has been rising in Kenya since the late 1980s (CBS et al. 2004), so physiological, replacement, and insurance effects often associated with this child loss are expected to be important especially in those parts of the country where child mortality is high. Secondly, motivation for fertility control also depends on the socio-economic status of the household or economic conditions in the community in which the woman lives. In a situation of deteriorating socio-economic conditions, it is possible that parents may compromise the desired quality of their children's upbringing and instead opt for closer birth spacing and hence more children. Thirdly, the costs associated with bringing up children such as those for their education, which have been rising in Kenya, may motivate parents to take the issue of fertility control more seriously and make decisions to space or limit their births, where they have not been practising such fertility control.

Once a couple is motivated and has decided to control their fertility, whether they use a particular contraceptive method depends on access, which comprises the economic, psychic, and social costs entailed in learning about and using specific methods of family planning (Easterlin and Crimmins 1985; Hammerslough 1992). This adoption process may consist of four sequential stages - women become aware of the possibility of fertility control, are informed about and evaluate the means of that control, try out a contraceptive method, and adopt one. Family planning programs may implement this process in three ways. To initiate the adoption process, programs typically try to increase awareness about three things. These are the possibility of fertility control, knowledge on how to achieve such control, and its approval. To speed up the adoption process, programs endeavour to lower costs associated with adoption of a method. Thirdly, programs increase the efficiency with which contraceptive users control their fertility by providing and emphasizing clinical or modern methods (Hammerslough 1992).

1.9 Hypotheses

Grouping of Hypotheses

Given the linkages outlined above, which are based on the stated research objectives and issues, a number of hypotheses are to be tested in this dissertation. They are grouped into four categories – those pertaining to issues to do with the trend patterns in fertility, the transitions to second and third births as a whole, hypothesis touching on transitions to uniquely the third birth, and hypotheses on the roles of demand for fertility control and access to family planning services. The focus of the first set of hypotheses (which are not subjected to the rigors of statistical tests due to the exploratory and descriptive nature of the analysis conducted) is on the relationships between trends in fertility, some of its proximate determinants, and fertility preferences at the national and sub-national levels. In testing hypotheses for transitions to second and third births, the focus is on examining the effects of three variables – region of residence, the time period during which the first or second birth took place, and the influence of age at first birth. Specific hypotheses are also tested for the progression to the third birth only – these seek to determine the influence of child survival and the gender composition of children. Lastly, hypotheses on the determinants of contraceptive use address the effects of four key variables – age, region of residence, motivation for fertility control (fertility preferences), and access to family planning services. The hypotheses are as follows:

Hypotheses on the Trend Patterns in Fertility:

1. Over time, declines in current fertility are greater in the more modernized regions of the country in comparison to those that are less developed.
2. The Kenyan fertility transition follows an age-specific pattern. From one successive cohort of women to the next, fertility declines are relatively higher when the women are older than when they were younger.
3. Both the declines in fertility and the changes in proximate determinants (contraceptive use and family formation) over the years follow a regional pattern. They are more precipitous in the modernized regions, and less so in other rural areas.
4. The increases in demand for fertility control over the years are greater in modernized areas but lower in regions that are less developed.

Hypotheses for Transitions to both the Second and Third Births:

1. At the sub-national level, there are regional differences in the transitions to the second and third births. In comparison to less developed areas, the risks of transition are expected to be relatively lower in more modernized contexts (associated with higher levels of development and less restrictive cultural norms related to reproduction).
2. The relative hazards of transition to the second and third births vary with the time period. During the period 1991-2003 (deterioration in development) in contrast to 1977-1989, it is expected that there would be increased risk of transition to the second and third births, particularly in the rural areas.
3. The difference in the pace of fertility decline between 1991-1997 (start of the stagnation in fertility) and 1997-2003 (stagnation underway) suggest corresponding variations in transition risks (to the second and third birth). During the six-year period of stagnating fertility (1997-2003), the risk of transition to the second or third birth should be equal to or higher than that for the six years earlier (1991-1997).
4. Increasing age at first birth is expected to be associated with lower risk of the second or third birth for both time-periods. However, the relative risk associated with age at first birth should be smaller during 1991-2003 in comparison to that for the 1977-1989 time-period. This is a result of lower fertility (and possibly longer birth intervals) during the 1991-2003 period.

Hypotheses for the Third Birth Interval Only:

1. Child survival has been on the rise during the period 1991-2003. Within this time period, it is predicted that the relative risks of transition to the second or third birth that are associated with child loss will be higher during 1997-2003 relative to 1991-1997.
2. The increased child mortality experienced in the country since the early 1990s has also affected parents' preferences for the gender of children. It is expected that the relative risks associated with bearing female children will be higher over the twelve-year period 1991-2003 compared to 1977-1989.

Determinants of Contraceptive Use

1. Age has an influence on contraceptive use. In conformity with the idea of parity-specific fertility control, and hence being more predisposed to stop further childbearing, older women are expected to use contraception more than those who are younger.
2. Contraceptive use is expected to differ by region of residence. Women from more modernised areas, such as rural Central Province, are expected to use contraceptive services more than those from less developed parts of the country.
3. It is expected that contraceptive use will depend on motivation for fertility control. Women who are more motivated to control their fertility will tend to use contraception more than those who are less motivated.
4. Contraceptive use is a function of access. It is expected that contraceptive use will be higher among women who are in closer proximity to health facilities offering family planning services or among those who make contacts with community based distributors (CBDs). Among women for whom such access is reduced, contraceptive use is predicted to be lower.

CHAPTER 2: LITERATURE REVIEW ON THE FERTILITY TRANSITION IN SUB-SAHARAN AFRICA AND KENYA

2.1 Organization of the Literature Review

A vast body of literature exists on the demographic and fertility transitions. The question therefore arose as to how best to sift through this extensive literature and focus on critical studies. To address this question, (and limiting the review to studies published since 2000 or to an earlier date for those that are older and yet important) a three-step, search and review, process was undertaken. First, the major theories of the fertility transition are presented: they are so important that they form the framework of other subsequent studies, whether theoretical or empirical. Next, empirical studies conducted in sub-Saharan Africa on the subject of the fertility transition were examined. On a sub-regional basis, the following outline emerged: fertility dynamics for the countries in the southern shore of the Mediterranean (the inclusion of this neighbouring region being relevant as there is much to be learnt from its fertility transition that may be pertinent to the Kenyan case, e.g. the levelling off in fertility in Egypt), fertility in West Africa, and fertility change in Southern and Eastern Africa. Lastly, to focus on the geographical locus of the study, an assessment of the fertility literature on Kenya was conducted, and the sub-sections below follow that order of review.

2.2 Theories of Fertility Change

The Repertoire of Perspectives for Analysing Change in Fertility

Although many were enunciated several decades in the past, a number of theories of fertility decline are so fundamental to any study on the subject that it is worth to represent, but briefly, their essence. As other population writers have acknowledged (Cleland and Wilson 1987; van de Kaa 1996; Mason 1997) what emerges from the literature is the multiplicity of theories that explain change in fertility. They should be viewed eclectically – having been developed from different subject areas and viewpoints. Over time, their application has varied depending on the policy focus at the time, social context, data availability, and analytic skills (van de Kaa 1996). In a generally chronological order from the time they were first proposed, these ideas include:

demographic transition, natural fertility, the role of mortality in the transition, preconditions for fertility decline, fertility demand and supply, wealth flows, the institutional approach, and "contingent lives". Among the social institutions, writings on the relationship between education and religion feature prominently in the literature: they are therefore reviewed here. From these numerous perspectives on fertility change, the fertility demand and supply approach was selected as the main framework used in this dissertation; its appeal is made stronger by the fact that it incorporates a number of the other perspectives on the fertility transition.

Demographic Transition

Considered to have been first developed in the French language by Adolphe Landry, and later in America by Frank Notestein and Kingsley Davis in 1945, the theory of the demographic transition was first applied to explain the high population growth in Europe and particularly Great Britain during the industrial revolution; the phrase referring to technical innovations that led to improvements in agriculture, transport, manufacturing, and sanitation as well as medicine. In this classic formulation, it was postulated that high population growth resulted from improvements in food supplies and personal living standards. According to the theory, fertility only declined following continued industrialization and modernization, which changed the economic and social structure of society, in particular increased urban populations and loss of some of the functions of the family (Szreter 1993). These changes in turn caused alterations in family structures - for example decreased fertility preferences and family nucleation - which have to adjust from the old dysfunctional system, ultimately leading to a fertility decline. In this approach, it is the ready accessibility of family planning services through modernization that leads not only to the satisfaction of unmet need created by diminished fertility preferences, but equally to further declines in fertility demand.

Under this concept, the role of the two other demographic variables, namely mortality and migration, emerges clearly. With a decrease in infant and child mortality, it is argued that parents no longer need many children, and fertility should equally decline. Similarly, rural-urban migration plays an important role in the transformation of the economy from one that is rural-based and agricultural to one that is urban-based and industrial. Due to lack of industrialization and mortality decline in some regions of the developing world, and sub-Saharan Africa in

particular, the application of this concept however waned. More recently, it has also been argued that the demographic transition theory focussed on specific historical demographic events and is unsuitable for long-term explanations (Caldwell and Schindlmayr 2003; Caldwell 2004). Instead, the idea of "social structure and demographic behaviour adjusting" is suggested, the emphasis being on the changing modes of production from hunting and gathering, through settled agriculture, to industrial production. Within this framework, it is predicted that governments in the developed world will ultimately implement policies aimed at raising fertility above replacement level.

Other studies have explored the macro-social and environmental underpinnings of the demographic transition theory that link the fertility transition to modernization, and suggest that human ecology and evolutionary theory could help re-specify and revitalise demographic transition theory (Crenshaw et al. 2000). This re-specification, it is argued, produces a more logical account of the fertility transition – it emphasizes the influence of service economies and the social adaptations attendant on ethnic diversities and the complexities of pre-industrial societies.

Natural Fertility

The idea of natural fertility, first attributed to the French Demographer Louis Henry, applies to couples living in long-term sexual unions (married) and is characterised by the absence of parity-specific birth control (Knodel 1977). The definition of control is significant – it means behaviour affecting fertility which is changed as the number of children increases. When the number of children that the couple desires is attained, beyond which it does not want any more, control starts to take place. Behaviour such as breastfeeding, abstinence, and spousal separation which affects fertility levels (frequent in sub-Saharan Africa) but which is not dependent on parity is not considered to contradict the definition of natural fertility. The practice whereby parents deliberately space their births but do not have a targeted family size in mind, a situation prevailing in most of sub-Saharan Africa, is also considered part of natural fertility.

Proximate Determinants

The framework of proximate fertility determinants (Bongaarts 1978) is a modification of the idea of intermediate fertility variables (Davis and Blake 1956). In the model of proximate determinants, the initial eleven intermediate fertility variables are reduced to eight. They are grouped under three categories: exposure aspects (the proportion of women married), deliberate marital fertility control (contraceptive use and abortion), and aspects related to natural marital fertility (lactational infecundability, frequency of intercourse, sterility, spontaneous intrauterine mortality, and the duration of the fertile period). To estimate the effect of each of the variables in reducing fertility from its natural level (estimated at 15.3 and which represents the total natural marital fertility in the absence of contraception), an index for each determinant is calculated. The model of the proximate determinants has however been put to criticism (Reinis 1992). Following the use of simulation methods, it is concluded that the method provides poor estimates of marriage delay, contraception, and induced abortion. In spite of this criticism, the model remains popular, being used to analyse the effect of various primate determinants such as abortion, on fertility.

The Role of Mortality in Fertility Decline

The important role that mortality decline plays in the fertility transition is highlighted in a number of studies (Mason 1997; Montgomery and Cohen 1998; Montgomery 2000). The studies point out that recent theories of the fertility transition have forgotten that even the classical demographic transition theory was about the equilibrium between birth rates and deaths rates; and that without a mortality decline, a fertility decline is equally unlikely to occur. It has been suggested, for example, that the low levels of child survival in Africa may be a contributing factor to the delay in the fertility transition.

In particular, the effect of infant and adult mortality on fertility has been examined in several studies. One of these, (Lloyd and Ivanov 1988), is on the linkages between child survival, family planning, and fertility, and suggests that this relationship is a process that evolves through a number of distinct stages of the mortality transition. According to the study, the stages range from family building by fate to family building by design; from insurance to replacement. The rate at which family building strategies evolve from one stage to the other while child survival

improves depends on the pattern of mortality decline and the socio-cultural environment. The conclusion to be drawn from this perspective on the relationship between mortality and fertility is that the provision of family planning services is critical, but that it should be delivered through an integrated approach.

Intergenerational Wealth Flows

The idea of intergenerational wealth flows is about a fundamental distinction between a high and low fertility regime which is based on social structure and more particularly family organization, with specific reciprocal obligations of parents and children. In the high fertility regime, wealth flows are in favour of parents or generally older persons; in the lower fertility regime, they are in children's favour. In this theory, which can be viewed as a restatement of the concept of demographic transition, emotional nucleation of the family results in economic nucleation: emotional nucleation defined as the emphasis by parents on the future of their children rather than on extended family ties (Caldwell 1976; van de Kaa 1996). This social revolution is caused by the diffusion of western ideas and values about the nuclear family and is transmitted via the education system and the mass media. Thus, the theory is rooted in the model of modernization of values. However, a criticism of the theory is that it is so embedded in the process of social change that its explanatory power is compromised (van de Kaa 1996). Empirical results from Côte d'Ivoire (Stecklov 1997) also conclude that in contrast to Caldwell's assertion, wealth flows are from older to younger generations in this environment of high fertility. Nevertheless, other studies observe that this contradiction with Caldwell's theory seems to be apparent rather than real (Lee 2003).

The Institutional Approach to Fertility Change

The purpose of the institutional approach in the analysis of fertility decline is to link macro and micro demographic levels (Simmons and Farooq 1985). The approach focuses on the intervening structures and the different contexts within which these operate (Piché and Poirier 1995). The emphasis is on institutions within which material production takes place, and in which demographic reproduction occurs as well. A feedback is suggested between production and reproduction at the level of an individual family. Demographic explanations thus have to take into account the interaction between the different forms of production and modes of reproduction

(Simmons and Farooq 1985; Piché and Poirier 1995; van de Kaa 1996). In these relationships, there will be elements of choice (fertility preferences) and decision-making or fertility behaviour (Lesthaeghe 1989).

One of the issues in the institutional approach is how to correctly model the corresponding relationships. One way to go around the problem is to look at the global and historical situation under which the particular change in fertility operated. This will need multiple studies of the system (Szreter 1993), and raises the question of the limitations of the quantitative techniques currently used in sociological analyses of population issues. As these methods are based on individual quantitative surveys, rather than qualitative (in-depth and open-ended) data collection methods, they reduce institutions to mere variables, and independent-dependent variable relationships. The problem is that the phenomena of social relations in institutions cannot be reduced to mere variables, without the risk of losing detail. In addition, considering just one variable at a time is very limiting (Piché and Poirier 1995). It is therefore necessary to link individual analysis with historical and contextual analysis. Such an integration of micro and aggregate data, which has been sought for several decades, is now possible through multi-level analysis. Equally, the methodology of event history analysis should now take precedence over transversal analysis. The re-emphasis on qualitative methodology in demography (Castle 2001) is also another important development.

The Fertility Supply-Demand Framework

The theory of fertility demand and supply takes as its departure point the micro-economic theory of fertility demand and adds to it a sociological variable, the supply of children (Easterlin and Crimmins 1985; Mason 1997). Change in fertility is then explained in terms of three factors, namely the supply of children, the demand for children, and the costs of fertility regulation. The supply of children is defined as the number of surviving children that couples would have in the absence of fertility control. The demand for children refers to the number of surviving children parents would have if fertility regulation were costless. The costs for fertility regulation in turn refer to both the couple's attitudes towards fertility control, and the access to the means for fertility control. Several criticisms have been levelled at the supply-demand framework – one of

which is that it is silent on the institutional determinants of the fertility transition (Mason 1997; Robinson 1997).

Diffusion of Innovations

Another idea that has been applied to the study of fertility decline is that of diffusion of innovations. Started in the 1920s when the American Department of Agriculture embarked on efforts to assist small-scale farmers by encouraging them to adopt new products such as hybrid seeds, fertilizers, and pesticides, the concept of diffusion of innovations has been subsequently applied to the study of fertility change and adoption of family planning methods (Cleland 2001). In the family planning program, medical programs (that had emphasized an epidemiological and preventive approach) gave way to diffusion programs that emphasized communications, incentives, and change agents or field workers.

Diffusion has been traditionally defined as the process through which a new idea is communicated through a given set of channels over time and among members of a social system (Rogers 1995). More recent work (Palloni 2001) however suggests that this definition needs to be reviewed in order to incorporate the possibility of rejection of the behaviour, and to take into account individual decision-making behaviour. Studies on diffusion of innovations in sub-Saharan Africa, particularly in Cameroon and Kenya (Watkins and Danzi 1995; Rutenberg and Watkins 1997; Valente et al. 1997) have included collecting empirical evidence on the relationships between family size, family planning, and social groups

Social Networks: Social Learning and Social Influence

To understand the place of social networks, social learning, and influence in the fertility transition, it is useful to start by considering what the literature says about the role of socio-economic development in initiating fertility transitions. In this regard, studies show that socio-economic development, in and of itself, may play a role in initiating the fertility transition. In addition, its role is boosted by the fact that it leads to an increase in the channels of communication, thereby enabling individuals to exchange information on the benefits and costs of children, and about specific methods of contraception more easily (Bongaarts and Watkins 1996). Nevertheless, an observation that is common in the literature on the fertility transition is that development alone is not adequate in explaining the timing of the onset, and consequent

pace, of the transition. Through the idea of the diffusion and adoption of innovations, social interactions and networks have been suggested as important mechanisms through which this transition takes place (Casterline 2001; Kohler et al. 2001). Nevertheless, one of the questions raised in the literature is at what level the interaction takes place.

The process of social interaction, through which fertility change takes place, has been examined at the level of the household, the latter being defined in a way that is different from the conventional view. In this regard one particular study, (Madhavan et al. 2003), is devoted to this issue and its results and conclusions are therefore briefly described here. According to the study, demographers have tended to focus on the household as the most important level for social relations or interactions. Anthropologists on the other hand have questioned accepted definitions of the household applied to sub-Saharan Africa. Households are neither isolated nor distinct entities but rather ever-changing groupings that are permeable and nested within a social context. There are wide variations in the attributes, functions, and membership of households, raising legitimate questions as to what households represent and what the household variables measure. Departing from the conventional view that defines households as the primary unit of social structure that allocates work and resources, the study views the household as being defined by social relations and practices. This designation of the household avoids the altruistic definition that is predominant in most theories based on the economic theory of the household: it leaves room for inclusion of the ideas of conflict and competition between household members, ideas that are significant in understanding the social basis of fertility behaviour and outcomes. The study suggests that given the many conceptual and empirical issues related to using the household as the basis of the social world of fertility of behaviour, women's support networks are better placed to capture the social processes that underlie this fertility behaviour; social interactions form part of these mechanisms that affect fertility norms and decisions.

Two different processes of social interaction are recognized in the literature: social learning and social influence (Pollak and Watkins 1993; Bongaarts and Watkins 1996; Kohler et al. 2001; Madhavan et al. 2003). The first refers to exchange, and joint evaluation, of information that occurs within a social network. Change in behaviour takes place when, following discussion, the perception of risk and uncertainty related to change for an individual is reduced to the extent that

he or she adopts new ideas. In the context of family planning, learning behaviour is more likely to occur in heterogeneous networks, where ideas to family planning are at variance to those commonly expressed.

The second process is social influence: to win approval and avoid conflict with the group, individuals behave according to the instructions of the gatekeepers and others who encourage prevailing social norms (Bongaarts and Watkins 1996; Madhavan et al. 2003). Broader cultural norms relating to gender roles, power structures, and social organization as a whole may also be conservative forces to which women are subject. In both these individual and institutional contexts, a woman's ability to decide freely, innovate or stray from commonly-held norms is constrained in highly connected and homogenous networks. Following changes in fertility behaviour, the conservative nature of social influence decreases and in its place the community accepts new ideas from the leaner and more heterogeneous networks.

The relationship between social interactions, social learning, social influence and the fertility transition has been described above. To recap these linkages, it is useful to remember the origins of the idea of social interactions. First, neither the demographic transition theory nor the micro-economic theory of fertility has found a tight link between development and fertility. Nevertheless, socio-economic factors may still play an important role in the fertility transition, but it was not clear which precise variables and processes are involved. Similarly, the theory of the diffusion of innovations has also been criticised for not being explicit as to what was spreading (Bongaarts and Watkins 1996); through the ideas of social learning and social influence, the concept of social interactions helps to explain what was diffusing and the process involved (Rosero-Bixby and Casterline 1993). However, the question is, "which of the two social interaction processes, social learning or social influence, is predominant, and when precisely?" As explained above, these mechanisms can be identified by analyzing the nature of social networks.

Contingent Lives

Based on the analysis of ethnographic and demographic data from The Gambia Republic in West Africa, the idea of contingent lives (Bledsoe and Banja 2002) critically examines

western perspectives on reproduction, aging, and social life that are found in several disciplines in the social, medical, and human sciences. This is a significant piece of work, one that is relatively new and critical of the classical explanations of theories on the fertility transition. It is therefore germane to this dissertation and so its findings and conclusions are given more space here. The conclusion of the study is that in rural Gambia, the way people perceive these issues has more in common with the empirical findings than with the frameworks developed by the western world to analyse the same question. In arriving at this surprising result, the authors adopted several strategies. First, numerical and narrative data were collected on how people manage their married and reproductive lives. Secondly, these findings (which comprise of demographic and anthropological data) are compared. The study finds that the western paradigm equates time with bodily experience, a parallel that may not necessarily be true in the African context.

The study further observes that in rural Gambia, aging is not perceived as a linear process; but rather dependent on external or contingent events. The issue in this context therefore is not time, but rather how reproduction brings about aging. The end of reproduction becomes important - it is at this point that the effects of intense reproduction become evident. The contingency approach explains why women who want many children view anatomical and energy limitations on the body as being more important than the end of childbearing through menopause. Secondly, it also explains the use of contraception in what appears to be counter-intuitive practice. Since the ability to reproduce is not tied to time, women perceive creating inter-birth time as not important in their pursuit of high fertility. Contraceptives can thus help preserve a pregnancy and give birth in order to attain high fertility goals. Women who are bodily young use contraceptives infrequently. On the other hand, young women whose children are weaned too early or whose fecundity resumed before the child attained a stage of good health use contraceptives. So do older women who are worn out by the toll of frequent births. The idea of contingency also explains why women who have suffered a non-live birth use contraceptives – to recover their health from a traumatic experience. It also explains why men and relatives oppose family planning. The cornerstone of the contingency approach is investing in social relations, which are characterised by bodily fragility, and unpredictability of the socio-economic environment. This

uncertainty makes women to cultivate diversity among their children, and social life then becomes critically important.

A conclusion of this and related studies by Bledsoe and her colleagues (Bledsoe et al. 1994; Bledsoe et al. 1998; Bledsoe and Banja 2002) is that lack of exposure to the experience of the contingent lives that African women go through has prevented the western world from seeing the risks within which childbearing takes place in the developing world. In that regard, population science has made two mistakes. First, it has assumed that the low fertility and safe reproductive environment in the western world applies equally to the fragile African continent. Secondly, it has assumed that the synthetic fertility models apply equally to the lives of individual women. Nevertheless, it is agreed that, to condemn wholesale current paradigms on fertility in the field of population science would be to err. Instead, an inclusive approach that adds to demography's background analysis of time from other disciplines - such as obstetrics, gerontology, and anthropology is suggested. The findings of the study have brought to the fore issues touching on a number of on social organization, demography, biology, and culture. What is novel is the synthesis arising from these divergent perspectives: there is common ground within which demography and anthropology, and other sciences, can work.

Education and Fertility

The importance of the spread of education as a determinant of social change has often been pointed out, and the diffusion of mass education in particular has also been linked to a broad range of social transformations including the demographic transition. Education is a key determinant of fertility preferences and behaviour. The important question however is how it affects fertility. A number of hypotheses have been generated linking education and childbearing at the individual level (Axinn and Barber 2001). One group of propositions suggests that an individual woman's own schooling experience influences subsequent fertility behaviour. As future parents, children who attend school learn something that alters their attitudes and plans and so they limit their childbearing later on when they are of childbearing age. A second suggestion is that the experience of sending children to school changes parents' subsequent fertility behaviour. Thus, changes in costs, benefits, or other consequences of childbearing affect parents' decisions. A third hypothesis posits that there are community effects of education that

affect fertility: for the parents or the children to be able to go to school, the schools must be located nearby, or the children must live near the schools. In addition, a study among 15-19 year olds interviewed in DHS surveys for 23 countries in sub-Saharan Africa confirms the fertility-reducing effect of mass formal education, and not just the education of parents (Lloyd et al. 2000). It also affirms the link between the achievement of universal education and the beginning of the fertility transition (Caldwell 1980).

Although conducted in the 1960s, a study on the relationship between higher education, religion, and women's education in the United States of America (USA) (Westoff and Potvin 1966) is pertinent. The study tested whether the higher fertility among catholic women who attended catholic institutions of higher learning reflects the experience of Catholicism or of selectivity of women with higher fertility into catholic colleges. The conclusion of the study is that it is more the selectivity factor, rather that learning in catholic schools, which is responsible for this finding. Based largely on the findings of this study, the author postulates a theory on family size desires which in effect says that a normative range of family size is internalized by girls during late childhood and the beginning of adolescence. The determinants of this normative context for the formation of family size desires depend on religion, ethnicity, and class membership.

Studies also show that the expected inverse relationship between education and fertility was not found in many rural illiterate societies; instead an inverted U pattern has been observed (Martin 1995). In an analysis of DHS data from 26 countries, the study confirms the association between higher education and lower fertility; however diversity is observed in the difference between the upper and lower strata of education, as well as in the strength of association. Although at the lower end education may be possibly related to fertility in less developed countries, this fertility-enhancing effect has gradually diminished with time.

Another important idea that relates education with fertility is the quantity-quality trade-off. Basically, the concept explains why with rising income of households, birth rates decline although children are not inferior goods (Hanushek 1992). The relevance of this concept is that it provides a useful framework for thinking about how increased education of parents affects choices in the quality and quantity of children. The main argument advanced for the direction of

this association is from empirical results which imply that parents increase child quality as a result of increased income. As a result, there is a decrease in the quantity of children, and this negative relationship between fertility and education is not simply a result of the ability to control fertility (Jensen 1985; Becker 1991; Lam and Duryea 1999; Bryant and Zick 2005).

That aggregate education should be included in studies that measure its effect on fertility is a finding of a study conducted with DHS data from 22 countries in sub-Saharan Africa (Kravdal 2002). When urbanization and education are controlled for or when several determinants of education are estimated, the average educational level in a community or village has a significant depressing effect on a woman's birth rate. Following simulations, results show that average fertility for these countries would be one birth lower if education were expanded from the current level in the region to the relatively high level in Kenya.

Religion and Fertility

The phenomenon of religion is receiving renewed attention in demography, and the theoretical approaches that examine its role in influencing fertility can be grouped into three (Agadjanian 2001; McQuillan 2004). First, there is the characteristics approach which maintains that the association between religion and fertility is often apparent rather than real, with the actual effect being that of the socio-economic characteristics of the group. The second approach, which assumes that the effect of religion remains even after holding constant socio-economic factors, is the particularized hypothesis. It maintains that the higher fertility of a religious group could be explained by the teachings of the religion on issues related to childbearing. The third is the minority-status hypothesis. In this explanation, it is argued that because minority groups frequently face impediments to full social and economic integration into mainstream society, one way to reduce the effects of these barriers to accomplishment is to limit fertility; it is also possible that fertility may actually increase in such a situation. Based on these hypotheses, new research has attempted to answer the question, "when does religion influence fertility?" The conclusion from the literature is that religion plays a crucial role when three conditions are met. First, the religion articulates behavioural norms with a bearing on fertility behaviour. Secondly, the religion holds the means to communicate these values and promote compliance. Thirdly, religion forms a central component of the social identity of its followers (McQuillan 2004).

2.3 Fertility Change in the Southern Shores of the Mediterranean

Contrasting Fertility Dynamics in Five Arab States

The fertility change in the countries bordering sub-Saharan Africa to the north, those in the so-called southern shore of the Mediterranean Sea, has received considerable attention in the demographic literature. Examination of the fertility dynamics in five Arab countries (Algeria, Egypt, Morocco, Yemen, and Sudan) reveals the different childbearing patterns in each country. In Yemen where fertility is highest among the five, reaching over seven children per woman, childbearing starts early and a large proportion of ever-married women reach high parities at a fast pace. Morocco and Egypt, which are characterised by lower fertility of about four births per woman exhibit a pattern of a delay in the onset of childbearing, a slow pace of childbearing, and a smaller proportion of ever married women that reach high parities. In Algeria and Sudan on the other hand, where fertility is between four and five children per woman, a delay in the beginning of childbearing plays a greater role in the fertility change, while the timing and volume of childbearing play a smaller role (Eltigani 2001).

The Fertility Transition in Egypt and Morocco

The decline in fertility in Egypt and Morocco is particularly pertinent. The literature indicates that between the 1970s and the 1990s, the adoption of family planning in Morocco and Egypt, which enabled women to meet their reproductive desires for smaller family size, was responsible for the important changes in the reproductive behaviour of married women in those countries (Eltigani 2000). In particular, Egypt, a country that has recorded a fertility transition (but a transition which has been constant in the recent past), has been the subject of several demographic studies. When the transitions from second to third birth are analysed, what emerges is that differences between the country's social groups persist; the difficult change for women with high educational standards being one factor responsible for the lag in transition. Even within the lagging groups, fertility change is taking place, and in particular the insistence on one of the children being a son is waning (Vignoli 2006). Similar results are obtained in neighbouring Morocco which is also characterised by falling fertility levels and important changes in its proximate determinants of fertility (D'Addato 2006). Although fertility differences persist among social groups, the different segments of the population, including the most

conservative groups such as illiterate women are all rapidly changing their fertility behaviour. Also, there are no clear preferences for male children in the progression to the third birth.

Proximate Determinants of Fertility in Egypt

When the effects of the most important proximate determinants of fertility - use of modern contraceptives, breastfeeding, and post-partum amenorrhea – are examined, it turns out indeed that they account for most of the variation in fertility. This occurs when calendar data on proximate determinants of fertility are introduced in analyses, rendering background variables - the social, economic, and cultural determinants of fertility - to be insignificant. This is the conclusion of a study which used these proximate determinants from the Egyptian DHS (Baschieri and Hinde 2007). The study also shows that with the calendar data, it is now possible to apply several methods (such as exposure analysis) to model the processes through which social and economic mechanisms influence fertility and thereby generate fertility differentials.

2.4 Fertility Dynamics in West Africa

2.4.1 Family Planning and Population Policy Concerns

The Themes Covered

The demographic literature on West Africa that bears on fertility change addresses many issues, and the most pertinent can be grouped under eight groupings. Family planning and population policy; rural development; migration; evidence of the fertility transition; abortion; women's social networks; and social processes are the eight themes treated below on fertility-related studies in West Africa. In the first theme, family planning and population policy, three salient issues that emerge are fertility intentions, the introduction of family planning interventions, and population policy.

Divergence in Fertility Intentions

Demand for contraception in the West African countries of Mali and Burkina Faso, in comparison to Ghana, is heterogeneous: it is dictated by men's attitudes, women's counting little (Andro et al. 2002). In contrast, contraceptive demand is found to be significant among women,

less strong among men, and negligible among couples. The pattern is nevertheless changing among the younger generations, where women's and men's attitudes are converging.

Introducing Modern Family Planning

Several studies treat the subject of family planning services in sub-Saharan Africa as a whole. One such theme is the future of family planning in Africa, and more precisely, the suggestion that Africa will be the family planning frontier of the twenty-first century is echoed in a number of studies (Caldwell and Caldwell 2002; Caldwell et al. 2002). This forecast is based on the observation that fertility levels and population growth rates persist at high levels, and also in noting that appropriate family planning programs suitable for the region are still being developed. It is evident that the fertility transition is on-going in a number of countries in sub-Saharan Africa, and particularly those in Southern Africa. Nevertheless, successful family planning programs will depend on political leadership, emphasis on hormonal contraceptives, and development of family planning programs that meet the needs of all segments of the population and not just married women. However, constraints include stagnation in economic growth, increasing child mortality, and the persistence of HIV/AIDS.

Research in northern Ghana in the Navrongo integrated family planning program has demonstrated a number of findings. One of these, a result from a longitudinal survey that models causality between spousal communication and contraceptive use (Bawah 2002) is that communication between husband and wife does indeed lead to increased use of contraception. The introduction of health and family planning services in a traditional African setting leads to reproductive change. This is a conclusion from another study carried out in the Navrongo Community Health and Family Planning Project (Debpuur et al. 2002). In the last study, knowledge of methods and of their sources increased as a result of exposure to project activities, and the deployment of nurses to the communities was associated with the emergence of preferences for limiting childbearing. Reduction in fertility was also evident in treatment cells, particularly in those where strategies included deployment of nurse-midwives, involvement of local traditional leaders, and male volunteers in program support.

The service delivery approach whereby village women provide basic health and family planning counselling and services to fellow women in their extended families has a high impact. This is a result obtained from a community trial conducted in a rural area in the Republic of The Gambia, a study whose purpose was to determine if a new community-mobilization approach that brings out untapped demand for contraception would lead to increased use, even where the availability of family planning services has not improved significantly (Luck et al. 2000). The study demonstrates that impediments to contraceptive use in rural Gambia are psychosocial in nature, and that approaches that provide services to women in their villages through social counselling do overcome these barriers.

In Cameroon, family planning campaigns have an impact on the demand for and use of family planning services (Babalola et al. 2001). That is a conclusion from a panel study that re-interviewed a sample of women from the 1999 Cameroon Demographic and Health Survey (CDHS). The study showed that at least 33% of the women were exposed to the media messages on family planning, with the exposure increasing with level of education, and the number of family planning clients more than doubling following the launch of the campaign.

Population Policy and Fertility Change in Nigeria

The fertility literature on Nigeria indicates that the country's population policy has had at most a moderate effect in reducing the country's high fertility (Obono 2003). This is because of the policy's assumption of a single cultural system and disregard for male attitudes. Belief systems in the country are diverse, but share a common interest in the fertility of crops, livestock, and people. Patterns of social organization are similarly varied. For the population policy to succeed there is a need to include, and not suppress, elements of the distinct cultures of the different ethnic groups.

Further examination of the reported contradictions in Nigeria's fertility dynamics reveals a number of issues (Smith 2004). In the on-going fertility transition in the country, Nigerians have to steer carefully through a political, economic, and cultural paradox: they have to balance between powerful forces that seek lower fertility and urge large families at the same time. Fertility behaviour in Nigeria should be viewed in the way that parenthood, children, family, and

kinship are closely related with the way people interact, and above all, in an economy that operates in an environment of patron-client relationships. All agree that the fertility transition is associated with modernization and development, and that with smaller families couples will be able to provide better education to their children and adapt to a modern society. Nevertheless, the ordinary person in Nigeria feels the pressure to limit family size in terms of an unsuccessful economy, frustration with regard to development expectations, and personal suffering.

2.4.2 Rural Development, Women's Labour-Force Participation, and Fertility

Two themes, related to development and fertility, which have been examined in the literature are the relationship between rural development and fertility on the one hand, and between women's labour-force participation and fertility on the other. First, the idea that modernising rural areas leads to reduced fertility is confirmed in a study conducted in Côte d'Ivoire (Kouame et al. 2002), based on data collected from 21 rural communities in the country. The presence of development infrastructure in the village (e.g. schools, health facilities, and electricity) leads to positive attitudes towards smaller family size. This takes place through the relationship between the reduced economic value of children and their increased costs. The provision of basic infrastructure reduces the demand for domestic tasks and hence children's time. The children in turn benefit from increased human capital investment, which is made easier by accessibility to educational and health facilities.

Regarding the relationship between women's work and fertility in developing countries, most studies that have examined the issue conclude that the association is context-specific and give the impression that women's work will lead to lower fertility only in westernized situations. This assertion has been questioned in a study (Derose 2002) which finds that continuity of women's work, and not just the type of work matters in influencing fertility. The research finds that continuous work in any sector increased the birth interval, and thus reduced fertility. It points to the importance of investigating the effect of work on fertility, even in a context that is not modern.

2.4.3 Migration and Fertility

In some settings in West Africa, migration and fertility are related in specific ways; and changes in attitudes and knowledge regarding birth control or that undermine traditional practices of marriage, breastfeeding, and abstinence are less important (Hampshire and Randall 2000). Thus, seasonal labour migration of young Fulani men of northern Burkina Faso to the urban areas leads to lower fertility when compared to non-migrant groups. This is because of secondary infertility possibly caused by increased incidence of sexually transmitted disease in urban areas.

Nor is modernization affecting pastoralists in West Africa alone. The way of life of the pastoralist communities in East Africa, for example the Maasai, Borana, and Rendille has been put under pressure now than ever before (Fratkin 2001). This has come about as a result of population growth, loss of herding land (to sedentary farmers, ranchers, game parks, and urban growth), increased commercialization of the livestock economy, out-migration by poor pastoralists, and dislocations that have come about as a result of famine, drought, and inter-ethnic clashes. The communities have responded by economic diversification (agro-pastoralism, wage labour, and market integration) and the changes have led to increased social stratification, rural-urban migration, and diminished nutrition for women and children.

2.4.4 Evidence of Fertility Transition

For long thought to be the bastion of persist high fertility, fertility transition is under way in a number of countries in West Africa. One such is Benin, in which new research findings show that a definite fertility transition has begun, following a pattern of stopping behaviour and long birth-spacing intervals. Changes in child mortality together with increased education among women have created demand for fertility control. The economic crisis of the 1980s may have been a catalyst for this transition, and the changes in reproductive preferences suggest a diffusion process from urban to rural areas, and from the more to the less educated women (Capo-chichi and Juarez 2001).

2.4.5 Abortion and Fertility Change

That abortion quite apart from other proximate determinants of fertility, might be a method of fertility regulation in some African cities such as Abidjan, is a conclusion arrived at in some of the literature on the fertility transition in sub-Saharan Africa (du Lou et al. 2000; Guillaume and Ltd 2003). The results of these studies indicate high levels of secret abortion in a number of districts in the city of Abidjan, particularly among young women entering reproductive life. The use of abortion and contraception are complementary: abortion is often used after method failure, particularly natural methods. The experience of abortion sometimes also leads to adoption of effective methods. Given the low contraceptive prevalence rate, these high rates of abortion could be a probable explanation for the rapid fertility decline registered in the city. Over the course of the fertility transition, the issue raises a number of questions, such as the sanitary conditions under which they are practised, the type of family planning needs that they imply, and generally the need to accommodate them in public health, and particularly maternal health, programs.

In most countries in the developing world, abortion is illegal, dangerous, and socially unacceptable. Yet research findings based on qualitative data collected in 1996 and 1998 from southern Cameroon (Johnson-Hanks 2002) show that it is often practised because it is the lesser shame. Educated women in the study were found to practice abortion in order to ensure a socially-acceptable, well-timed and honourable entry into motherhood. In southern Cameroon, it is mistimed motherhood and not premarital sex in itself that brings about shame. The difference between premarital sex and abortion is most apparent when the pregnancy and abortion are public knowledge, and different systems of honour translate into different patterns of abortion. The study shows that to the extent that decisions about abortion, marriage, and reproduction are made in a social context, abortion is one strategy of transiting to the honourable status of mother.

2.4.6 Women's Social Networks

Two ways in which women's social networks are related to fertility are the extent of collaboration among network partners, and its nature; empirical findings on each are discussed below. First, the level of competition and collaboration between co-resident women within a

household is important in determining fertility and child survivorship outcomes within the context of an extended family structure in sub-Saharan Africa (Madhavan 2001). This is likely to affect fertility through spacing and stopping behaviour. The extent of collaboration could also be a factor in child survival, as is that of culture – higher fertility is found to prevail in ethnic groups among which there are cooperative women in the extended household to assist in childrearing. Research on female collaboration and conflict is therefore timely in countries well into the fertility transition such as Zimbabwe, Botswana, and Kenya.

Secondly, that demographic phenomena occur within a social context is not in doubt, the problem is how to conceptualize and measure this social world within which individuals live. Results from a quantitative survey conducted among Bamanan women in Mali permit exploration of the social networks of these women and their effects on fertility decisions (Madhavan et al. 2003). Using ordinary least squares and logistic regression, the study examines the effect of selected household and social network characteristics on children ever born and use of contraceptives.

The results show that while household characteristics do not have a significant effect on either outcome, network characteristics do. Inclusion of conjugal kin in the network reduces the number of children a woman has ever had; but when the husband or unrelated older women form part of the group, the woman has fewer children. Ever-use of contraception increases if the woman participates in a credit scheme; it also rises as the number of network members situated outside the village increases. When the number of network members who are conjugal kin increases, ever use of contraception increases, it also increases with the presence of the woman's mother. Network effects on fertility are much more pronounced for women who are aged at least 30 years than amongst those who are younger. The effects are also different for older and younger women. Programs should therefore consider not only women's individual and household characteristics, but equally their broader social networks.

2.4.7 Social Processes and Fertility Change

The idea of contingent lives, in which fertility decisions are made within the context of broader social and economic considerations, and not simply according to the natural versus controlled

fertility paradigm (whereby women cease childbearing when they reach a targeted family size), is applied in a number of empirical studies carried out in the Gambia and Cameroon. First, research conducted in the Republic of the Gambia (Bledsoe et al. 1994) questions the idea of a natural fertility population that is symbolized by birth intervals of roughly equal duration (around twenty-four months) and large family sizes. Contrary to this anticipated fertility regime which in addition comprises low contraceptive use but extended breastfeeding, findings show that women in the North Bank area of the Gambia use western contraceptive methods to sustain natural fertility. The nature of this modern contraceptive use is such that it is parity-specific and short-term. Thus, the women's birth-spacing practices are not only intentional, contraceptive use also varies according to each parity.

Secondly, follow-up research (Bledsoe et al. 1998) shows that in the Gambia, female reproduction is not bounded by chronological age or time but rather, by a limited bodily capacity, which can be depleted much earlier than the end of childbearing: through miscarriages, stillbirths, and child deaths. Women who have experienced these events use contraception in order to recuperate from childbearing - a practice that is in contradiction of conventional explanations of contraceptive use in Africa. The study shows that when the effects of repeated births are examined from the processes of childbearing and aging, they are similar to the biological and medical consequences of high fertility. These medical tolls of reproduction and the difficult economic circumstances under which childbearing takes place can be viewed as costs of high fertility. Viewed from this African perspective, the study offers crucial learning for the theory of fertility transition.

Thirdly, a conclusion from a study carried out in Cameroon (Johnson-Hanks 2002) is that reproductive practice may be motivated by broader social issues, rather than merely fertility considerations. Using qualitative data gathered from the field in 1996 and 1998 and the Cameroon Demographic and Health Surveys (CDHS) for 1991 and 1998, the study questions the model that equates temporal management and biomedical contraception with modernity, against one whereby lack of intentional timing and uncontrolled fertility is made to be synonymous with tradition. The respondents, women from the Beti ethnic group in southern Cameroon, prefer to use periodic abstinence because it allows them to express their modern, educated, and disciplined

identity. Research on family planning programs therefore needs to understand the social system within which such programs operate.

Fourth, although some educated women in Cameroon marry later and bear a smaller number of children than the uneducated, contrary to expectations, they also have a higher premarital fertility rate. This is a conclusion from an analysis of quantitative data from the 1998 Cameroon Demographic and Health Survey (CDHS), in conjunction with ethnographic data collected from the field (Johnson-Hanks 2003). Premarital fertility is high because the women studied come from communities that are more tolerant of pre-marital childbearing - that place more emphasis on individual character - and devote less importance to marriage for women. Education is not a sufficient explanation for the difference in fertility in the two communities among which the study was conducted - there are other reasons (political, social, and economic) that explain why girls in the two communities differ in their school attendance rates. Thus, as pointed out in other studies (Bledsoe and Banja 2002), an adequate account of African fertility not only needs to understand the statistical patterns, but equally the social processes that underlie it.

Fifth, contrary to most theories of fertility change which emphasize the stability of family-size desires across the reproductive cycle, recently-conducted research in Cameroon (Johnson-Hanks 2004) shows that it is equally, if not more important, to understand the process, social context, and contingency surrounding childbearing in general and specific births in particular. The study examines the interval between the first and second birth, and shows that it is longer and more variable because of factors associated with the uncertainty of education in Cameroon. The classic demographic model of the female life cycle, while important in estimating fertility rates is not useful in explaining them. The fertility patterns observed in Cameroon also depend on the social organization of schooling and family formation. Thus, to understand reproductive intentions, it is critical to comprehend the structure of the social world within which those intentions are made.

Finally, although young women in Cameroon and in sub-Saharan Africa in general often say that they cannot plan because the future is uncertain, they do in fact strategise for the future and act effectively (Johnson-Hanks 2005). This is the conclusion of an ethnographic study conducted in southern Cameroon with specific reference to marriage and childbearing. According to the study,

action is based on wise opportunism, whereby the individual grabs chances that come by, which enable them to get by.

2.5 Fertility Dynamics in Southern and Eastern Africa

2.5.1 Issues in the Fertility Literature

A number of empirical research findings, that have a bearing on fertility in Southern and Eastern Africa, are presented in the discussion below. They comprise social interaction and religion in Mozambique, civil strife in Angola, and the fertility transition in South Africa. Moving closer to Kenya, also discussed are natural fertility in Malawi, fertility change in Ethiopia, the fertility transition and HIV/AIDS in Tanzania, and finally, a comparison of fertility in Uganda and Kenya.

2.5.2 Informal Social Interaction in Reproductive Change in Mozambique

Qualitative research on informal social interactions (verbal and non-verbal communication) among men and women in the capital city of Mozambique – Maputo - demonstrates the process through which people obtain family planning and related information in order to develop their attitudes and fertility intentions (Agadjanian 2001; Agadjanian 2002). Not only are the interactions gendered, they hardly overlap, and rarely are similar issues discussed in the often separate interactions. Women tend to focus on the material and physical difficulties they experience in reproduction (including the side-effects of contraceptive methods). In their interactions, women also exchange advice and encouragement with their peers about trying out family planning methods; men on the other hand concentrate on the need to preserve their position of managing reproductive life in the household and on the sexual repercussions of family planning. A conclusion from the study is the confirmation of a gendered nature of men's and women's interaction networks. Family planning programs should therefore direct varying messages to the male and female audiences and in particular target men's networks.

2.5.3 Religion and Fertility in Mozambique

The influence of religion on fertility can be considered as taking place through the idea of adoption of innovations, and within this idea, through the perspective of social interaction. It is often argued that diffusion of innovations is most effective when participants in the communication process are diverse with respect to the innovation but similar on other social characteristics (Rogers 1995). These ideas are tested with qualitative and qualitative data collected from the city of Maputo in Mozambique (Agadjanian 2001). In this metropolitan milieu, approval and use of modern contraception is more favourable in areas where social life and culture are more heterogeneous and two main religions - the Roman Catholic and other Christian denominations – prevail, but less so in parts of the city dominated by homogeneous small churches. In the rural areas on the other hand, socio-cultural heterogeneity within and between religious groups being negligible, adherence to these religious faiths fosters learning behaviour about contraception.

2.5.4 Civil Strife and Fertility in Angola

The effect of war on a pre-transitional society's fertility is illustrated by a number of studies in Angola (Agadjanian and Prata 2001; Agadjanian and Prata 2002), a nation that has known a drawn-out civil war since four decades. Demographically, the country is characterised by natural fertility - early initiation of reproduction, high ultimate family size, and low contraceptive prevalence. The studies show two fluctuations – a drop in fertility during times of war, and a baby-boom after the war; with the intensity of this cycle being more marked in areas that are more involved in combat, and according to women's socio-economic status (more educated and less poor women being more responsive in their reproductive behaviour to the war). These immediate variations resulting from the war will most probably chart the future path of the demographic transition in the country (Agadjanian and Prata 2002).

2.5.5 The Fertility Transition in South Africa

Historically and economically, South Africa counts as a giant, not only in Africa south of the Sahara, but for the continent as a whole. Consequently, its fertility dynamics are treated here in

more detail – starting with a discussion of its fertility transition, and then the factors related to contraceptive use before and after the abolition of the apartheid system of Government. Two issues closely related to fertility in the country and its neighbours - living arrangements and infertility, are also discussed here.

Before the abolition of apartheid, inadequate data and stringent policies limited the analysis of fertility in South Africa. However, the 1996 census and the 1998 Demographic and Health Survey now provide widely available data at the national level for the country since 1970. The total fertility rate (TFR) in 1996 was 3.2 nationally and 3.5 among black women, levels that were lower than in any other country in sub-Saharan Africa at the time. Beyond these results for 1996, the literature shows that fertility has been falling in South Africa since the 1960s, and this transition predates the introduction of the family planning program in 1974 (Moultrie and Timaeus 2003).

The characteristics and causes of this silent fertility revolution that has been taking place not just in South Africa but a number of its neighbours as well - Zimbabwe, Botswana, and Lesotho – are documented in the literature (Potts and Marks 2001). The total fertility rate in Southern Africa is currently three to four children, and represents a decline of 40-50% from peak levels for Zimbabwe, Botswana, and South Africa. Although the fertility transition was taking place and the economic value of children was declining, the cultural values attached to reproduction remained high, and this new trend towards smaller family sizes has not undermined the fundamental position of fertility in the society. For many women, bearing children remains the most common avenue to achieving social status; while for men, it is a means for social esteem. Children are viewed as an important part of marriage, but the literature points out that the value placed upon having children is so high that marriage often does not count in childbearing.

Understanding the effects of the apartheid-era (1948-1994) conditions on the racial patterns of contraceptive use is a theme addressed in several studies on the fertility of South Africa (Burgard 2004). Results of these studies show that despite strong state family planning programs that targeted black women, use of modern contraception among the latter remained lower than that for other racial groups in the country before and after the political transition in 1994. Black,

coloured, Indian and white women also show different patterns of contraceptive use during their reproductive years. In particular, contraceptive use is observed to be high among younger, black but unmarried, and coloured women. Use of the injectable contraceptive is also high among black and coloured women, while it is not the preferred method among Indian and white women. In trying to understand the effects of contraceptive use, the long-standing politics of fertility control also need to be taken into account: family planning is viewed with suspicion by black South Africans, which could explain the lower contraceptive use among these women.

Other studies on the fertility of South Africa (Moultrie and Timaeus 2001) show that although the total fertility rate for the country as a whole dropped to about three children per woman by 1996, the fertility of the black African population began to fall in the late 1950s or early 1960s, and that by 1988 contraceptive use among black women was at 44%. Variation in fertility is affected by such factors as urban-rural residence, level of education, and household income. On the other hand, core socio-economic differences explain the fertility of women of different language groups.

Another pertinent aspect investigated in the fertility of South Africa is the effect of household structure on fertility. Living with relatives from the previous generation has a marginal effect on lifetime fertility. However, residing with a relative of the same generation has an important and negative effect. Women from the Nguni language groups have comparably higher fertility than those from Sotho groups – a reflection of higher socio-economic status and urban residence among the latter. Unmarried and separated women have lower fertility than the married of the same age. Women's living arrangements have become more diversified recently, but they continue to both modify and mediate the effects of other factors on fertility (Moultrie and Timaeus 2001).

Further research on fertility in Southern Africa has re-emphasized the high value placed on children; but it also reveals the fear of infertility (Upton 2001). Most demographic discourse tends to focus on the positive values of lowering fertility; however in an environment of high extramarital fertility and HIV/AIDS, infertility is highly significant for the people of northern Botswana. For many women, infertility is a serious social and psychological concern, and one

that is intricately linked to local conceptions of contraception and witchcraft. Following men's migration, women find themselves confronted with economic concerns and the necessity to negotiate childbearing in that context. At the cultural level, individuals experience social stigma if they are perceived as being infertile. For women, this experience is more profound, as men are rarely considered to be infertile, and the onus of renegotiating fertility becomes a woman's responsibility. While education about family planning and contraceptives has had effects on lowering the total fertility rate, it seems to be having very little effect on lowering rates of teenage pregnancies and HIV infection. Cultural explanations of infertility are rarely taken into account in demographic explanations of why rates of early childbearing and HIV/AIDS are rising. A central concern should therefore be an understanding how concepts such as fertility and childbearing, vis à vis infertility and lack of children, relate to the negotiation of identity. Patterns of migration and identity also need to be taken into account.

2.5.6 Natural Marital Fertility in Malawi

Ethnic differences in postpartum sexual abstinence in Malawi are related to variations in perceptions about it in three communities inhabiting northern, central and southern Malawi. Research results on the subject (Zulu 2001) show that the duration and pattern of breastfeeding did not change much in the three communities between 1988 and 1998. The duration of post-partum abstinence on the other hand is much longer in the north at a mean of 17 months, and shorter in the south and centre, at 10 and 6.6 months respectively. In particular, it is the differences in the definition and timing of child-strengthening rituals that couples are required to perform before resuming sexual intercourse following the birth of a child that are important. The primary rationale for abstinence following the birth of a child in the communities is not linked to child-spacing. Most of the respondents abstain when they are already protected by the annovulatory effect of breastfeeding. The timing of sexual resumption in the north suggests that sex is used primarily for procreation, with most women here practicing the ritual after the resumption of menstruation. In the south and centre, the rituals can be performed at any time after the end of post-partum bleeding. The study underscores the utility of the micro-level approach in understanding fertility in sub-Saharan Africa.

2.5.7 Fertility Change in Ethiopia

Between 1990 and 2000, the total fertility rate (TFR) in Ethiopia declined from 6.4 to 5.9 children per woman of reproductive age, and in the capital city from 3.1 to below replacement (1.9 children per woman). What is striking is that this decline occurred in the absence of a strong national family planning program. The components of this decline in Addis Ababa, capital city of Ethiopia, are identified using the Bongaarts model of proximate fertility determinants (Sibanda et al. 2003). A decrease of the composition of the age-specific proportions of women who are married, followed by increased contraceptive use are the most important mechanisms through which fertility has declined in Addis Ababa. Poor employment prospects and high housing costs are the most likely factors that encourage later marriage and increased use of contraception.

In another study (Bhargava 2007), the determinants of children ever born and of women's preferences for additional births are examined. Among the main results, education of the mother is important in determining family size; so is family-size desire in predicting the number of children born. Secondly, the ideal number of surviving children on wanting more children, with women indicating the desire to limit their family size as the number of surviving children increased. A conclusion from the study is that the provision of counselling to couples about family size, and enhancing the use of health care services can lead to a reduction in fertility in Ethiopia.

2.5.8 The Fertility Transition in Tanzania

The number of countries in sub-Saharan Africa joining the fertility transition is growing, Tanzania being one of the new entrants (Hinde and Mturi 2000). Commencing in the late 1970s and early 1980s, the fertility transition in Tanzania shows patterns that are similar to those in Zimbabwe and Kenya. The fertility decline has been most marked in urban areas and by a rapid uptake in contraceptive use from low levels before the 1990s to about 20% in the late 1990s. Falling marital fertility, which is associated with increased contraceptive use, rising age at first marriage, and the HIV/AIDS epidemic have been the major causes of this decline. A conclusion of the study is that the three conditions for a fertility decline prescribed (Caldwell et al. 1992) -

infant mortality rates of below 80 per 1,000 live births, high levels of primary-school education, and use of any contraceptive method of between 20 and 44% as in Zimbabwe, Kenya and Botswana - need to be applied selectively. This is because in the case of Tanzania, fertility declined without meeting these conditions.

In addition to documenting the nature of the fertility transition in Tanzania, the impact of HIV/AIDS on fertility has also been examined in the country. A survey on this subject (Ainsworth et al. 1998) explores the relationship between measures of mortality and the probability of a birth in the last 12 months. The results indicate that individual perceptions of mortality are likely to be influenced by mortality in the respective community, as well as by deaths in the household and extended family. The results also confirm the positive but weak relationship between community levels of child mortality and recent fertility. Community levels of adult mortality are negatively correlated with recent fertility, but not statistically significant at conventional levels. Deaths of female adults are associated with lower fertility among surviving women from the same household as the deceased. However a male death is not correlated with fertility of surviving women. Thus, high adult mortality will lead to lower fertility. The relation of the deceased adult to the surviving woman also matters.

An examination of the impact of other indicators of fertility intentions reinforces the hypothesis that higher adult mortality will lead to a decrease in fertility. Higher awareness of AIDS mortality is associated with reduced desire for additional children among men and women, and a decrease for sexual activity among men, and young women aged 15 to 19 years. Overall, these results show that the effect of AIDS mortality on fertility to be significant and negative, and that the effect of increased mortality due to HIV/AIDS will include both behavioural and biological responses.

Apart from ultimately affecting fertility, mortality due to HIV/AIDS will raise mortality in two groups - children under 5 years of age, and adults aged 15 to 50 years. Nevertheless, child mortality is already high in Africa, while adult mortality in the prime ages is among the lowest when the age groups are compared. While the HIV/AIDS epidemic will marginally raise child

mortality, mortality in the prime ages might increase by as much as four-fold, the study concludes.

2.5.9 Fertility in Uganda and Kenya Compared

As a prelude to a review of the fertility transition in Kenya, the findings of the comparison of the fertility dynamics in neighbouring Uganda and Kenya are examined (Blacker et al. 2005). The study shows that between 1980 and 2000, the total fertility rate (TFR) in Kenya fell by 40% from some eight births per woman to around five. During the same period, fertility in Uganda declined by less than 10%. The higher drop in fertility registered in Kenya was mainly due to an increase in contraceptive use; nevertheless in Uganda there was also a decrease in pathological sterility. Women in Kenya wanted fewer children than in Uganda, but there was also greater unmet need in Uganda. This may be attributed to the divergent paths to economic development pursued in the two countries; and also to the Kenya Government's active promotion of family planning services through the health system, an activity that did not start in earnest in Uganda until 1995.

2.6 Literature on the Kenyan Fertility Transition

2.6.1 Introduction to Studies on the Kenyan Fertility Transition

The demographic and health surveys, as well as the population census carried out in Kenya since the 1970s document three major trends in Kenya's post-independence fertility. First, in the late 1970s and early 1980s, fertility began the downward trend: it peaked and commenced the descent from the high to the lower levels. Secondly thereafter, from the early 1980s, it declined rapidly from high levels (over 8 births per woman) to reach 4.7 in 1998. Thirdly, between 1998 and 2003, childbearing levelled off in the country, remaining at an average of 4.8 births per woman. Responding to these demographic events, research studies on the subject in the country moved in three waves; this section follows the same organisation. In section 2.6.2., studies that examine the turning point in the fertility transition are examined. Section 2.6.3 looks at research studies that address the factors associated with the fertility transition between 1989 and 1998. Lastly, research on the most recent phenomenon, constant fertility between 1998 and 2003, is reviewed in section 2.6.4.

2.6.2 Studies on the Turning Point in Kenya's Fertility Transition

The study by the National Research Council (NRC) on the fertility dynamics of Kenya (Brass and Jolly 1993) is among those that have comprehensively reviewed and confirmed the empirical evidence on the beginning of the fertility transition in Kenya. According to the study, the fertility rates depicted in the late 1970s and 1980s, which indicated the beginning of the fertility transition in Kenya, were accurate. Also examined were the trends, patterns, and differentials in fertility during this period. Thus, with respect to the trend, the total fertility rate (TFR) fell from 7.8 during the period 1973-1978 to 6.7 over 1984-1989. Another indicator of fertility, the parity progression ratio (PPR) followed a similar, downward trend. Regarding the pattern of decline, although there were fertility reductions in all age groups, it was greatest in the middle and late reproductive stages. As to the differentials, fertility decline was pervasive in all sub-groups of the Kenyan population - age groups, regions, areas of residence, and educational categories. Finally, concerning limitations, although the study identified regions with the greatest and least fertility declines – Central province on the one hand and Western and Nyanza on the other – one of its shortcomings was to ignore structural factors as possible causes for the decline. Instead, problems with the data are cited as possible reasons for the small decline in fertility observed in the last two provinces between 1977/78 and 1988/89.

Studies on the turning point acknowledging important variations at the sub-national level in Kenyan fertility and mortality; but they also point out the importance of contraceptive use as a cause of the downward trend in fertility in the late 1970s and early 1980s (Kelley and C. E. Nobbe 1990; Brass 1993). In particular, an examination of proximate determinants revealed that although post-partum infecundity was the most important fertility inhibiting factor then, contraceptive use had replaced marriage as the second most crucial determinant accounting for the incipient fertility decline.

Given the evidence for the irreversible fertility decline, a question that arises - and answered in the literature - is why earlier studies had maintained that high fertility would persist in the country (Robinson 1992). First, previous studies were led astray by fixed ideas about the micro-economic model of fertility decisions – which rests on the suppositions, not-quite right for high fertility regimes, that couples desire high fertility since it is in their interest and they have access

to all information about family planning methods. Secondly, it had been erroneously assumed that Kenyan values, institutions, and practices all favoured high fertility. Thirdly, the effectiveness of the family planning program had been under-estimated, and it was taken for granted that since the family planning program did not provide substantial results within the few years it had been in operation, then it would not lead to fertility decline. Instead, a rational weighing of the benefits and costs of child-bearing took place, and modernization won over the traditional pro-natalist beliefs. Equally, Government programs were effective in increasing the costs of children and at the same time reduced the costs of obtaining family planning methods.

2.6.3 Accounting for the Decline in Kenyan Fertility between 1989 and 1998

The issues related to the start of the Kenyan fertility transition have been outlined above; in this sub-section, the dynamics behind the decline in fertility that took place between 1989 and 1998 are examined. The themes that address this question in the literature are many and varied. Nevertheless, they can be grouped into five broad areas – the empirical relationship between youth sexuality and fertility, the role of the two other demographic variables (mortality and migration), contraceptive use, institutions within which childbearing and rearing takes place, and the idea of social interactions.

Youth Sexuality and Fertility

Reproductive health and sexuality among the youth are part and parcel of the issues in the fertility transition. In that regard, fertility among the youth is a recurring theme in the literature and deserves attention. A sample of this literature, presented below, is devoted to the factors associated with adolescent reproductive behaviour, the effectiveness of programs that address youth sexuality, and the place of pre-marital childbearing within a traditional Kenyan community. First, studies confirm that a big proportion of Kenyan in-school youth are sexually active, and that the youth would consequently benefit from health education interventions on abstinence, contraception, pregnancy, and STDs (Kiragu and Zabin 1993). The correlates of this early sexual activity among boys and girls include socialization with sexually-experienced peers, substance use, rural residence, having attained puberty, weak religious dedication, and an unstable family environment.

Secondly, evaluation of projects intended to address adolescent reproductive health shows that such interventions are effective. One such intervention, tried out in the Nyeri district of Central Province in Kenya, demonstrates that youth reproductive health programs which are adapted to be in line with traditional culture stand higher chances of acceptance and success (Erulkar et al. 2004). The indigenous cultural practice refers to initiation of youth to adulthood, and in this case consisted of having respected young parents communicate with the youth and their parents on matters of sexual reproductive health. While female youth were found to be more likely to adopt abstinence in the project sites compared to control sites, and the young men showed more tendencies to use the condom in the project than control sites, in the experimental cells both were found to be more likely willing to discuss reproductive health issues. Nevertheless, other studies also caution about the accuracy of reporting by adolescents on their sexual activity and related sensitive behaviors (Mensch et al. 2003).

The conceptualization of childbearing among the youth in these more westernized parts of the country follows the life-planning approach: reproduction and parenting among the youth should commence after schooling. Other studies however show that among some traditional communities, in particular the pastoral Turkana who inhabit the arid North-Western part of the country, having a baby before marriage is neither considered a social whistle to start childbearing nor a legitimization of the birth (Shell-Duncan and Wimmer 1999). This is in contrast to the popular hypotheses that view the rise in pre-marital fertility in the country as being caused by the collapse of social prohibitions on pre-marital childbearing or to the use of marriage by women as a means to attain their objectives. The lesson from this and other similar studies on youth sexuality in Kenya is that the cultural specifics of each community need to be taken into account when mounting youth programs.

The Place of Mortality in Fertility Change

Before focussing on mortality studies specific to Kenya, it is useful to examine the findings of a number of studies conducted elsewhere in sub-Saharan Africa on the subject. Within the broader issue of the effects of infant and child mortality on fertility, the issues of insurance effect and reproductive strategies feature in studies conducted in Zimbabwe and Senegal. That increasing

child mortality may not necessarily lead to an increase in fertility in an environment of HIV/AIDS is one of the themes explored in Zimbabwe (Grieser et al. 2001). The study finds that contrary to the hypothesis of the insurance strategy, Zimbabweans have fewer children as a result of perceived increase in the prevalence of HIV/AIDS, and are shy to continue childbearing after the death of a child; this being indicative of only a weak replacement effect. Early childbearing also emerged as a strategy to mitigate the HIV/AIDS scourge. As a whole, the results show that Zimbabweans are altering their reproductive behaviour in order to protect parents and children from the HIV/AIDS scourge.

Also, that the insurance and replacement effects are not the main and only concerns of populations in high-mortality contexts such as rural Zimbabwe and in modern settings is a conclusion that emerges from two qualitative studies carried out in Zimbabwe and Senegal (Grieser et al. 2001; LeGrand et al. 2003; Randall and LeGrand 2003). Deliberate fertility-limitation strategies were found to be infrequent. In this context of HIV/AIDS and modernization, there are far-reaching changes in attitudes, strategies, and behaviour regarding reproduction. Rather than being fixed on a target family size, fertility aims go beyond just the numbers of children and mortality. Varied investment in child quantity and quality is one strategy to attain the similarly different reproductive goals, the insurance strategy being just one of these aims. Further, in Senegal, replacement and insurance strategies are limited, meaning that their impact on fertility is negligible. Child mortality is not the only issue when it comes to making decisions about fertility. Rather, in urban areas, the cost and difficulties of child rearing are the main concerns. In rural areas on the other hand, the health of the mother is a legitimate concern and stimulates the need for longer birth-spacing (Randall and LeGrand 2003).

In Kenya, the relationship between mortality and fertility is a recurring subject in the literature. Findings from three studies – on factors associated with birth outcomes, child mortality, and HIV/AIDS as a possible cause for the rise of child mortality are examined here. To the extent that morbidity and hence mortality during early infancy has a bearing on fertility, the study on unfavourable birth outcomes (Magadi et al. 2001) is pertinent to this literature review. The findings of the study indicate that the likelihood of such outcomes (premature deliveries, small baby size at birth, and caesarian section) is greater for first-order births. The research study also

shows other findings for each of the three outcomes. First, there is a negative association between antenatal visits and the possibility of a premature birth. Secondly, maternal nutrition is important in determining the baby's size at birth. Lastly, short maternal stature, higher socio-economic status, and district of residence are associated with caesarean section.

The relationship between childhood mortality and fertility in Ghana and Kenya has been examined in a number of studies using DHS data (Gyimah 2000a; Gyimah 2000b; Gyimah and Fernando 2004). For both countries, women with prior infant deaths were found to have more births than those with fewer and this result is suggestive of both physiological and behavioral responses. However, the fertility response to child mortality is found to be larger in Ghana than Kenya, indicating the association between fertility response and the phase of the particular fertility transition. Regarding the delayed response of fertility to childhood mortality, the literature shows that the death of the first child is associated with an increased risk of a higher birth order. The policy implication of these studies is that improved child survival programs could enhance the fertility transition through interventions aimed at influencing both biological and behavioral responses (specifically post-partum and generally maternal and child health/family planning programs).

A background to the trend in child mortality in Kenya is important in understanding the role played by HIV/AIDS. Mortality for children aged less than five years decreased in Kenya after independence until the 1980s. Beginning in the late 1980s however, it increased by as much as 25%. When the question of what caused this increase in child mortality is posed, debate on the role of HIV/AIDS stands out in the literature. For example, based on data from the Kenya 1993 and 1998 DHS surveys, it is concluded that the increases in mortality are associated with the upsurge in the HIV/AIDS pandemic in the 1990s (Hill 2004). The relationship between family planning and sexual behavior in the context of the HIV/AIDS pandemic is also a recurrent theme in the literature. A qualitative study conducted in Nakuru district of the Rift Valley Province in Kenya (Bauni and Jarabi 2000) finds that although people consider the risks of unwanted pregnancy and HIV/AIDS as serious, they do not generally use condoms or deny partners sex even in the face of risk. This may have a number of implications, including higher infection rates and hence infant, child, and parental mortality.

More recent research on the possible effect of HIV/AIDS on the leveling off in fertility in Kenya between 1998 and 2003 has tended to focus on specific regions within which HIV/AIDS prevalence is high. In particular one study, (Magadi and Agwanda 2007), which uses the 2003 KDHS data examines the province-level link between the spread of HIV/AIDS and fertility. The fertility-inhibiting effect of HIV/AIDS among women who are infected is confirmed, and the influence of HIV/AIDS on fertility is found to work in part through two proximate determinants of fertility - exposure to coitus and breastfeeding. The study further concludes that by reducing the duration of breastfeeding following loss of a child and increased desire for more children, HIV/AIDS may have played a part in the recent leveling off in fertility. The largest increase in fertility and biggest decline in contraceptive prevalence occurred in Nyanza province, an area with the highest HIV/AIDS prevalence. The increases in age at first sex and first marriage were also lowest here, thereby indicating that together with reduced breastfeeding, these patterns of change in the proximate determinants could have contributed to the leveling off in fertility.

Migration, Urbanization, and Change in Fertility

The process of urbanization has proceeded at a rapid pace in Kenya particularly after political independence in 1963. While according to the 1962 population census only 7.8% of Kenyans were living in urban areas, this had increased to 34.5% by 1999 (UN-Habitat 2007). When the proportion of women of reproductive age living in urban areas is considered, a similar upward trend is observed. In 1989, 17.3% of women aged 15 to 49 were living in urban areas. This increased to 17.8% in 1993, 23.2% in 1998, and 25.1% in 2003 (NCPD 1989; NCPD 1994 ; NCPD 1999; CBS et al. 2004).

Although less attention is devoted in the literature to the relationship between migration and change in fertility, two studies nevertheless illuminate this subject for Kenya. First, the problem of urban poverty, environment, and child health in Nairobi's sprawling urban slums has been examined in the context of growing urbanization in the country (Amuyunzu-Nyamongo and Taffa 2004). Research findings show that mothers correctly conceptualize child morbidity in urban slum areas as arising from impoverished status and environments, and do not show inadequate understanding of disease processes. The indicators of this impoverishment, which

have implications for child survival programs and possibly fertility, include inadequate clean water, unsafe waste disposal, inadequate nutrition, and air pollution.

Secondly, the relationship between migrant labor economies, gender, and multiple livelihoods has been examined in the literature (Francis 2002). Conducted in Kenya, Lesotho, and South Africa, the study shows that, following shrinking urban employment prospects, spouses admit interdependence and renegotiate, or may separate, leading to marriage breakdown. Results of the study also indicate that women may become less enthusiastic about marriage, because the material basis of the household is weakened. An increase in the number of women-centered households is a likely result, with attendant effects on fertility.

Contraceptive Use and the Fertility Decline

Contraceptive use is an important proximate determinant of fertility; true to this central role it plays in fertility change, several studies are devoted to it. The studies on contraceptive use in Kenya presented here focus on unmet need, differentials in contraceptive use, and trends in the use of particular contraceptive methods. Unmet need on its part is examined here with two issues in mind – its role in the increase in contraceptive prevalence, and its differentials. In addressing the role of contraceptive use in influencing change in fertility, the roles of changes in preferences on the one hand and unmet need on the other are important. It is undisputed that increases in contraceptive prevalence lead to a decline in fertility; nevertheless the cause of increased prevalence has been contentiously debated. According to a number of studies that have used regression decomposition methods, the main factor behind the increase in contraceptive prevalence in developing countries including Kenya since the 1970s has been the increased satisfaction of unmet need, also known as change in rates, rather than increase in the proportion of women who want no more children or change in composition (Feyisetan and Casterline 2000). Thus, the increase in prevalence was due to increased access or reduction in costs of family planning, rather than from increased demand for smaller family size. This conclusion, it is suggested, is consistent with and justifies investment in family planning programs.

A study carried out to determine the factors behind the increase in contraceptive prevalence in the country, a prevalence that was found to vary greatly by region during the decade 1978-1988

(Njogu 1991) deserves mention because its method and results are relevant to the examination of contraceptive change in Kenya over the period 1989-1998. Also using regression decomposition as the analytical method, research results showed that in contrast to the satisfaction of the unmet demand explanation presented above, the increase in prevalence was due to shifts in the composition of educated women, and in the proportion who wanted no more children.

The extent of unmet need is related to investment in family planning programs (Pritchett 1994; Casterline 2000) and hence to change in fertility. An examination of its differentials in the country shows that over the period 1989-1993, unmet need declined in urban areas, Central and Rift Valley provinces of the country, among women who have secondary level of education, who desired less than three children, and whose husbands approved of family planning (Kekovole 1998). On the other hand, it increased in Nyanza and Western provinces, among women with no education, and for those who - along with their husbands - disapproved of family planning. Thus, the factors most associated with unmet need for family planning were residence, province, educational level, the respondent's and husband's approval of family planning, religion, desired family size, and parity.

A number of studies have observed a narrowing of contraceptive use across the rural-urban, educational, and regional divides in Kenya. It is argued that the increased availability of family planning services, the socio-economic progress of the 1960s and the 1970s, and the contrasting economic hardships of the 1980s have all encouraged Kenyans to opt for smaller family sizes (Mburugu and Zulu 1998). The increase in the proportion of women who work outside the home, live in urban areas, and who approve of contraceptive use is indicative of the contribution of social, economic and cultural environments in the fertility decline. Additional differentials in fertility and contraceptive use are also noted by a number of studies. It has been observed that declines in fertility occurred among all age-groups, ethnic and socio-economic groups, and regions in Kenya (Fapohunda 1998). However, the reductions were greatest among those aged 15-29 years. At the district level, decreased fertility is however associated with higher educational attainment, wage employment, urbanization, and contraceptive use (Wasao 1998).

As part of the quality of care framework, the range and use of specific contraceptive methods is important in increasing prevalence (Bruce 1990). One recent study (Magadi and Curtis 2003) takes up this theme by examining the trends in the use of specific contraceptive methods in Kenya between 1989 and 1998. The results, which demonstrate greater contraceptive use in urban areas, with the inverse being true for traditional methods, show a new development: prevalence of the injectable contraceptive method is elevated among rural women, those whose partners do not approve of family planning, women with no schooling, and among women infrequently exposed to media messages about family planning.

Contextual Factors and Social Institutions

Another theme, prominent in the literature on the analysis of the dynamics of fertility change in Kenya, is social institutions and context (as opposed to individual variables). The elements of this set of institutions, discussed in turn below, comprise the question of land, gender, marriage, family, population policy, ethnicity, and social interactions.

The Question of Land

The literature recognizes the place of land, and in particular land of high agricultural potential, in influencing change in fertility in the country in two ways. First, regions with high agricultural potential are associated with high fertility. For example, the relationship between population growth, land-use, and food self-sufficiency in the densely populated Kisii Highlands of Kenya is not necessarily a problem due only to high fertility which leads to increased population densities (Omosa 1998). Rather, harmonization of agricultural policies and rural development by provision of basic infrastructure might better address the problem of food resources. Another study of the Kisii districts, (Uitto 1992), illustrates the preconditions for fertility decline. Despite a general decline in fertility in the socio-economically advantaged regions of Kenya, Kisii district, “an agriculturally rich region that includes steep hills and deep rounded valleys” has been an exception. Fertility remained high at 8.2 births per woman as compared to the national average of 7.7 at the end of the 1970s. The study concludes that with high population densities of about 395 persons per square kilometre, modernization and land shortage have pushed families to seek non-farm employment, a response that was already observed in the early 1960s among industrialized nations – in particular Japan – by leading demographers (Davis 1963).

Secondly, the literature shows that the question of land ownership underlies the evolution of Kenya's past and present-day social and political life, including fertility. In a review of population policies in developing countries, (Jain 1998), the roots of the Kenya population policy are traced to the colonial period, and to land in particular. The British colonial administration confined or pushed Africans, and particularly members of the Kikuyu ethnic group, to native reserves as part of their policy for cheap labor. The population densities subsequently became so high that their political implications began to emerge; the frustrations among the African population later becoming the basis of the Mau Mau armed struggle, as a result of which political independence was granted by the colonial master, Britain, in 1963. In spite of this account, the full demographic consequences of this resettlement policy and liberation struggle, and more particularly its fertility impact, are yet to be comprehensively analyzed.

Gender Systems and Fertility

The idea of gender may at one point be considered as an individual aspect; it can equally be considered at the level of the family or social context. Gender is generally construed as the beliefs, norms, practices and sanctions associated with being male or female, and the roles (division of labour) that ensue (Mason 2001); it is treated under a number of sub-themes in the literature. First, the question of male involvement in family planning is raised in a study (Ronno 1998) where the determinants of contraceptive use among men in Kenya are analyzed using data from a survey of 300 men in the Nandi District of Rift Valley Province. In this relatively well-endowed and small-scale farming district, male approval of contraceptive use is contingent upon attainment of desired family size: male attitudes toward contraception are therefore a critical factor in contraceptive use.

Secondly, beyond the involvement of men in family planning, other gender issues addressed in the literature include measurement, and the status of women. Beginning from the observation that data on contraceptive use frequently show differences between couples with regard to levels of use, it is often not clear whether this is due to over-reporting by men or under-reporting by women (Ezeh 2000). Results show that wives' discrepancies on contraceptive use are more accurately confirmed than men's. While gendered fertility preferences are explained by female education in urban areas, in rural areas it is male preferences which predominate (Dodoo and

Tempenis 1998). Further conceptualization of the measurement of couple unmet need using Kenyan DHS data also shows the importance of the husband's preferences and contraceptive use (Bankole and Ezeh 1999).

The question of the status of women and its relationship to fertility change in the country is explored in a study which, among other things, measures the status of women by the proportion of women and men with schooling and in professional/occupational categories (Magadi 1997). The study identifies Nyanza Province in Western Kenya as one of the regions with low status of women - a status that is associated with the low health status of infants and children. The study also shows that traditional beliefs and practices about the role of women and men shape the status of women, and are related to child health (and ultimately fertility) in the high mortality region of Nyanza province. Men, the study notes, are responsible for most of the decision-making in the household and community, irrespective of the educational level of the spouse.

Marriage and Fertility

The question of marriage type in Kenya is addressed in a number of studies; it is useful as a prelude to briefly present its levels and trends. In 2003, 16.4% of married women of reproductive age were in polygynous union (CBS et al. 2004). The general trend in polygyny (the state of having more than one wife and by implication the situation of sharing a husband with at least one co-wife) over time has been downward, having decreased from 23.4% in 1989 to 16.0 in 1998. However between 1998 and 2003, the level of polygyny has remained basically the same (NCPD 1989; NCPD 1994 ; NCPD 1999; CBS et al. 2004). This proportion (of married women who have at least one co-wife) is higher in rural than urban areas; it is also higher among wives with no education compared to those who have education, as well as among poor women. Among the provinces, the percentage of married women with at least one co-wife is lowest in Central province where in 2003, it was at 3%, while in the other provinces, particularly Nyanza, Rift Valley, Western and coast, it was much higher, ranging between 20 and 23%.

Turning to specific research work on marriage type, one study (Dodoo 1998) uses datasets from the Kenya and Ghana Demographic and Health Surveys (DHS) to examine the influence of marriage type, namely polygamous or monogamous, on reproductive decisions. Results do not

support the assertion that polygamy hampers the implementation of women's fertility preferences. On the contrary, the study reveals a stronger female influence in polygamous marriages, and a weak male advantage in the monogamous samples. In view of the contradicting findings, the topic merits further research, particularly in relation to the broader question of the reliability of responses from single partner versus dyad interviews.

Another issue pertaining to marriage that is addressed in the literature is the different types of polygamy (low, medium, and high polygyny regimes in Kenya) and how they relate to fertility (Ezeh 1997). Arguing that men in a high polygyny regime maintain high fertility through marriage of many wives, the study also suggests that women on the other hand maintain high fertility through the maximization of their reproductive potential. This strategy is implemented through early initiation of sexual activity, universal and minimal interruption of marriage, non-use of contraception, and favorable feelings towards a large number of children.

Surveys carried out in Kenya also show that fertility varies directly with the level of education; new research shows that education also significantly affects age at first marriage, this effect persisting even after controls have been accounted for (Ikamari 2005). Women who are educated are likely to delay their first birth, and notable differences in the effect of education across different cohorts of women are visible. This effect is greater among younger women, which indicates that there has been postponement of marriage over time. Pre-marital sexual activity, childbearing, region of residence, religion, and year of birth are also significantly associated with age at first marriage.

Beyond the institution of marriage, a number of studies also document the effect of other related institutions on fertility. For example, that changes in institutional factors such as education, the economy, family, and marriage have had an independent effect on fertility in Kenya, quite apart from that of programs, is a conclusion arrived at in some studies (Ezeh and Dodoo 2001). The implication is that fertility should decline even in cases of weak programs. The study nevertheless notes that for some institutions, further research needs to be conducted - for example, on the institution of polity (Government) and its effect on fertility. Similarly, it is

observed that the use of occupation and type of employment as independent variables may be biased measures of the true effect of the institution of the economy on fertility.

Family System

Based on two comparable surveys conducted in 1981 and 1992 in rural Western Kenya which use Caldwell's idea of intergenerational wealth flows theory (Dow Jr et al. 1994), we now know more about the relationship between the fertility decline, wealth flows, and family nucleation. Identical questionnaires that measured lineal and lateral wealth flows and emotional nucleation were administered to comparable samples of male heads of households. As hypotheses, the study posited that the key to the timing and slope of the fertility decline will be to track the continuity and change in the pattern of wealth flow and nucleation within the family. The results showed that harsh economic limitations have necessitated a redefinition of fertility levels in all the sub-groups of the population and that a resurgent population program has been able to supply the necessary contraceptive supplies to satisfy the unmet need that has been created.

Population Policy and Fertility

The role of population policy in fertility change is addressed in various studies; it is appropriate to mention at the outset the role of the institution of Government both as a manager of society and a key player in the policy-setting process (McNicoll 2001). First, the literature shows that the effect of policy on contraceptive use and fertility should be examined with caution. Differences in fertility levels and trends on the one hand and contraceptive prevalence on the other have often been interpreted to signify the differential success of the family planning program. This is one of the observations from a study on population policies in four developing countries including Kenya (Jain, 1998). However according to the study, this is erroneous, as areas with high fertility and low contraceptive prevalence are often those with high infant and child mortality, and low female literacy rates. These are social settings that are not favorable to low fertility preferences. The study also suggests that there is a gestation period during which there are debates on the population issue before a population policy is adopted. Perhaps such a lag also exists between the implementation of programs and their effects in terms of a decline in fertility. The implication is that an immediate, ex post facto, evaluation of a program may not show the effects, while an impact evaluation conducted later could.

Secondly, research results on the relationship between population policy and fertility show that population policy has an effect, at least in Kenya. When the effects of demographic, socio-economic, and political factors on contraceptive use are examined (Toroitich-Ruto 2001), it emerges that initially (in the late 1960s when the family planning program was launched and integrated into the maternal and child health division of the Ministry of Health), reduction of population growth was not a priority. Later however, with the development of the population policy guidelines of 1984, resources were specifically set aside for reduction of population growth, and this led to a rapid decline in fertility; the complimentary role of Non-Governmental Organizations (NGOs) to that of Government in service provision having been equally important.

Another mechanism through which population policy affected fertility in Kenya was through the interaction between international population movements and national governments. A study of the evolution of population policies in Kenya and Malawi (Chimbwete et al. 2005) shows how international population organizations adopted common strategies to influence the Governments of Kenya and Malawi to adopt neo-Malthusian population policies and implement family planning programs. The Governments of Kenya and Malawi reacted differently, the response depending on each country's approach to nation-building, degree of acceptance to domination by this external influence, strength of desire to preserve traditional culture, and perception of the benefits to be reaped from this assistance.

The current Kenyan population policy is an enactment of the ideas agreed upon during the 1994 Cairo Population and Development Conference (NCPD 2000), and it is in this context that a study of the feedback from developing-country elites to this international policy (Luke and Watkins 2002) is pertinent. According to the study, to view the adoption of such international population policies as a spontaneous cultural diffusion is not exactly correct. On the contrary, such cultural flows can be directed by outside forces, may be unattractive to the targeted audiences, and could also require convincing and inducements. While some of the elites eagerly accept the Cairo policy, all acknowledge the roles of donor power and resources in directing the diffusion of the policy.

Ethnicity and Fertility

Two ideas – modernity and political capital - have been the bases of explanations for ethnic differences in contraceptive use, and ultimately in fertility, in Kenya. One study, (Bauni et al. 2000), finds that even after socio-demographic variables which include residence, education, and marriage type are controlled for, the central Bantu group of Kikuyu, Embu, and Meru (KEM) has smaller family sizes than other groups. This fertility differential has been achieved through the use of modern contraceptive methods. The authors' arguments are based on historical and contemporary events in Kenya and suggest an early exposure to modernity as a factor that placed these groups in a unique position with regard to reproductive outcomes. The implication of this argument is that going back in time, one should be able to identify a time, possibly the pre-independence period, when the inter-ethnic variations in fertility were not as great.

Another idea advanced in the literature to explain ethnic variations in fertility is that of a political approach to the analysis of demographic behavior (Weinreb 2001). It is argued that inter-ethnic variations in reproductive behavior often tend to be masked behind markers such as district or region; alternatively they are subject to simplistic cultural explanations. A different explanation that is based on ideas from political economy, sociological theory, and political science is proposed, testing it empirically with Kenyan data. A measure of political capital at the district level is used to demonstrate that this approach explains residual ethnic differences in contraceptive use in Kenya. It is found that the key factors which underlie ethnic demographic behavior in Kenya (particularly among the two major ethnic groups – the Kikuyu and the Kalenjin that have each produced presidents in the past and present) are access to power, and through it an opening to controlling state resources such as clinics, schools, and employment opportunities.

Social Interactions and Fertility in Kenya

The idea that different parts of the country are in different reproductive stages is expounded in a number of studies. The first, the existence of a natural fertility regime side by side with modern fertility-control settings is documented in an investigation on the relationship between birth intervals and the sex of a child in the Gabbra pastoralist community of northern Kenya (Mace and Sear 2000). Subsequent birth intervals for male children are found to be longer than those for

their female counterparts. This, according to the study, is a sign of greater parental investment in male children. Nevertheless, the difference disappears at higher parity. The overall conclusion to be derived from this study is that the pattern shows a strategy of maternal investment in children with the highest reproductive potential.

An important study on reproductive models in Kenya examines the subject from a perspective of local contexts, social networks, and historical facts (Watkins 2000). In examining the question of local and foreign models of reproduction in South Nyanza district of Kenya using a survey on diffusion of innovations, the study shows that the local reproductive culture gradually changed in three ways. From a culture whereby a large family was initially seen as riches, perceptions have moved to a model of a small family representing modernity, and to one in which there is increasing use of family planning services. The conclusion of the study is that the results show culture to malleable rather than being a barrier.

The study notes that the era of widespread concern about rapid population growth in developing countries began in the 1940s when some western academics and foundations predicted a looming crisis. That period ended in 1994 with the International Conference on Population and Development (ICPD), when more emphasis was placed on the achievement of gender equity and reproductive health for women in the developing world, against the rationale of population goals set earlier. Currently, most Governments in the developing world have developed population policies aimed at reducing population growth, and fertility has declined in most countries. Unlike other studies which have reviewed the decline in fertility in Kenya between 1989 and 1998 at a national level, the study on reproductive models does so at a sub-national level, focussing on the South Nyanza districts of Kenya. The thesis of the article is that local communities are under the influence of powerful outside forces that change local circumstances, which compels local networks to re-assess their cultural models.

Based on the same longitudinal dataset and in the same region of South Nyanza district of Western Kenya, a number of studies have pursued issues related to the concept of social networks. These ideas, addressed below, comprise informal discussions in family planning clinics, the structure of social networks, the communication process in the adoption of

innovations, and the measurement of social interactions. First, the idea of social interactions helps to explain certain behaviours by women attending family planning clinics (Rutenberg and Watkins 1997). The study responds to three questions raised in family planning forums. First, when women talk to each other about family planning outside the family planning clinic, are they just spreading myths and rumours? Secondly, why isn't the information provided by the nurses not enough? Thirdly, why do women, after being counselled by the nurse, also talk to the cleaner about what they have jut been told? Results of a household survey carried out in South Nyanza district of Kenya show that the women are hesitant about using family planning methods. They consequently add on experiences from other persons who are more like them. Therefore, family planning programs need to view clients and providers as members of informal networks. Equally, more should also be learnt about the motivations of family planning providers.

Secondly, demographers have argued that social interactions are an important mechanism for understanding fertility behaviour. However, it is still not clear whether contraceptive use takes place through social learning or influence among social networks. These mechanisms can be differentiated by analysing the density of social networks and its interaction with the proportion of contraceptive users among network partners (Kohler et al. 2001). In the South Nyanza district of Kenya, social learning is most relevant in a context of high market activity. However, in areas of the district which have modest market activity, social influence is the dominant means by which the social linkages affect contraceptive use among women.

Thirdly, in investigating the impact of social networks on changes in contraception, the literature shows that social networks have an impact on contraceptive use. In particular, the question of whether it is social learning or social influence that is more important in the adoption of contraception is explored in a study based on a rural household sample in South Nyanza district of Kenya (Behrman et al. 2002). The model yielded estimates which indicated four outcomes. First, social networks have an effect even after controlling for unobserved effects. Secondly, controlling for these unobserved factors may alter the effects of networks. Thirdly, network effects are important for men as well as women. Lastly, network effects are non-linear and asymmetric, implying that networks provide information principally through learning rather than influence.

Studies on measurement issues in the analysis of social networks (White and Watkins 2000) seek to answer at least two questions: 1. How accurately do respondents report the characteristics of their network partners? 2. How stable are these networks over time? Research results find that there is a strong relationship between the reports of the individual's and their network partners' behaviours. However, discrepancies between the respondents' reports of their network partners' contraceptive behaviour on the one hand, and those of their network partners are substantial. Levels of network stability and reliability are also found to be low. The problems are primarily due to incorrect responses and difficulties in measuring diffuse social structures. Thus, the influence of social networks on behaviour may be strong or weak, but the idea of social networks has systematic measurement problems that researchers need to be aware of.

2.6.4 The Nature and Determinants of Constant Fertility in Kenya

The evidence for the levelling of fertility between 1998 and 2003 at 4.8 births per woman is well documented in the Kenya 2003 DHS; the question is, "what factors are associated with this phenomenon?" Relative to the rapid decline in fertility between 1989 and 1998, fewer studies have been devoted to this subject, understandably since it is a more recent phenomenon. However, those that have can be grouped into three – aggregate, individual level, and future fertility scenarios.

When the constant trend in Kenyan fertility between 1998 and 2003 is examined at the level of individual women, the possible role of HIV/AIDS in retarding the fertility decline emerges (Westoff and Cross 2006; Magadi and Agwanda 2007). An examination of this trend by differentials shows a number of observations. Constant fertility between 1998 and 2003 is evident throughout the country but is most visible among the least educated women, with those having secondary or higher education nevertheless still showing a modest decline in childbearing. Accompanying the levelling in fertility was the plateau in contraceptive use - it is mainly observed among younger women and those with less education, but at the same time slightly increasing among women who are sexually active, irrespective of marital status. While the use of the injectable contraceptive increased over the period 1998-2003, use of oral contraceptives, the IUD, and sterilization decreased. The period 1998-2003 is not only

characterised by the levelling off in fertility decline and contraceptive prevalence, but also by the decline in the proportion of women who want no more children. The marginal decline in the proportion wanting no more children is observed in urban and rural areas, in all provinces and ethnic groups, for women with less than secondary education, and among women as well as men. The HIV/AIDS epidemic may have a role in the reversal of reproductive preferences – women who experienced the death of a young child were more likely than others to want another child soon.

Research results carried out in seven other countries alongside Kenya (Bangladesh, Colombia, the Dominican Republic, Ghana, Peru, and Turkey) provide additional insights into the nature and determinants of the levelling off in fertility (Bongaarts 2006). First, apart from registering wide variations in constant fertility (which ranged from a total fertility rate of 4.7 in Kenya to 2.5 in Turkey), there were no important increases in unwanted births or in the already-high unmet needs for contraception. Improvement in access to address the high unmet need would therefore be necessary. Secondly, when fertility started to stabilize, the level of fertility was lower than that expected for the corresponding level of socio-economic development (as measured by Gross Domestic Product, child survival, and the proportion of women who have been to school). For desired family size and current fertility to come down from the high levels, socio-economic development will need to improve, particularly in Ghana and Kenya where it is low and has stagnated.

The deceleration in the fertility decline by the year 2000 as compared to the mid-1990s in these countries has repercussions for future demographic trends, as minor variations in fertility trends have big impacts on the size and age structure of populations (Bongaarts 2007). If the slower pace of recent fertility transition persists, it means that the African continent, and by implication Kenya, could approach or exceed the high variant of the United Nations population projections. This trend could have adverse effects on the prospects of social and economic development, political stability, and sustainability of natural resources.

While the fertility transition is taking place in a number of countries in sub-Saharan Africa, it is levelling off in some, in mid-stream in others, and beginning in some (Shapiro and Gebreselassie

2007). As found in an earlier study (Bongaarts 2006), constant fertility may be related to the slowed pace of development (schooling, lagged infant and child mortality, and delayed growth in GDP per capita). The future perspective of the fertility transition in sub-Saharan Africa will depend on the course of education and infant and child mortality. What emerges from the literature is that as had been predicted in the past, fertility might remain at four to five births in Africa, reflecting the demand for children as old-age security. This would mean that in the absence of old-age security, even improved socio-economic development may not be adequate to prevent widespread levelling off in fertility.

The question of how far the decline in Kenyan fertility on its part will go has been addressed in the literature (Blacker 2002). The results of the analysis show that the total fertility rate in the country is unlikely to fall below three births per woman. This conclusion is based on the projection of the completed family size for cohorts of women of childbearing age, the constant level of contraceptive use, the stable trend in the total fertility rate in Central Province, among women with secondary education, and the steadying of ideal family size at about 3.7 births per woman. However, much will depend on the path taken by the HIV/AIDS pandemic as well as its effect on fertility. If life expectancy at birth does not fall below 45 years, stable population models suggests that a total fertility rate of three would be adequate to ensure replacement. Until the HIV/AIDS epidemic comes under control, a total fertility rate of below three may therefore not be possible.

The levelling off in fertility in Kenya between 1998 and 2003 is related to fertility norms (White et al. 2007). Large ideal family size has been used to support the view that high fertility prevails in countries of sub-Saharan Africa; but with the decline in fertility in Kenya, the question arises whether family-size norms and attitudes have similarly fallen. The fastest reduction in ideal family size took place between 1984 and 1989. However, the most rapid fall in the total fertility rate took place five to ten years later, between 1989 and 1998. The data therefore support the traditional view that demand for fertility limitation leads to fertility decline. The decline in family size norms was both a period and cohort effect. The new fertility norm of four children per woman may have developed by 1989 and continued to 1998. This is consistent with, and could have been used to predict the levelling off in fertility, the study (White et al. 2007) notes.

Summary

In reviewing the theoretical foundations upon which studies on fertility are carried out, what has emerged is the multi-disciplinary nature (involving demography, biology, economics, sociology, and anthropology) of fertility and its determinants, and the place of each is summarised below. First, from a demographic point of view, the idea of natural versus controlled fertility enables the modelling of change in fertility over the reproductive life cycle with the use of rigorous mathematical and statistical methodology. The merit in the approach is the ability to measure and predict quantitatively the phenomenon of fertility; at the same time this is a limitation because the fertility processes taking place in every-day life cannot be reduced to mere point or interval statistical measures. Secondly, the biological factors that underlie fertility are captured in the idea of proximate determinants of fertility. In spite of its popularity, the model has been criticised as providing biased measures of the intermediate determinants of fertility.

Thirdly, the supply and demand framework for fertility analysis is about how parents balance the demand for children with that for other goods sought in life against the economic constraint of limited resources. Undeniably, many decisions are made in the context of limited resources; nevertheless, the assumption that decisions about fertility are always made in a rational manner – maximising, minimising, or optimising a number of objective functions does not always work in the real world. To the extent that fertility decisions and events take place in the context of societal processes, the institutional approach to analysis of fertility determinants situates fertility processes within the realm of sociology. Modern approaches to modelling such processes can however be complex, involving several levels or hierarchies and complex statistical models. Lastly, in examining the reproductive case histories of individual women, the field of anthropology has exposed the reasons why specific fertility decisions might be made, and in particular the contingencies (health, social, and economic) that underlie many of these individual decisions, and in particular childbearing.

The research evidence of the fertility determinants in sub-Saharan Africa has been examined from one or the other of these perspectives; they should be seen as complementing, rather than rivalling, one another. When the literature on fertility in sub-Saharan Africa is considered as a whole, across the different sub-regions in the continent, a number of issues emerge. First, partly

as a result of the emergence of the HIV/AIDS epidemic, a number of studies emphasize the need to re-examine traditional assumptions about the linkages between mortality and fertility. Secondly, that sub-Saharan Africa will be the next frontier for family planning comes out in the literature: fertility and population growth rates persist at high levels.

At the sub-regional levels, studies show that the introduction of innovative strategies to deliver family planning information and services is effective in a number of countries such as Gambia and Cameroon. Similarly, not only have population policies been adopted in a number of countries such as Nigeria, fertility transitions have also been observed in some countries in the sub-region, e.g. Benin. Nevertheless, studies also point out that the relatively low contraceptive use in the sub-region is related to male control over reproductive decisions. Population policies also need to factor in the strong pro-natalist cultures. The ideas of social networks and contingent lives provide a better understanding of the factors behind the fertility dynamics in the sub-region. In the extended family system of West African countries, and particularly among the Bamanan people in Mali, cooperation among women in the extended household is positively related to fertility. Equally, in the Gambia, studies show that women use modern contraception for short durations, post-partum, in order to maintain high fertility, the purpose being to replenish reproductive capacity that is temporarily depleted by frequent childbearing.

A number of countries in Southern and Eastern Africa have experienced the fertility transition. However, it is the transition in South Africa that attracts most attention in the recent literature for the sub-region, not least because of the more recent dismantling of the apartheid system of Government and release of demographic data hitherto unavailable. Three conclusions can be drawn from the literature on the fertility transition is South Africa. First, by the mid-1990s, fertility in South Africa was about three births per woman, the lowest in sub-Saharan Africa at the time - the fertility transition having started much earlier, in the 1950s and 1960s in the country. Secondly, although family planning programs were specifically targeted at the black female population, contraceptive use among black women remained below that for other racial groups both before the abolition of apartheid in 1994 and thereafter. Thirdly, fertility desires remain high among the black population within and neighbouring South Africa. Fear of infertility is high in the sub-region, and seems to be related to migrant labour and the rising pre-

marital fertility, particularly in Botswana. In addition to the fertility dynamics of South Africa, two other currents in the literature on Southern Africa are the effects of peace-time and war in depressing and increasing fertility respectively in Angola, and how social interactions influence contraceptive use among various groups including church membership.

Literature that has examined Kenya's fertility dynamics from the mid-1970s can be sub-divided into the three stages in which fertility has evolved since then. They comprise the turning point in fertility, the rapid decline between the late 1980s and 1990s, and the period of constant fertility between 1998 and 2003. While studies on the turning point did confirm the irreversible fertility transition in Kenya, an issue that emerged was why earlier studies had been pessimistic about the prospects for fertility decline in the country. Earlier predictions were in the wrong for three reasons. First, they had erroneously assumed that high fertility in Kenya reflected a high demand for children and that this high demand was based on the rational micro-economic model of fertility. Until these economic and social forces that led to a high demand for children were addressed, fertility would remain high. Secondly, it had been assumed that Kenyan fertility is characterised by a culture of natural fertility in which marriage starts early and is universal; such a culture would not change even in the face of modernization. Thirdly, it had been wrongly assumed that the Kenyan family planning program was not effective enough in delivering family planning services and in meeting existing needs.

Several studies have addressed the question of the decline of fertility in Kenya that started in the early 1980s, and the idea of change in reproductive models over time stands out. According to the model, Kenyan fertility, and in particular fertility in rural areas of Nyanza province, and possibly other rural areas in the country, has changed in three ways over time. First, in pre-independence and colonial Kenya, high fertility was seen as riches. With the advent of western culture and ideas, Kenyan parents began to see a small family as representing modernity. Thirdly, with the diffusion of contraceptive innovation in the country through international programs, a new model, the "mzungu model" on the use of family planning methods, has come to be. The three changes imply that culture is not static, but can be changed.

From the mid-1990s, the decline in fertility levelled off, and a number of studies have addressed the reasons for this constant fertility. Suggestions on the causal factors have ranged from lack of socio-economic development to increased infant and child mortality. More recently, the possibility that reduction of breastfeeding due to rising infant and child mortality associated with HIV/AIDS contributed to constant fertility has been suggested. Beyond the current stabilization in fertility, the question of how much lower Kenyan fertility will descend is pertinent. It has been suggested that given the current levels of mortality, replacement-level fertility in Kenya will be between three and four births, and not lower. It is argued that the fact that fertility desires, and in particular ideal family size, has remained at about four births per woman in the recent past also indicates that the trend in fertility demand can be used to predict that in current fertility.

CHAPTER 3: EVALUATION OF DATA QUALITY

Introduction

The datasets used in this dissertation are all (quantitative) sample surveys rather than complete enumerations (censuses) of the population, or qualitative. In that regard, a distinct characteristic of the sample survey is that it can be divided into a probabilistic part, the one for which sampling errors can be estimated, and a non-probability part for which sampling errors are impossible to avoid and difficult to evaluate (Kish 1965; CBS et al. 2004). In line with this two-way classification, this chapter, that discusses the strengths and limitations of the datasets used in this dissertation, can be said to be broadly divided into two parts: first a component that presents how the sampling was designed and implemented; secondly, an examination of a number of relevant questions posed to respondents in order to collect the requisite data.

Within this broad grouping into aspects dealing with sampling, and those related to the questions put to respondents, this chapter is divided into the following parts. First, in section 3.1 the sampling design of the surveys is discussed. Further to this clarification of the sampling strategy and its implementation, in section 3.2 the question of whether there were fundamental differences in the sampling composition of the various surveys is next addressed. This is an important question, first raised during the onset of fertility transitions for a number of countries in sub-Saharan Africa, which would respond to the argument that the downward trends in fertility in these countries (which includes Kenya) observed then and that continued thereafter might be the result of errors in the sample compositions, rather than genuine fertility declines. In section 3.3 key questions (from which important variables used in the dissertation are developed) are examined for differences across the five survey datasets; remedies to address issues raised are also suggested. Section 3.4 examines the quality of data - from the demographic perspective - at the levels of the household, individual woman aged 15 to 49 years, and children, recorded in the birth history and related tables of the survey questionnaires. In section 3.5, the issue of the level at which some of the analysis will be carried out in the dissertation - whether national, provincial, or district - is addressed. Section 3.6 briefly presents the methods to be used for data analysis, the chapter finally ending with a summary of issues addressed.

3.1 Overview of the Sampling Designs and Implementation

3.1.1 The Stock of Demographic Data in Kenya

The quality and quantity of the Kenyan demographic data has been hailed in the population literature (Henin et al. 1982; Brass and Jolly 1993) and it is useful to briefly enumerate the stock of demographic data that have been collected in the country, which can be categorized into three groups. The three population censuses conducted in 1948, 1962, and 1969 constitute the first group - they were implemented, respectively, during the periods before political independence, just before independence in 1963, and soon after independence. The second cluster includes the population census of 1979 and several demographic surveys carried out at about the same period, the surveys comprising the Kenya Fertility Survey (KFS) of 1977/78, and the Kenya Contraceptive Survey of 1984. The third phase represents the entry of the Kenya Demographic and Health Surveys (KDHS): these are backed up by population censuses conducted decennially, the most recent of which were the 1989 and 1999 censuses of Population and Housing.

Six datasets were used in this dissertation - the 1977/78 Kenya Fertility Survey (KFS), the four Kenya Demographic and Health Surveys (KDHS) that were carried out in 1988/89, 1993, 1998, and 2003 respectively, and the Kenya Service Provision Assessment (KSPA) conducted in 1999. The process and methodology of the surveys are comprehensively addressed elsewhere (CBS 1980; NCPD 1989; NCPD 1994 ; NCPD 1999; MOH 2000; CBS et al. 2004). The purpose of this section is to highlight sampling issues in these surveys that might have a bearing on the various estimates used in later sections of the dissertation. Accordingly, in this sub-section, five aspects which are important in sampling design are addressed. These are the survey objectives, frame construction, stratification, weighting, and sampling errors.

3.1.2 Objectives of the Surveys

An examination of the objectives of the five surveys reveals a common thread running through all of them - the need to provide sound data for policy design and program implementation. Nevertheless, population concerns specific to each survey are also apparent from the survey objectives. Thus, in the first survey, the 1977/78 KFS, the concern was high population growth which was related to falling mortality and high fertility. As a result, the objective of the 1977/78

KFS survey was to investigate community and individual factors related to fertility in order to provide sound information for policy purposes. This focus on providing information on fertility has been the characteristic of this and subsequent surveys. Nevertheless, as the socio-economic circumstances changed and new research issues arose, survey objectives were expanded. For example in the 1988/89 and 1993 surveys an additional objective was the provision of data that would enable assessment of the effectiveness of the family planning program. In the 1998 and 2003 surveys on the other hand, estimation of HIV prevalence, female circumcision, and gender violence were new objectives that were added to the core objective of providing data on fertility and its determinants.

3.1.3 The Sampling Frame

It is useful to examine the sampling frame for the surveys to determine if there were important changes in the lists from one survey to the next, which might render comparison difficult. As indicated in the previous sub-section, the selection of the sample for each of the five surveys was based on the respective survey objectives. This selection yielded sample sizes that ranged between 7,500 and 8,100 interviewed women of reproductive age for each survey, details of which are in Table VII at the beginning of chapter four. Nevertheless, before the selection of the sample, the universe of the population from which the sample was selected had to be established. This was done through a program for the national sampling frame, known as the National Integrated Sample Survey (NISP) for the 1977/78 KFS survey, and the National Sample Survey and Evaluation Program (NASSEP) thereafter. The sampling frames were developed from the census enumeration areas (EAs) or administrative locations used in the 1969, 1979, 1989, and 1999 censuses. It is to be noted that in the first four surveys, this frame excluded the whole of North Eastern province, the districts of Marsabit and Isiolo in Eastern Province; Samburu and Turkana in the Rift Valley province. Although these regions are large in area, they contain only between four and five percent of Kenya's population. For the first time however, in the 2003 survey, the sample frame consisted of the whole country, including the above regions which had been omitted in earlier surveys. This has practical applications to this study: these regions, which were excluded in previous surveys, are also excluded in the analysis of data for this dissertation, this decision being made to make comparisons easier.

A second aspect to the changing population universe from which the samples were drawn that merits to be highlighted is the issue of urban areas. To the extent that the definition of the minimum population that constitutes an urban area, as well as the geographical boundaries of urban and surrounding rural areas have been changing from the time of one survey to the next, interpretation of results will take cognizance of this evolving idea of the urban area. Secondly, with the purpose of bringing better representation to the variety in the urban area, and the phenomenon of urban slums in particular that has increasingly become important in Kenya's major cities and Nairobi in particular, the 2003 KDHS added more urban slums as urban sub-strata in Nairobi. This could lead to higher fertility estimates for the 2003 survey relative to the previous ones. To what extent this renders comparison across surveys is not clear; this development will be borne in mind during the analysis and interpretation of findings.

3.1.4 Sample Stratification

Another important and relevant stage in the design and implementation of the surveys was stratification. The four KDHS surveys used a two-stage sample design which was first stratified by urban and rural residence. Within the rural strata (rural parts of the provinces), there was further sub-stratification by district. In general, the same procedure was followed in the KFS survey: the rural stratum was stratified by province and crop zones, while the urban sample on the other hand was stratified by economic zones which were homogenous in terms of household income levels. With this stratification strategy in the urban areas, the six largest towns (Nairobi, Mombasa, Kisumu, Eldoret, Thika, and Nakuru) were selected, in the 1977/78 KFS survey, into the sample with certainty; the rest of the urban centres selected being grouped as other urban.

As early as 1977/78, the time of the KFS survey, migration and multi-unit dwellings were already identified as factors affecting response rates (CBS 1980). These have continued into the sampling of KDHS surveys, and were addressed first by inflating the expected sample sizes to take into account the possibility of non-response from such vacant and changing dwellings. Secondly, as explained below, weighting of the samples to take into account the varying probabilities of selection (due to non-response at the household and individual interview levels) was undertaken for each survey.

The actual processes involved in the selection of the sample – and strata in particular - for the 1993 KDHS are illustrative of those for the rest of this group of surveys. In the first stage, the 1989 census enumeration areas (EAs) were selected with probability proportional to size (PPS) (NCPD 1994). The EAs were then segmented (divided) into standard-sized clusters, and one was chosen at random to be the NASSEP cluster. This process yielded a sampling frame or universe of 1,048 rural and 328 urban clusters, from which 536 clusters were chosen: 444 rural and 92 urban. These were then mapped and listed by Central Bureau of Statistics (CBS) staff a few months before the interviews. The household listing yielded a systematic sample of 22 households in urban clusters and 17 in the rural; all women aged 15 to 49 years found in each of the selected households were then to be interviewed.

3.1.5 Sample Weights

Different probabilities of selection were applied in the different stages of the five surveys: none of the five surveys is therefore self-weighting at the national level. In the 1977/78 KFS survey, due to discrepancies in sampling in the urban areas, particularly Nairobi where migration and unexpected multiple dwellings emerged as issues, the urban sub-sample is similarly not self-weighting. Similarly, in three of the four KDHS surveys, (the 1988/89, 1993, and 1998 KDHS), it was decided to over-sample in 13 priority districts. Consequently, sample weights were used to compensate for unequal probabilities of selection between strata. Nevertheless, reliable estimates can be obtained for each of the eight provinces, as well as for urban and rural areas. For the priority districts however, only some estimates can be obtained, for example the contraceptive prevalence rate.

The weights used to compensate for unequal probabilities of selection at the different stages of sampling are to a large extent a product of the response rates at the levels of the household interview and the individual woman's interview. An indication that the weights applied do not result in errors is provided by the high response rates at the level of the individual woman's interview. While the response rate for the 1977/78 survey was 88.9%, for the four KDHS surveys it was much higher, rising to 96.3% for the 1988/89 KDHS survey, 94.8% in 1993, 96% in 1998, and 94% in 2003. Thus, the samples cannot be said to be too biased by selective non-response (CBS et al. 2004).

3.1.6 Variability of Sample Estimates of Population Parameters

An idea of the quality of the surveys is also provided by the sampling errors – more precisely the standard errors within which the true values of the population parameter lie (CBS et al. 2004). In the 1977/78 KFS and the four KDHS reports, sampling errors are provided for most of the variables covered in the data collection process. Here however, they are presented for only some of the main indictors. Thus, for the 1977/78 KFS survey, the sampling error for children ever born (CEB) for the three years before the survey is 0.05. Another important variable for this dissertation is contraceptive prevalence: for the 1988/89 KDHS, the sampling error for current contraceptive use among married women aged 15 to 49 years is 0.01 (NCPD 1989).

From an examination of sampling errors for variables in the five surveys, it is apparent that the magnitude of sampling errors at the national level is not big. The size of the errors however increases as estimates for sub-populations, e.g. the province and district levels, are considered. The 1977/78 KFS and four KDHS surveys are not simple random samples, but rather relied on complex (multi-stage) sample designs. Consequently, the Taylor linearization method - which is based on the Taylor series approximation - is used to calculate sampling errors for survey estimates that are means or proportions. For more complex statistics however, such as the total fertility rate, the jackknife balanced replication method - which involves repeating the estimation procedure using all but one cluster at a time - is used (CBS et al. 2004).

The relative standard error - which is defined as the standard error divided by the estimate - is useful in that it gives an idea of the size of the standard error in comparison to the sample statistic that is being estimated. For example, for the 1998 KDHS, the relative standard errors range from a low of 0.2% to a high of 22.5%, with an average of 4.2%. The relative standard error for the total fertility rate (TFR) is small, at 2.3% of the value of the estimated sample statistic (NCPD 1999). The highest relative standard error is for estimates of very low values – if these were excluded from the calculations, the relative standard error would even be smaller - 2.4%. Hence in general, relative standard errors (particularly at the national level) are low, except for estimates of rare occurrences.

3.2 Possible Changes in Sample Composition between Surveys

3.2.1 Confirming the Fertility Decline in sub-Saharan Africa

While questioning whether the statistical results on the onset of the fertility transition in Zimbabwe and Botswana in the 1980s were genuine or not, fundamental issues touching on the design of the DHS surveys were raised, which have direct implications to the Kenyan DHS data and this dissertation in particular. It is therefore useful to devote some space to the issues raised and discussed. Following the onset of the fertility transition in several countries in Southern Africa, one of the questions raised was whether the successive sample surveys on which they are based were drawn from the same population or emanated from different populations. In a comparison of the Zimbabwe and Botswana CPS and DHS Surveys conducted in 1984 and 1988 respectively - with frequent reference to the emerging fertility trends in Kenya as well - studies (Blanc and Rutstein 1994; Thomas and Muvandi 1994a; Thomas and Muvandi 1994b) this question is examined.

The publication of the Contraceptive Prevalence Surveys (CPS) and Demographic and Health Surveys (DHS) for Zimbabwe and Botswana in 1984 and 1988 respectively indicated the start of the fertility transition; this motivated interest to have another look at the data. Some results of this supplementary examination of the surveys showed that the declines in aggregate fertility rates were due to differences in sample composition, with the cohort of women in the second survey appearing to be better educated than the same group in the first survey (Thomas and Muvandi 1994a). It is reported that this explains part of the observed fall in fertility, accounting for up to half the fertility decline among women aged 25 to 34 years in Zimbabwe. A subsequent publication (Thomas and Muvandi 1994b) re-iterates this observation, arguing that part of the observed decline in the number of children ever born can be attributed to differences in sample composition between the surveys in Zimbabwe and Botswana conducted in 1984 and 1988 respectively. The differences in educational levels are also re-asserted.

In response to this criticism of the CPS and DHS surveys conducted in sub-Saharan Africa and the evidence for the fertility transition, a spirited defence of the conduct of the CPS and DHS surveys has been made (Blanc and Rutstein 1994). Defenders of the surveys conclude that the fertility declines in three countries - Kenya, Zimbabwe and Botswana - are unequivocal,

particularly given that the declines have been accompanied by corresponding increases in contraceptive prevalence.

Two points emerging from the defence of the results of the two sets of surveys are worth highlighting. First, to conclude that the samples represent draws from different populations, and in particular that in the second sample women are more educated than those in the first is erroneous. This is because tests for differences in the distributions were apparently significant in only one age group, and only in one country. The methods used for testing for the contribution of differences in education to differences in the samples are also inappropriate (Blanc and Rutstein 1994). The second point to be retained from the debates is that in seeking to compare the different sample surveys, it is easy to confuse between age, period, and cohort effects; the most appropriate way to examine declines in period fertility is to examine period fertility rates. When this is done through standardization of the total fertility rates (TFRs) by the education distributions of the 1988 and 1984 surveys, the results show only minor reductions in fertility (Blanc and Rutstein 1994). Thus, a conclusion to be drawn is that the supposed difference between the samples of the 1984 CPS and 1988 DHS surveys in the two countries has not resulted in an important overstatement of the fertility decline. Independently, results from the subsequent DHS surveys conducted in the three countries in the leading edge of the African fertility transition (Zimbabwe, Botswana, and Kenya) – which indeed have shown consistent fertility declines - confirm the conclusion.

3.2.2 Changes in Education as Possible Correlates of the Fertility Transition

The Wording of Questions on Education

The proximate determinants of fertility aside, education and fertility are related: greater public investment in social development, and in the education sector in particular, is expected to lead to reductions in fertility (Thomas and Muvandi 1994a). However, a question that arises is, “is the reported decline in fertility in line with real changes in education?” To respond to this question, three aspects related to the changes in education are examined: the wording of questions on education in each of the five surveys, the changes in the educational system, and the evolution of educational achievements among women over the five surveys.

In the five surveys, education was captured by two questions that asked about the level of education attained, and the number of years spent in formal school. In this dissertation, analysis of education is carried using the level of education and also years; the main interest is therefore to examine how the level has changed over the different surveys. As can be observed in Table I below, except for very minor alterations, the wording of the questions on education is similar in the KFS and four KDHS surveys. The five datasets are therefore comparable with regard to questions on education.

Table I: Wording of Questions on Education in the KFS and KDHS Surveys

	Wording of Question
Year of Survey	
1977/78	What was the highest level of school you attended – primary, secondary, or university? What was the highest (standard, form, years) you completed at that level?
1988/89	What was the highest level of school that you attended: primary, secondary, **higher** or university? What was the highest (standard, form, year) you completed at that level?
1993	What is the highest level of school that you attended: primary, secondary, or university? What is the highest (standard/form/year) you completed at that level?
1998	What is the highest level of school that you attended: primary, secondary or **higher**? What is the highest (standard/form/year) you completed at that level?
2003	What is the highest level of school you attended: primary, **vocational**, secondary, or higher? What is the highest (standard/form/year) you completed at that level?

Sources: (CBS 1980; NCPD 1989; NCPD 1994 ; NCPD 1999; CBS et al. 2004)

Note: The (minor) differences in the wording of questions are in bold.

Evolution of the System of Education in Kenya

The organization of the system of education has changed over time in Kenya. Prior to 1985, it consisted of seven years of primary education, four of ordinary-level secondary education, two of advanced-level secondary education, and three for the first degree at university (7-4-2-3). Beginning in 1985 however, the system changed to eight years of primary, four of secondary, and four for the first degree at the university (8-4-4). In addition, pre-primary education takes about three years in the urban areas, with the entry age into primary school being six years. This means that the surveys conduced after 1985 captured respondents who studied both under the old and new systems. If the analysis is conducted with years of schooling, then it is possible that some respondents would not end up completely within a distinct category of education; the example below clarifies. A respondent with eight years of schooling under the old system would fall under the beginning of secondary education. However, in the new system, this would be categorised as having completed primary school. Using level of education, rather than years of schooling however, this problem is avoided. Thus, having attained primary school education remains the same, whether under the old system (seven years) or the new one (eight years).

Changes in Educational Attainment among Women

If the sampling design, and indeed other aspects of the survey process, is not conducted well, then it is possible that survey results – for specific variables- can indicate changes that may not be real. One such variable examined here (Table II) is the educational attainment of women, education being an important indicator of social change (CBS 1980). The results show that there has been a steady increase in the educational attainment among women in Kenya. This is despite some minor setbacks, for example between 1991 and 1993, when the proportion of females aged 15 to 19 years who had primary education declined from 56% to 40%; this trend is consistent with the disinvestment in education which took place during this time of reduced economic performance (NCPD 1999).

The proportion of women aged 15 to 49 years with no education has decreased in Kenya from 44.2% in 1977/78 to 12.7% in 2003. Likewise, the percentage of women with some primary education has risen over the years, from 45.8% in 1977/78 to 58% in 2003. Similarly, the percentage with at least secondary education has been on the increase: from 10% at the time of

the 1977/78 KFS survey to 29.4% by 2003. Since they show a clear and expected trend over the years, it is hard to imagine that these changes are the result merely of differences in the sampling design. Rather, it is persuading to consider them as genuine changes that reflect the effect of Government and other stakeholder interventions in the sector.

Table II: Distribution of Women by Educational Level, Kenya 1977 - 2003

	Weighted Percent		
Level of Education	None	Primary	Secondary+
Name/Time of Survey			
KFS 1977/78	44.2	45.8	9.8
KDHS 1988/89	25.1	54.4	20.4
KDHS 1993	17.9	57.6	24.5
KDHS 1998	11.5	59.2	29.2
KDHS 2003	12.7	58.0	29.4

Sources: (CBS 1980; NCPD 1989; NCPD 1994 ; NCPD 1999; CBS et al. 2004). Note: Some percentages may not add up exactly to 100 due to missing cases or rounding error.

3.3 Comparability of Questions in the Five Surveys

3.3.1 Variables Considered

It has been argued that differences in the wording of questions in DHS surveys – in particular the questions on education - might in a substantial way in turn influence the observed measures for the fertility transition (Blanc and Rutstein 1994; Thomas and Muvandi 1994a; Thomas and Muvandi 1994b). In this sub-section, a number of crucial variables are in turn examined to determine whether their wording changed over the surveys, and if so, what implication this has for the analysis to be carried out in this dissertation. The variables examined are fertility intentions, ideal family size, and contraceptive use. In addition, the implications of changes regarding the reference period for births that took place in the recent past are examined.

3.3.2 Fertility Intentions

Several questions are used to measure fertility demand and preferences in surveys. Among these, questions on fertility intentions on future childbearing are considered to be comparatively unbiased (Bongaarts 1990); they are examined here for variations in wording over the five surveys. As can be seen in Table III below, first, it is useful to note that questions on future fertility intentions may be grouped into whether the woman is currently pregnant or not. Secondly, the possible responses are categorized into wanting another child (yes), not wanting any more children (no), and undecided. There is a fourth category for fertility intentions: women who report that they want more children are asked in a follow-up question (not shown in Table III) how soon they want the next child. From the response to this follow-up question, the categories of wanting soon and wanting after at least two years are developed to replace the "yes" category above. The examination of these questions reveals that they are similar and therefore comparable across the surveys.

Table III: Questions on Fertility Intentions in the KFS and KDHS Surveys

Name/Year	Wording of Question on Fertility Intentions
KFS 1977/78	Pregnant: Do you intend to have another child sometime, in addition to the one that you are expecting? (yes, no, undecided) No live births: Do you want to have any children? (yes, no, undecided) One or more live birth: Do you want to have another child sometime? (yes, no, undecided)
KDHS 1988/89	Not pregnant or unsure: Would you like to have a (another) child or would you prefer not to have any (more) children? Pregnant: After the child you are expecting, would you like to have another child or would you prefer not to have any (more) children? Choices: have another, no more, says she can't get pregnant, undecided or don't know
KDHS 1993	Not pregnant or unsure: Now I have some questions about the future. Would you like to have (a/another) child, or would you prefer not to have any (more) children? Pregnant: Now I have some questions about the future. After the child you are expecting now, would you like to have another child, or would you prefer not to have any more children? Choices: have (a/another) child, no more/none, says she cannot get pregnant, undecided/don't know

Sources: (CBS 1980; NCPD 1989; NCPD 1994 ; NCPD 1999; CBS et al. 2004)

Note: Since the corresponding questions in the KDHS 1998 and 2003 surveys are similar to those for the 1993 survey, they are not presented here.

3.3.3 Ideal Family Size

Ideal family size constitutes another variable of importance to this dissertation, and wording of questions that sought to collect information on this variable is shown in Table IV below. In the

KDHS surveys, the questions are initially posed by first considering whether the woman has living children, or no children; in the 1977/78 this is not the case. Questions on future fertility preferences are then posed based on this categorization. The majority of the questions, those in the KDHS surveys, are therefore similar, thereby easing comparison in the analysis to be performed.

Table IV: Questions on Ideal Family Size in the KFS and KDHS Surveys

	Wording of Question
Name/Year	
KFS 1977/78	If you could choose exactly the number of children to have in your whole life, how many would that be?
KDHS 1988/89	No living children: If you could choose the number of children to have in your whole life, how many would that be? Has living children: If you could go back to the time when you did not have any children and could choose exactly the number of children to have in your whole life, how many would that be?

Sources: (CBS 1980; NCPD 1989; NCPD 1994 ; NCPD 1999; CBS et al. 2004)

Note: The wording of the questions in the 1993, 1998, and 2003 surveys is similar to that in KDHS 1988/89, hence their exclusion from the table.

3.3.4 Contraceptive Methods

As with the other two variables above, the 1977/78 KFS and the four KDHS surveys pose specific questions on knowledge and use of modern and traditional methods of family planning; this is done through an elaborate "contraceptive table". An examination of the tables for each of the five surveys shows that it has changed little over the surveys, with questions on basically similar methods being asked. Among the modern contraceptive methods on which questions are posed, these include: the pill, IUD, female sterilization, male sterilization, injection, and the (male) condom. The traditional methods include the rhythm (natural family planning) method, and withdrawal. As new (modern) methods became available however (e.g. norplant as from the 1993 survey, and emergency contraception as well as the female condom in the 2003 survey),

they are included in the table. Similarly, old methods which were phased out, e.g. diaphragm, foam and jelly, although appearing in the first four surveys, are not included in the most recent survey, the 2003 KDHS. Thus, as with the other variables presented above, the variable, contraceptive method currently used, is comparable across the surveys.

3.3.5 Reference Period for Estimation of Fertility

The changing reference period for births that took place in the recent years preceding the survey is another pertinent issue. In the four Kenya DHS surveys considered here, unlike in the KFS, women were asked to provide additional information on all their recent births. Nevertheless, even between the four KDHS surveys differences exist on the length of this reference period. While this information was required for all births in the last five years in the 1988/89, 1993, and 2003 surveys, the time was reduced to three years in the 1998 survey. There is evidence that in the case of the 1988/89 KDHS, births which took place five years before the survey were pushed back to at least six years by interviewers, presumably to reduce the workload of filling out the health section of the questionnaire for children (NCPD 1989); a similar practice may be true for the other three surveys for which the reference period of recent births was five years. Likewise, it is expected that births which occurred three years before the 1998 survey may have been pushed further back. This problem is compounded where age misstatement is pronounced and dating of events is not accurate; fertility estimates derived using these reference periods may therefore be biased (Thomas and Muvandi 1994a; Rutstein and Rojas 2003). To circumvent this problem, in this dissertation, the period of analysis for recent births is taken as four years.

3.4 Assessment of Data Quality

3.4.1 Overview of Issues in Data Quality

In this section, the question of data quality is addressed at three levels. First, at the level of the household interviews, the population age structure of women is developed, and results compared to those from a census conducted near the time of the survey. Secondly, for data at the level of the individual woman, the problem of age heaping is examined in greater detail. Thirdly, data quality is evaluated at the level of births to the individual woman interviewed. This review

consists of examining possible errors in the reporting of date of birth, age, and age at death of the child - where the child has died.

As far as data quality as a whole is concerned, a number of errors are present in the reporting of demographic data that can bias fertility and nuptiality estimates. These comprise errors in the mis-reporting of the age of the mother, omission of births, mis-allocation of the date of birth of the child, migration, and truncation. These issues are exhaustively reviewed elsewhere, (Henin et al. 1982; United-Nations 1983 ; Goldman et al. 1985; Brass and Jolly 1993). This sub-section provides, upfront, an idea of how some of the problems in data quality – and in particular those related to fertility measures - are dealt with in this dissertation. First, as in studies conducted in the past (Blanc and Rutstein 1994; Pullum 2006) the accuracy of period fertility estimates in a current survey is assessed based on those for the next survey. Secondly, cohort fertility rates are developed to supplement period measures. Thirdly, to mitigate bias in measuring age at first birth and at first marriage (Westoff 1992; van de Walle 1993; LeGrand and Zourkaleini 2006), analysis of the two variables will be confined to the more recent past - women aged between 15 and 24 years. The presentation of issues in data quality now follows.

3.4.2 Age Composition of the Household Population

The 1977/78 Survey - Comparison of the Household and Model Populations

One of the methods for assessing the quality of demographic survey data on age consists of comparing the observed population structure with that from a model population (CBS 1980); the model population being developed using the Brass logit system. The other is to compare the age structure of the household population from a survey to that from a census. The former method has been applied to the 1977/78 KFS data: the results, which are summarised below, point to two areas in which this model population structure differs from that for the observed survey population.

First, in the 1977/78 KFS survey, there is a tendency for overstatement of young children's ages. This is shown by the relatively smaller population of children aged less than five years as compared to those aged five to nine years. Secondly, unlike in the model population, there is a pronounced bulge of girls aged 10 to 14 years relative to those aged between 15 to 19 years in

the observed sample population. This may be an indication that interviewers in the KFS survey tried to lessen their workloads by transferring some women who were 15 or more years old to the pre-reproductive age group of 10 to 14. This could have implications for fertility and nuptiality estimates. If this underestimation of age was selective (i.e. women who have children and those who are married were selectively misplaced in terms of age), then survey estimates of fertility and nuptiality may be inflated for the age-group 15 to 19 years. However, this hypothesis seems to be unfounded, as comparison of the proportions married and the mean number of children ever born for the cohorts aged 15 to 19 years shows that they are similar, implying that results from the KFS survey are not biased.

Secondly, the proportion of women aged 40 to 49 years is less than that aged 50 to 59. This, again, may imply that interviewers reduce the numbers of women in this boundary age-group in order to lessen their work. In an attempt to circumvent this problem, the age limit for the KFS interviews was raised to 50 years. However, this apparently did not solve the problem; instead age heaping persists, taking place at age 51 for women but remaining at 50 for men. Shifting of women out of the reproductive age (particularly those in the borderline ages approaching 49 years) also persists: it now occurs at between ages 51 and 55.

Thirdly, in the KFS household age structure, the proportion of women aged 25 to 29 years is higher than that aged 30 to 34 years. This may imply that the ages of women may have been moved in from both directions of age group 25 to 29. As explained in the next sub-section, this inflation of the age group 25-29 years is mainly caused by severe age heaping at age 25. In spite of this observation, it is concluded that no serious age distortion has taken place (CBS 1980).

1977/78 Survey - Household Population by Single Years of Age

Additional information on the quality of age reporting for the de facto household populations enumerated in the 1977/78 KFS surveys is obtained by examining age heaping, and more precisely digital preference, by single years. The results show that there is substantial heaping at ages that end with 0 and 5, and to a lesser degree at ages that end with 2, 4, and 8 (CBS 1980); the heaping being less pronounced among the female household population, but emphasized in the male population. That heaping is less pronounced among females possibly shows that more

probing of the ages of female respondents paid off. Thus, in the distribution of the female household population by single years of age, severe age heaping is noted for age 25 and to some extent age 20 among the female population; distortions at the beginning of childbearing (age 15) and end of childbearing (age 50) are equally visible.

Comparison of Female Household Populations in the Five Surveys

The distributions of the de facto populations in the five surveys and those for related censuses are shown in Table V below. An examination of the distribution for the age groups 10-14 and 15-19 shows the expected discrepancies in the distribution for the sample surveys. Thus, while the distribution from age 10-14 to 15-19 is more gradual in the population censuses, it is more abrupt - and the difference much bigger - for the sample surveys. A similar observation, this time more obvious, can be made about age groups 44-49 and 50-54. In the 1977/78 survey results, the populations aged 45-49 and 50-54 are respectively estimated at 3.0% and 2.9% of the total (column one). This is as expected, and follows the usual pyramidal pattern of age distributions for developing countries; the same trend can be observed for the 1979 census results for the same age groups in the adjoining column three.

For the each of the KDHS surveys however (columns four, five, seven, and eight in Table V) the distribution of the estimated percentage of women aged 45 to 49 and 50 to 54 respectively shows a reverse trend: the percentage of women aged 50-54 is higher than that 45-49. This is unlike the corresponding results for the 1989 and 1999 census results. It is therefore apparent that in the KDHS surveys, a transfer of women occurred - as in age group 15-19 - from age group 45-49 to 50-54. In order to address this issue in the dissertation, in some of the analyses (especially in chapter four which addresses the trend patterns in the fertility transition) the age groups are amalgamated into bigger age sets.

Table V: Distribution of Female Household Population (%), Kenya 1977- 2003

Comparison Base:	**1979 Census**		**1989 Census**			**1999 Census**		
Survey	KFS 1977/78	1979 Census	KDHS 1988/89	KDHS 1993	1989 Census	KDHS 1998	KDHS 2003	1999 Census
Age								
0-4	19.7	18.4	17.6	15.2	17.4	13.9	15.7	15.0
5-9	17.3	16.1	17.7	17.4	16.1	14.5	14.0	13.6
10-14	15.4	13.3	17.4	15.8	13.8	15.8	13.6	13.8
15-19	9.0	11.5	7.8	9.4	11.2	10.4	10.5	11.9
20-24	6.7	8.9	6.7	8.7	9.4	8.6	9.5	10.5
25-29	7.0	7.0	6.8	6.8	7.9	7.7	7.8	8.5
30-34	4.7	5.4	5.0	5.6	5.3	5.4	6.2	5.9
35-39	4.3	4.2	4.4	4.1	4.2	5.6	4.9	5.1
40-44	2.9	3.6	3.4	3.4	3.4	3.7	4.4	3.6
45-49	3.0	2.9	2.2	2.2	2.7	2.7	2.9	2.9
50-54	2.9	2.5	3.8	3.6	2.2	3.4	3.1	2.4

Sources: (CBS 1980; NCPD 1989; NCPD 1994 ; NCPD 1999; CBS et al. 2004)

Note: The interest here is on the reporting of the female population of reproductive age, as well as on children (under 5 years). Consequently, the female population aged 55 years and above has been excluded from the table.

For the four KDHS surveys, further evaluation of data quality is provided by examining age heaping and digital preference. The results of this analysis for the 1988/89 KDHS survey are presented here as an illustration, and show that there is a tendency to report age that ends in preferred digits of 0 and 5 (age heaping). A measure of age heaping, Whipple's index, was estimated for the survey and related censuses. The index is constructed within the range 100 to 500: the minimum of 100 implies no preference for ages ending with 0 or 5 while the maximum 500 indicates that all ages end in either 0 or 5. Thus, Whipple's index was estimated at 134 for males and lower (at 121) among females. Although there was slightly more age heaping in the 1988/89 KDHS than in the 1984 Kenya Contraceptive Prevalence Survey (KCPS), this index was however lower than that from the 1962, 1969, and 1979 censuses. This may be due to the fact that surveys are much smaller operations than censuses and therefore more controllable (NCPD 1989). Similarly, the index for women is lower than for men.

3.4.3 Quality of Data from Individual Interviews of Women

Woman's Date of Birth and Age

Results from the 1977/78 KFS survey, on data quality at the level of eligible women interviewed, serve as an example of the issues on age reporting that traverse the five surveys. In this regard, three variables provide a basis for evaluating the quality of reporting on age and date of birth: the woman's age in completed years, year of birth, and month of birth.

Information on the age of women aged 15 to 49 is collected at two levels: during the household interview and the during the individual woman's interview. Consequently, the age distribution of individual respondents should be similar to that in the population of women aged 15 to 49 at the household level. The justification of separately examining age reporting at this level is that additional information collected in the individual interviews, together with background characteristics, gives us further insights into the nature of this age mis-reporting. In particular, in the five surveys, interviewers were requested to state whether the respondent was able to provide her date of birth or age, or alternatively, this information had to be obtained by probing. For the 1977/78 KFS survey, the results indicate that 68% of the women were able to state their year of birth or age; the remaining cases being estimated (CBS 1980).

Knowledge of age was better among younger women, and the tabulation of age heaping by age shows that it is more problematic among those who did not know their date of birth or age than those who did know it. The results also show that the ability to state an age is linked to the degree of age heaping; the proportion of women in various sub-classes of the samples are an indicator of the relative quality of age data. In addition, they show that the extent of formal education is a major factor determining knowledge of age. As educational status increases, the percentage of women whose age had to be estimated falls; although this is exaggerated by the fact that younger women are more educated. Quality of age reporting is also likely to be worse in rural as compared to urban areas.

Cumulative Fertility

Assessing the pattern of cumulative fertility and marital status is another method for checking the quality of data on age. It helps to detect erratic fluctuations that could be indicative of age

misreporting. Unexpected increases in the number of children ever born or proportion ever-married (at the critical ages of 19 to 20 and 29 to 30) could indicate selective age errors. Nevertheless, examination of the 1977/78 data does not show signs of such errors (CBS 1980).

Fertility Estimates from Successive Surveys

A major objective of the KFS and KDHS surveys is to provide fertility estimates, and in this regard, estimates of age specific fertility rates (ASFRs) and the total fertility rates (TFR) are generated from each survey. Nevertheless these are often subject to errors due to mis-reporting of the age of the woman, omission of children from the birth history table, or dates of birth of children are moved systematically (Pullum 2006). In addition to the data quality assessments presented above, a good way to evaluate this mis-reporting is to re-estimate these rates from a subsequent survey and compare the result with estimates calculated from the previous survey. This comparison is undertaken in the next chapter - on trend patterns in fertility and its proximate determinants.

In applying this method however, particular attention will be paid to the uneven intervals between the surveys, more so the interval between the 1977/78 KFS and 1988/89 KDHS. Unlike the uniform five-year interval commonly used in the classification of age groups, the interval between one survey and the next is not always five years. For example, the period between the KFS and the first KDHS survey is about 11 years. Care will therefore be exercised in chapter four that, in validating fertility estimates for one survey period based on those for the next survey, that in this back-dating the dates match (Croft 1991; Brass and Jolly 1993; Rutstein and Rojas 2003).

Age at First Marriage

Apart from the respondent's date of birth, the other important date provided in the woman's questionnaire in the surveys is the date of first union or marriage (Pullum 2006). During the interviews, the age at first marriage is imputed if the respondent provides the year of first marriage; if not she is requested for her age at the time of her first marriage. The response (either given by the respondent or estimated by the interviewer) is based on year of marriage, years ago, or age at marriage. An analysis of DHS data to determine the extent of age heaping and digital preference was conducted (Pullum 2006), but the Kenya data are not highlighted as having

serious problems of age heaping and digital preference for age at first marriage. Further insights into the quality of data on age at first marriage are provided by the KDHS surveys (NCPD 1994 ; NCPD 1999; CBS et al. 2004). For the 1993 KDHS survey, only 2.6% of ever-married women of reproductive age had missing information on the date or age at first union. The corresponding percentages for the 1998 and 2003 surveys, which show an improvement in the completeness of data on this variable, were 0.5% and 0.1% respectively. In chapter four of this dissertation, the quality of data on age at first marriage and on age at first birth is further examined for accuracy.

3.4.4 Completeness of Data Based on Birth Histories

Date of Birth and Age of Children

Incompleteness of data in the birth history tables can bias certain demographic measures of relevance to this dissertation. Two particular variables that can be a source of error - and which are examined in this sub-section - are the date of birth and age of the child, as well as the age at death (for a child who has passed away).

One method by which the quality of data from the birth history table was assessed is by estimating completeness of information about the date of birth of the child and the amount of imputation required; incompleteness being defined as the case in which the date of birth of the child and the age at birth are missing (Pullum 2006). A threshold level of 20%, i.e. this or higher percentage of births being incomplete is similarly proposed. For most of the KDHS surveys, results of this evaluation of data quality indicate that incompleteness is not too serious and does not exceed the threshold level (NCPD 1994 ; NCPD 1999; CBS et al. 2004). As can be seen in Table VI, less than 9% of the children had a missing month of birth. The case for both month and year of birth is even stronger: for the three surveys indicated below, the month and year of birth is missing for 0.3% or less of the births.

Table VI: Percent Observations Missing Information on Births and Child Deaths, Kenya 1993-2003

Type of Event	**Birth Date**		**Child's Age at Death**
Information	Month only	Month/Year	
Survey Year			
1993	8.3	0.3	0.5
1998	2.1	0.1	0.3
2003	4.6	0.2	0.3

Source: (CBS 1980; NCPD 1989; NCPD 1994 ; NCPD 1999; CBS et al. 2004)

Notes: Estimates were not readily available for the KFS 1977/78 and KDHS 1988/89 surveys. Estimates for the percentages of missing dates of birth refer to births occurring within 15 years before the survey. For child deaths, the percentages refer to children who passed away within 15 years preceding the survey.

Implications for Accuracy of the Preceding Birth Interval

Birth intervals are an important focus in this study, and an additional view on the accuracy of dates of birth is provided by an examination of the previous birth interval. Most birth intervals are five or less years in length; similarly few are less than a year in length because of the gestation period of nine months and postpartum amenorrhea. Modification of Myers Index of age heaping to multiples of six months (for durations of birth intervals of up to 59 months) constitutes one way of assessing the quality of estimated birth intervals. Such an analysis has been conducted on DHS survey data world-wide including those from sub-Saharan Africa (Pullum 2006), with a critical level of 10% or higher irregularities in the Myers Index being considered as a serious case of heaping at intervals of six months. The results of this analysis do not indicate the presence of heaping of birth intervals in the Kenyan data.

Quality of Data on Age at Death of Child

Child survival is a variable of interest in this dissertation; the quality of data on children who passed away is therefore presented here. Data on child mortality are based on the birth history module of the woman's questionnaire. Starting with questions on the general childbearing experience of women interviewed (including the number of children who have passed away), detailed information is next collected on each of the births. This information includes whether the child is alive, the current age of the child, and for a child who passed away, the age at death. One of the observations made with regard to data quality in DHS surveys as a whole is that there

is a tendency for the ages (at death) to be heaped at intervals of six months, and twelve months in particular. This can lead to underestimation of the infant mortality rate and overestimation of the child mortality rate (Pullum 2006). However, it does not appear to be a problem in the Kenyan data.

The quality of child mortality estimates very much depends on the completeness with which births and deaths are not only reported, but equally noted during the process of the interview. The data on age at death of the child (Table VI) are as whole complete, 5% or less cases being incomplete. Where there are problems of completeness, the most serious relates to the selective omission, from the birth history table, of births that did not survive; this leads to underestimation of mortality rates. The occurrence of selective omission of childhood deaths is most severe for deaths during early childhood. In particular, when early neonatal deaths are underreported, there results a very low ratio of deaths under one week as compared to all neonatal deaths; also the ratio of neonatal to infant deaths becomes unusually low. Problems of reporting of infant deaths are also more severe for births that took place further back before the survey period. The quality of data on child deaths has been examined in the 1977/78 KFS and four KDHS surveys, and it does not appear that (early) infant deaths were severely underreported (CBS 1980; NCPD 1989; NCPD 1994 ; NCPD 1999; CBS et al. 2004).

Lastly, the assumption being made by basing the estimation of childhood mortality on reports from mothers (birth history table) about child survivorship will not be lost to mind. In developing estimates this way, it is taken that adult female mortality is not very high. Where this assumption is violated (maternal mortality is high and related to the child's risk of death), then the resulting childhood mortality will be underestimated (NCPD 1999).

3.5 Level of Analysis

A question that had to be addressed early during the dissertation was the sub-national level at which analysis would be carried out. The decision-process started with a consideration of the country's administrative set-up. Kenya is divided into seven rural provinces and the eighth, the capital city of Nairobi. Each of the seven provinces can be considered to be largely internally homogeneous, but between them heterogeneous, in terms of culture, level of development, and

ecological factors (Mosley et al. 1982; Anderton and Sellers 1989). The urban areas comprise, first the two primate cities of Nairobi and Mombasa, and secondly the smaller towns, the majority of these comprising provincial and district headquarters.

The provincial rather than district level was chosen as the unit for grouping regions. This is because most national sample surveys provide reliable estimates up to the province. When this sub-national and regional grouping was considered, the contrasts between rural Central Province and the rest of rural Kenya on the one hand, and Nairobi city and the Other Urban areas on the other became clear at once. The following four sub-national levels were therefore adopted: Nairobi city, Other Urban Areas, Rural Central Province, and Other Rural Areas.

Central Province is a fitting choice for analysis for several reasons. First it hosts the Kikuyu, the most populous community in the country who, being members of the Kikuyu, Embu, Meru (KEM) Central Bantu Group, are also the most powerful ethnic block in terms of the economy and politics. Central Province has also been more closely associated with British colonial occupation and settlement than any other province in the country, hence the possibility of greater influence of modernization (Bauni et al. 2000). Nairobi city was chosen for three reasons. First, it is one of the urban strata in the national sampling frame. Secondly, it is one of the eight provinces in the country which form domains often used for statistical analysis of survey and census data. Thirdly, it is the capital city of Kenya with a population size and economic activities that dwarf those of any other urban area.

The question of sample size at these sub-national levels equally became important: in some of the analyses, it was necessary to amalgamate the seven age categories into a smaller number that would still enable the study of age patterns. Thus, as in other studies, (Brass and Jolly 1993), the conventional seven age groups were re-organized into three categories namely 15-24, 25-39, and 40-49. In the text, following terminology in the work by Brass and Jolly, they are also referred to as the Early (E), the Middle (M), and the Late (L) reproductive stages respectively.

Summary

The objective of this chapter was to highlight issues that might affect the quality of data to be used in the dissertation, questions which were addressed under six headings. The first three examined were the design and implementation of the sampling for the five surveys, possible changes in the composition of the samples between the surveys, and comparability of questions across surveys. The next three were data quality, the geographical level of analysis, and methods for data analysis.

The five surveys are based on a national sampling frame that is updated after every decennial census. From this frame, a two-stage sample is drawn that is stratified by urban and rural areas, and within the rural strata, by district. The sampling unit consists of the cluster or village, and households were systematically selected in the chosen clusters to give a national sample that yielded between 7,150 (in the case of the 2003 survey) and 8,100 (the 1977/78 KFS) completed interviews with women of reproductive age. The sampling errors for most variables - and in particular the total fertility rate - at the national level are modest, this indicating that the estimated sampling statistics predict the population parameters fairly well.

In this chapter, key variables, such as fertility intentions, ideal family size, and contraceptive method were examined to determine whether their wording might have changed form one survey to the next. Overall, the results show that the questions and variables are comparable. Nevertheless, it was observed that questions on the health of children born five or three years before the survey tended to make interviewers push back the dates of birth for some children, and hence possibly bias fertility estimates. This problem is surmounted by taking the reference period for estimating fertility to be four years. A related problem is truncation of the age of women the further one goes back in the past: it will be addressed in the dissertation by limiting fertility estimates to cohorts free from such truncation.

The chapter also addressed the question of the quality of data at the levels of the household, the individual woman, and the birth history table. When the age structures of women captured from the household questionnaires are compared to those from a model population or nearby censuses, a tendency for women to be pushed downwards of age 15 and upwards of age 49 is observed.

Age heaping at certain ages, for example the peak childbearing age of 25, and more generally ages that end with 0 or 5 is also observed. In spite of these observations, overall, examination of reporting on the woman's age, as well as on the age at first union reveal a surprisingly good quality of data. Nevertheless, the completeness of reporting either on the year and month of birth or on age of the respondent improves with increased education, among younger women, and with urban residence. Similarly, examination of data on the date of birth of the child, age of the child and - where the child has passed away - age at death indicates good quality data. Incompleteness of data on child deaths is most severe during early childhood and further back in the past. Nevertheless, the data on early child deaths do not show such lack of quality. In the next chapter, the methods that will be used to analyse the data and attain the three respective objectives of the thesis are presented and discussed.

CHAPTER 4: METHODOLOGY

Introduction

In Chapter three, a number of issues concerning the reliability and quality of the data to be used in this dissertation were examined, and several conclusions emerged. Firstly, to the extent that the samples in the five surveys to be used were drawn from generally the same universe of the national population, the individual samples are comparable. Secondly, questions asked in the surveys, which captured key variables to be used in the thesis (such as those on fertility preferences and contraceptive methods) are similar across surveys. Lastly, evaluation of the data based on conventional demographic data quality checks reveal variables that are robust to reporting errors. In this chapter, the methods that will be used to analyze these datasets are presented. Beginning with a presentation of the methods to be applied in the descriptive analysis of the trends in fertility and some of its proximate determinants, this chapter next discusses survival analysis as a method to examine the factors associated with transitions to second and third births in Kenya. Thirdly, it describes several regression methods that examine the determinants of contraceptive use in the country, before concluding with a review of particular datasets for each analysis.

4.1 Exploratory Analysis

The methods used to derive results for the first objective of this dissertation – trend patterns at the national and sub-national levels – are descriptive and exploratory, rather than inferential and multivariate. In this regard, three particular methods are applied. These are the estimation of period and cohort fertility rates, parity progression ratios, and medians for age at first marriage and at first birth. Each of these is presented in turn.

First, demographic techniques in the form of fertility analysis are used to estimate period and cohort fertility measures. Defined as the process through which the human population increases itself through reproduction (Preston et al. 2000), there are a number of issues which are unique to fertility and which need to be pointed out. First, although human reproduction involves two individuals of the opposite sex, analysis is made simpler by linking the births to the mother.

Secondly, the risk of producing a live birth is not universal among women. It is limited to the reproductive age groups 15 to 49 years, and within these age limits it also depends on fecundity (the ability to produce a live birth) and to sterility (definite inability to conceive). Thirdly, fertility depends on individuals' behaviours and in particular sexual activity, much of which takes place within the institution of marriage. Thirdly, fertility also depends on whether couples regulate their childbearing - through contraceptive use, including abortion. Lastly, in addition to the fact that fertility (unlike mortality) is a renewable event, it has to be analysed from multiple dimensions, and in particular on the basis of age.

Fertility can be examined from two perspectives – the cross-sectional or period approach, and the cohort or longitudinal view. In the period approach, fertility is examined cross-sectionally, meaning that births which occur within a specified period of time (normally a year) are analysed (Newell 1988). In this regard, there are a number of measures of period fertility, such as the Crude Birth Rate (CBR) and the General Fertility Rate (GFR). Nevertheless, the Total Fertility Rate (TFR) which is derived from the Age Specific Fertility Rates (ASFRs) was chosen for analysis in this section of the thesis. The main reason for this preference is related to the fact that the TFR is a single number, unlike the ASFRs which consist of seven fertility rates for seven five-year age groups ranging from 15 to 49. An element of arbitrariness is also introduced when one wants to compare fertility rates between the several age specific fertility rates, an inconvenience which the TFR overcomes.

The Total Fertility Rate can be formulated as:

$$TFR = \frac{\text{summation of ASFRs x 5}}{1{,}000}$$

Where:

The summation ranges from the beginning of childbearing (15 years) to the end (49 years);

It is necessary to multiply by five in order to capture the five years within each of the seven five-year age groups;

It is conventional to divide by 1,000 in order to convert the ASFRs (which are expressed in terms of per 1,000 women) into births per woman.

In the estimation of the total fertility rate, the calculation of the ASFRs is critical, and this aspect is next briefly examined. In this thesis, the ASFR for a give age group can be expressed as:

$$\text{ASFR} = \frac{\text{Births in the 1-48 months before the interview for the age group}}{\text{Woman years of exposure in 1-48 months before interview in age group}}$$

In this case, the question of the reference period to which the births refer is important. Due to the possibility of birth displacement at five year age-intervals, the reference period is taken as four years (48 months).

Thus formulated, the period TFR is defined as the mean number of children that a woman would bear if she lived throughout the reproductive age period and followed the given age specific fertility rates. Thus, the period fertility rate represents the fertility of a "hypothetic" or "artificial" cohort that would survive throughout the reproductive period and bear children at the rate prevailing at a particular period.

Unlike in period fertility where a cross-sectional perspective is important, in cohort fertility, the childbearing experience of a group of women who were born within the same time interval is considered over time (Newell 1988). The additional merit in examining fertility from the cohort perspective is the cumulative and repetitive process of fertility – a woman's past birth history can affect future childbearing (Preston et al. 2000). Like with the period total fertility rate, the cohort age specific fertility rates can be summed to give the cohort Total Fertility Rate, a measure which is also known as the Completed Fertility Rate (CFR). It is then defined as the number of children that would be born to an actual birth cohort of women, if all of them survived to the end of their childbearing years, and if they bore children during each age at the rate observed for surviving members of the birth cohort.

A number of issues need to be pointed out with regard to the cohort perspective. First, the TFR for a cohort can only be determined when all the members of the cohort have reached the end of their reproductive age. Secondly, if a number of demographic factors such as mortality and migration were unchanging over time, then the period and cohort TFRs would be the same. Due to changes in these and other demographic variables however, period and cohort fertility rates

will differ. Furthermore, the average competed family size (mean number of children ever born) for the cohort would not be the same as the cohort TFR. The merits of the cohort approach to fertility analysis notwithstanding, there are a number of disadvantages with the method. First, it requires data in the form of a long and consistent time series. Secondly, there is the problem of censoring – the future reproductive experience of younger and more recent cohorts is not known beyond the time of interview. To attempt to overcome these problems, in this thesis, only the birth cohorts who have practically completed their childbearing (those aged 45 to 49 years) are taken into account in estimating the cohort TFRs.

There exist other differences between the period and cohort approaches that need to be pointed out. Compared to the cohort perspective, the period approach to fertility analysis has been found to be more sensitive to period effects. Several studies (Ní Bhrolcháin 1987; Newell 1988; Bongaarts and Feeney 1998; Preston et al. 2000; Siegel et al. 2004) comprehensively treat the subject of period and cohort fertility. Suffice it here to highlight again the merits, and limitations of each. In the period perspective, the fertility experience of different birth cohorts of women is examined. While the advantage of this synthetic or hypothetic cohort approach is that it is up to date, it has been criticized for being an artificial measure that may bias real fertility. Thus, it is often argued that it may be subject to frequent variations over time when there are rapid changes in timing effects. In the cohort approach however, the reproductive experience of the same birth cohort is examined over time in order to assess temporal variations in fertility. Although its advantage is that it is a real measure of fertility, it does not convey recent fertility trends. The two, period and cohort fertility, can however be reconciled by the process of translation, an undertaking that is beyond the scope of this dissertation.

Another measure of fertility applied in this thesis is the parity progression ratio (PPR). Also a cohort measure of fertility, the PPR captures the fertility process, not through the movement of a woman through the various age groups, but through the change from a given parity to the next. It is defined as the proportion of a birth cohort who having had *i* births, go on to have *i*+1 births. In symbolic notation, it is expressed as:

$$PPR_{(i,\, i+1)} = \frac{\text{number of women at parity i+1 or more}}{\text{Number of women at parity i or more}} = \frac{P_{i+1}}{P_i}$$

The rationale for the use of the parity progression ratio in this dissertation is related to its capability as a measure for the analysis of fertility limitation (Brass and Jolly 1993; Preston et al. 2000). The estimation of parity progression ratios is simple for cohorts who have completed their childbearing. However, in the case where the data are from birth histories of women who are still in a position to carry on with childbearing, the estimation procedures become more complex, and require taking into account the removal of women from the risk of childbearing during the reproductive period. This is achieved with the use of life-table techniques, details of which are explained in the next sub-section. In short, for each group of women, the rates of progressing from the ith to the (i +1)th birth are estimated in intervals of months from the previous birth. However, as the interval widens the number of women with that experience becomes too few for effective estimation. Nevertheless, it is thought that most births take place within five years. Therefore, in this thesis, the proportion of women who having had the ith birth move on to have the (i+1)th birth within sixty months or five years (B_{60}) is calculated using life table techniques (Rodriguez and Hobcraft 1980; Smith 1980; Brass and Jolly 1993). However, a limitation of the B_{60}s which needs to be borne in mind is that they are slightly biased due to the truncation of birth histories.

In addition to their use in the estimation of parity progression ratios, life table techniques are also applied (in this thesis) to calculate the median ages at marriage and at first birth. A word about the method is consequently in order. One might as well have used other measures, such as proportions, to estimate these variables, but the results would not be precise enough. This is because the three - parity progression ratios, age at first marriage and at first birth are duration variables which are subject to both censoring and truncation for incomplete birth histories. In other words, some of the individual women may not yet be exposed to the risk of the event. Others – although exposed - have not yet experienced the event and we do not know when they will experience it.

Whether for the estimation of parity progression ratios or for calculating the median ages at first marriage and at first birth, two pieces of information are required for constructing the life-table. These are the tabulation of women by duration of exposure and by status of termination. For

parity progression ratios, the duration of exposure to the risk of the next birth consists of the number of women for various durations (in months) since the previous birth. For the median age at first marriage and first birth, these are the durations since birth. The status of termination for parity progression ratios refers to whether the next birth has taken place. For age at first marriage and first birth they refer to whether the first marriage and first birth have taken place respectively.

Given these two pieces of information, calculation of the various columns of the life-table is straight-forward, as follows:

1. Duration of exposure (x,x+n): For estimation of the parity progression ratio, the duration of exposure is grouped in single months since the previous birth. For age at first marriage and first birth, it is grouped in years since birth (of the woman).
2. Number observed at start of the interval (N_x): This refers to the number of women under observation at the beginning of each interval of exposure. In the first interval of exposure, this would be the total number of women of parity i, the total number of women in the birth cohort (for age at first marriage and at first birth). The number observed during each subsequent interval is determined as the number observed at duration x minus those who are censored or have the next birth (for PPRs), first marriage, or first birth respectively.
3. Number censored ($_nC_x$): This is the number reaching interview time without experiencing the event.
4. Number of events ($_nE_x$): the number of failures (next births, first marriages, or first births) in the interval.
5. Number of women exposed to the risk (N_x^*): This is the number observed at the beginning of the interval less those who reach the interview time.
6. Proportion of women experiencing the event during the interval ($_nq_x$): It is estimated as the number of events in the interval ($_nE_x$) divided by women exposed (N_x^*).
7. The proportion among all women experiencing the event in the interval x and x+n ($_xb_n$): It is estimated as the proportion that has not yet experienced the event by duration x multiplied by the proportion that has experienced the event between intervals x and x+n. In symbolic terms, $_nb_x = (1-B_x)\,_nq_x$. The definition of the measure B_x is provided below.

8. Finally, the cumulative proportion experiencing the event by duration x+n (B_{x+n}): This is calculated as the summation of the proportion experiencing the event by duration x with the proportion that experiences the event between durations x and x+n. In other words, $B_{x+n} = B_x + {}_nb_x$. Interest is on the duration at which 50% (median proportion) of women experience the event. This is estimated from this column by interpolation.

While period and cohort total fertility rates (TFRs) and the parity progression ratio (PPR) were selected as measures to examine the trend patterns in fertility, a number of other variables are applied in the exploratory analysis of the trend patterns in fertility over time. These comprise age at first marriage, age at first birth, contraceptive use, stopping behaviour, and spacing behaviour. It is useful to explain why this group of variables were selected. The basic idea that guided the selection of variables with which to compare trends in fertility over time is that of proximate determinants (Bongaarts 1978). In that regard, fertility changes due to postponement of the age at which childbearing commences (through variations in age at first marriage or in age at first birth depending on which comes first) or due to contraceptive use for postponing, spacing, or limiting births. In line with this idea of proximate determinants, these variables were chosen to broadly explore the trends in the onset of childbearing (age at first marriage and at first birth) and in fertility control (contraceptive use). Furthermore, the trend patterns in the spacing and limitation of births are examined in greater detail through estimation of proportions of women wanting no more births, wanting to space, and not sure whether they want any more children or not.

4.2 Survival Analysis

For the second objective of this dissertation – analysis of the factors associated with the initial rapid fall and subsequent reduced pace in then fertility transition - survival analysis was the main method used. Accordingly, the presentation of this approach will be as follows. First, the nature of survival analysis and how it is different from other methods of data analysis is outlined. Then, within survival analysis, two particular methods applied in the preliminary exploration of the data – life tables and Kaplan-Meier survivorship probabilities - are presented. Thirdly, the main method under survival analysis applied in the thesis – Cox regression – is outlined. Lastly, a justification is provided for the choice of variables included in the analysis.

To the extent that survival analysis is concerned with examining the time to the occurrence of an event (Cleves et al. 2004), it is an apt method for analysing the second chapter on results in this thesis: the factors associated with the risk of transition to the second and third births in Kenya. Undoubtedly, other statistical methods such as ordinary least squares (OLS) and linear regression exist, but they would not be appropriate in this case. This is because in OLS and linear regression, it is usually assumed that the error terms are normally distributed. This would not necessarily always be true in the distribution of waiting time to an event, for example the occurrence of the second or the third birth. The advantage of survival analysis over other methods for the statistical handling of data is that more appropriate distributions of the waiting time to the occurrence of the event can be modelled. These range from parametric models in which specific functions are developed to model the distribution of such waiting times, to semi-parametric models (where the assumption about the distribution of the waiting time to the event is unspecified), to non-parametric methods such as Kaplan-Meier survivor functions (in which no distribution is assumed for the waiting time).

Key to a fundamental understanding of survival analysis is the idea of the hazard function. It is defined as the probability that an event (such as a second or third birth) takes place in a given interval, conditional on the observation that the subject of the observation (a woman) has "survived" up to the beginning of the interval without experiencing the event, divided by the width of the time interval. Thus, the hazard or risk function is an instantaneous rate of the possibility of the event occurring (meaning that the probability is divided by time), and not merely the probability of the event taking place. In the usual calculus notation, it is expressed as:

$$h(t) = \lim_{dt \to 0} \frac{\Pr(t+dt > T > t \mid T > t)}{dt}$$

Where h(t) is the hazard or risk function in question;
dt is the time interval which approaches zero;
t is the beginning of the time interval;
and T is the time to the event occurring.

A number of basic concepts characterise survival analysis, and among these, the ideas of censoring and truncation are particularly pertinent to the analysis of transitions to the second and third births. The question of right censoring (a woman has not yet had her second or third birth by the time of the interview) is pertinent. Rather than ignore such information, the methods of survival analysis applied here specially treat such cases as censored. This means that such cases (censored) are considered to have been in the risk set up to just before the time of interview. The question of left truncation also arises because some of the second or third births enter into the risk set before observation starts. In this regard, it was decided to observe all second or third births that occurred 12 years before the interview date. Hence, second or third births that took place more than 12 years before the interview date are excluded from the analysis.

Two techniques in survival analysis are used to explore the data before full-fledged multivariate analysis is conducted. These are the life table approach and Kaplan-Meier survivorship functions. The methodology of the life table as applied to duration events has already been described above. What is important here is to outline how it is applied to the transition to the second and third births. Thus, the method is used to determine the median duration to the second and to the third birth. Similarly, the method of Kaplan- Meier is used to determine probability of remaining in the states of first birth and second birth. For this method, the first step is to calculate the number of individuals at risk minus the number of events, divided by the number of individuals at risk. Then these results are multiplied for all time periods t for which the event occurred. In symbols, the Kaplan-Meier survivor function can be expressed as:

$$S(t) = \text{product} \left(\frac{n_t - b_t}{n_t} \right)$$

where:

S(t) is the Kaplan-Meier survivor function;

n_t are the number of women exposed to the risk of a second or third birth (respectively) during time t;

and b_t are the number of second or third births (as appropriate) that occur at time t.

In this thesis, the main method applied in the survival analysis of transitions to the second and third births is the Cox semi-parametric and proportional hazards model. The choice of the Cox

model over parametric regression was based on the objective of the analysis – to determine the effect of the covariates of the birth interval without necessarily taking into account the shape of the baseline hazard function. The Cox model is semi-parametric and is expressed as a product of a baseline Hazard Function (HF) that has an unspecified form, and another factor that is a linear function of a specified number of independent variables which are expressed in exponential form. The baseline hazard is representative of an individual whose covariates or independent variables are zero. It is a proportional model because it is assumed that the hazard for one individual is simply a constant proportion of the hazard of another. In mathematical notationa, the Cox model can be expressed as:

$h(t\,|x_j) = h_0(t)\,\exp(x_j B_x)$
where $h_0(t)$ is the baseline hazard (which is left unspecified);
and $\exp(x_j B_x)$ is a linear function of a set of x independent variables that are exponentiated;
B_xs are coefficients which are to be estimated from the data.

To determine the effects of covariates on the hazards of transition to the second and third births, three models are developed. In model one, only three covariates – region of residence, period of first and second birth, and age at first birth - are included. In model two, other interesting explanatory variables are added to the basic model. Model three includes interactions: in addition to the basic and control covariates, interaction terms between selected covariates and period of first or second birth respectively are integrated. The choice of covariates for interaction was based on tests of the proportionality assumption for the Cox regression model (Cleves et al. 2004). Covariates that violated the assumption - those that showed significant results at the 5% or lower level when interacted with the logarithm of time during each of the two periods - were interacted with period of first or second birth. In so-doing, it was assumed that an additional effect of the interacted variable on the hazard is through the period of first or second birth, as appropriate.

The following covariates were included in the Cox regression model:
Region of residence: The inclusion of this covariate in the model is important because it is thought that the hazards of transition in the country to the second or third birth differ by region due to variations in development and culture;

Period of first and second birth: These covariates measure the extent to which the different time periods, and particularly the time of constant fertility (1997-2003) as compared to that when the stall in fertility may have just been beginning (1991-1997), could have affected transitions to second and third births;

Age at first birth: The covariate measures the extent to which the timing of the onset of reproduction has an effect on transitions to the second and third birth;

Education: The amount of time spent in schooling is expected to affect transition to the second and third birth. For example, higher levels of education could affect the risk of transition through contraceptive use and employment;

Survival status and sex of the child: The covariate will be used to assess the observation that high child mortality is associated with higher risks of transition to the next birth. Similarly, it is often thought that there is preference for male children, so the risk of the next birth should be higher where the previous child is female.

Socio-economic status: This covariate is meant to assess the contention that higher social status (for example higher income) is associated with lower overall fertility and by general implication, a lower risk of transition to the next birth.

Religion: There are several religious groups in Kenya. These comprise Catholics, Protestants, and Muslims. It is possible that among the more conservative religions, such as Catholicism and Islam, in contrast to the Protestant church, the risk of progressing to the next birth would be higher.

Ethnic group: each community has its own residual cultural practices that might influence the transition to the next birth. Some communities might be more innovative - for example adopt contraceptive use more readily, while others might be limited only to natural fertility. The transition to the next birth would be different in the two communities.

Ever married status: To the extent that most childbearing in Kenya takes place within the institution of marriage, higher risks of transition to the next birth would be expected to prevail among ever-married women as contrasted to those who have never been in marriage.

4.3 Addressing Endogeneity through the Instrumental Variables Approach

To present the methods of data analysis for the third objective of this dissertation, it is useful to begin with the underlying structural model. Among popular theories of fertility change, contraceptive use (which is a proximate determinant of variation in fertility) is considered a function of basic determinants, with fertility demand acting as an intermediate variable (Easterlin and Crimmins 1985). In the straight-forward case of this model, the determinants of contraceptive use can be grouped into two parts: those which directly influence it, and the others which do so only indirectly through fertility demand (motivation for fertility control). However, it is quite possible that unobserved variables affect both motivation for fertility control and contraceptive use - in which case there will be endogeneity between the two variables. An example is a woman's fecundity – it determines both fertility demand and contraceptive use, but often it is unmeasured (Bollen et al. 1995). Thus, a typical Kenyan woman, in wanting many children, is not open to contraceptive use. In surveys however, in asking a woman about her ideal family size, this question about infecundity is not taken into account. On the other hand, a woman who thinks that she is infecund may report wanting few additional children; she will also not use contraceptive methods. This means that if two regressions were conducted, the first on the determinations of motivation for fertility control, and the second on factors affecting contraceptive use (where motivation for fertility control is included as one of the determinants) unobserved factors represented by the two error terms would be correlated, which further implies that the error term in the contraceptive use equation would be correlated with motivation for fertility control. This constitutes a violation of one of the assumptions of the classical linear regression model (Wonnacott and Wonnacott 1995; Kmenta 1997; Kennedy 2003). The

estimates of the magnitude of the coefficients (and not just the coefficient for motivation but for other factors such as exposure to family planning messages and access to family planning facilities as well) are likely to be biased, in this case overestimated.

Given the polychotomous nature of the endogenous variables – current contraceptive use and fertility intentions - a number of options are available to address the biasing effect of endogeneity on coefficients of parameter estimates. For the multinomial regression that would consequently be required, one solution would be a system of simultaneous equations, which is solved through the full information maximum likelihood (FIML) method (Guilkey and Jayne 1997). However, this undertaking is beyond the scope of this analysis and readily available software: requiring, for example, the application of a special generalised linear and latent mixed model (GLLAMM) or writing out the entire system of simultaneous equations and then using the maximum simulated likelihood method to address the unobserved heterogeneity (Haan and Uhlendorff 2006).

If the endogenous variables are regrouped into either continuous or binary code, a second solution would be to apply the instrumental variables (IV) method (Kmenta 1997; Wooldridge 2000; Kennedy 2003). The limitations of this approach are the difficulty in finding a good instrument, and the larger variances that consequently result; its strength lies in yielding consistent estimates of the parameters when an appropriate instrument is applied,. A third solution would involve ignoring the endogeneity between contraceptive use and the number of additional children desired. The last two approaches are applied in this chapter, using the probit distribution, with motivation for fertility control (additional children desired) being considered as a continuous variable. While it would have been useful to consider contraceptive use as a polychotomous variable - categorised into not using, using a modern method, and using a traditional method - this is not possible with the instrumental variables model applied here. Instead, contraceptive use is simply grouped into using a method (modern and traditional) and not using. In the final analysis, the focus of the regressions performed is the simple probit in which the problem of endogeneity is ignored – past studies having shown that it might be better to apply this simpler method than more complicated techniques (Bollen et al. 1995). The binary probit distribution is also preferred to the corresponding logit because of the symmetry between

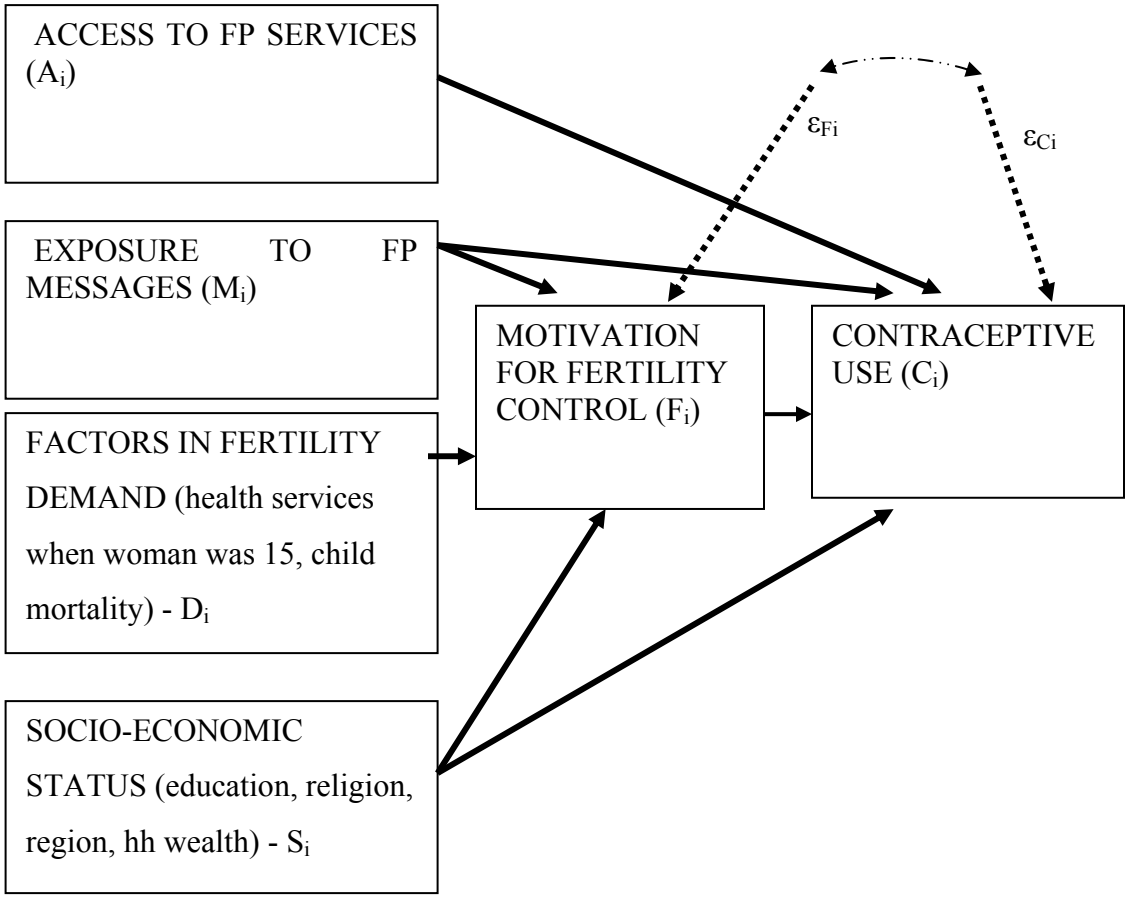
probit and ordinary least squares (OLS). Finally, a multinomial logit regression in which the endogeneity between motivation for fertility control and contraceptive use is not taken into account is also applied, the purpose here being limited to alternatively evaluating the significance and direction of hypothesized effects.

The following models are therefore implemented to address the third objective of this thesis. First, an ordinary least squares (OLS) regression is performed, with the additional number of children desired as the dependent variable. This step assesses the factors that determine the additional number of children desired, a key determinant of contraceptive use. Secondly, a simple probit regression is run that ignores the problem of enodogeneity. Thirdly, to test the exogeneity of additional children desired, a probit regression is effected with contraceptive use as the dependent variable, and the residual term from the first (OLS) regression included as part of the regressors. The fourth regression involves applying the two-step instrumental variables technique – whether health facilities were available in the community when the woman was 15 years old, and the community child mortality ratio acting as the identifying variables for the contraceptive use equation. This set of variables is thought to be correlated with the endogenous variable. Finally, contraceptive use is determined in reduced form, without including additional children desired in the regression, and the five regressions closely compared. Two other simple probit regressions implemented for further comparisons, are those constrained to the merged 1998 KDHS (individual level) and the 1999 KSPA (community) survey data, and to the 1998 KDHS survey alone. Lastly, a multinomial regression that takes into account the polychotomous categorization of the dependent variable (contraceptive use) and motivation for fertility control is also run for general comparison purposes.

The pathways for the influence of basic determinants and motivation for fertility control on contraceptive use are illustrated in the diagram below (Figure 3) in which two equations, comprising additional children desired and contraceptive use as dependent variables, arise. First, contraceptive use is determined by the endogenous variable (additional children desired) which includes the indirect effects of exogenous variables acting through the endogenous variable, but also through their direct influences. Current access to family planning facilities is modelled to affect contraceptive use directly. The predetermined variables include those grouped under

socio-economic status, the factors in fertility demand, exposure to family planning messages, current access to facilities, and whether the health facility to which the respondent's community is affiliated was open by the time the respondent was 15 years old. Secondly, motivation for fertility control (the number of additional children desired) is affected by the exogenous variables. Nevertheless some of the predetermined variables - community mortality, and whether the health facility was open when the woman was 15 years old - are assumed to affect contraceptive use only indirectly through motivation for fertility control.

Figure 3: Path Diagram for Relationship between Basic Determinants, Motivation for Fertility Control, and Contraceptive Use



Given these relationships, the following equations are therefore modelled in order to address the problem of endogeneity:

1. OLS Regression: $F_i = \beta_{0F} + \beta_{1F}M_i + \beta_{2F}D_i + \beta_{3F}S_i + \varepsilon_{Fi}$

2. Simple Probit ignoring endogeneity: $C_i = \beta_{0C} + \beta_{1C}F_i + \beta_{2C}A_i + \beta_{3C}M_i + \beta_{4CP}S_i + \varepsilon_{Ci}$

3. Probit with motivation manually predicted:
   $C_i = \beta_{0C} + \beta_{1C}F_{i(est)} + \beta_{2C}A_i + \beta_{3C}M_i + \beta_{4C}S_i + \varepsilon_{Ci}$

4. IV Probit with access to health facilities at age 15 and child mortality as exclusions:
   $C_i = \beta_{0C} + \beta_{1C}F_{i(pred)} + \beta_{2C}S_i + \beta_{3C}A_i + \beta_{4C}M_i + \varepsilon_{Ci}$

5. Reduced-form Probit:
   $C_i = \beta_{0C} + \beta_{1C}S_i + \beta_{2C}A_i + \beta_{3C}M_i + \varepsilon_{Ci}$

In the five equations, the coefficient with a zero subscript (β_0) refers to the intercept, while the others pertain to the following variables as defined in the path diagram: A: current access to family planning services; M: having been exposed to a family planning message in the last six months before the survey; D: factors in fertility demand; S: socio-economic variables; F: motivation for fertility control. The subscripts F and C in the coefficients relate to the dependent variables – motivation for fertility control and contraceptive use respectively, while ε refers to the error term in the respective equation.

4.4 Datasets

The question about the quality of the data used in this thesis was comprehensively addressed in chapter three. Nevertheless, subsequent to the above presentation of the statistical methods applied in this thesis, it is appropriate to outline the datasets on which each of the methods is applied. For the objective of exploring the trend patterns in fertility and its proximate determinants over time, all the datasets from five sample surveys conducted in Kenya over the period 1977-2003 are used. These are the 1977/78 Kenya Fertility Survey (KFS), and the Kenya Demographic health Surveys (KDHS) conducted in 1988/89, 1993, 1998, and 2003 respectively. For the analysis of the factors associated with transitions to the second and third births in Kenya, two datasets are used. These comprise the 1988/89 and 2003 KDHS surveys. However, due to the multi-level nature of the analysis of the third objective of this thesis – determining the factors related to contraceptive use in Kenya - the datasets used to conduct that analysis (chapter seven) require more explanation.

Data for chapter seven – devoted to the determinants of contraceptive use in Kenya - are from the 1998 KDHS (an individual-level dataset) and the 1999 KSPA survey (a community and health-facility based survey). The two surveys are linked - half of the 536 clusters sampled for the 1998 KDHS were randomly selected for the KSPA community and health-facility survey. The objective of the 1999 KSPA survey was to provide information on reproductive and child health services in Kenya (MOH 2000). It contains information on the functioning and quality of health services in the key areas of family planning, maternal health, child health, sexually transmitted infections and HIV/AIDS. The survey focused on services provided at the health facilities, and on related perceptions of community members. It therefore had at least two components – one on the community and the other on the health facility. Some of the variables captured in the community part of the survey and used in this chapter include the type of locality (whether a city, town, or rural area), and the presence of community-based distributors in the community. Similarly, in the health facility inventory questionnaire, a number of variables comprising access to the different types of health facilities, and the date in which the health facility was opened are used in the analysis. Nevertheless, out of the 388 health facilities visited by the interviewing teams, information on the date of opening was available for only 337, or 86.9%, of them.

So constituted, the two datasets - the 1998 KDHS and the 1999 KSPA - enable examination of individual and community-level factors involved in choosing to use a contraceptive method, taking into account both fertility demand and supply factors. From the 7,881 women of reproductive age interviewed in the 1998 survey, only those in the 536 clusters covered in the KSPA 1999 survey were retained. Within this new dataset, confined to the clusters covered both in the 1999 KSPA and 1998 KDHS surveys, further restrictions were applied in order to comply with the requirements of the analysis. Women who were currently married, not pregnant, not sterilized, but fecund were retained; those who indicated being undecided about their ideal family size were excluded – this in order that one of the key variables in the analysis, the number of additional children desired, could be rendered continuous (Bollen et al. 1995). The process resulted in a total sub-sample of 1,923 women, and the type of health facility they were associated with was then matched with each of these individual cases.

Among the problems encountered while merging the KSPA survey with the individual dataset - the 1998 KDHS survey - identification of the health facilities with the respective community or cluster they were associated with initially turned out to be difficult. This is because the main identifier – cluster number or community name – was not always indicated in all the community and health facility data files. Nevertheless, the availability of two Geographic Information System (GIS) datasets in the internet greatly facilitated the merging and matching of health facilities, clusters, and women respondents. These were, first, the GIS on the location of health facilities in the country, which is maintained by the Nairobi-based International Livestock Research Institute (ILRI). The second was a similar database on the location of health facilities in the country's administrative set-up, which is hosted by the Kenyan Ministry of Health. The resulting match, which although not perfect, was informed by the administrative location of the health facilities provided in the two GIS databases. Secondly, while it was desired that the distance to the nearest health facility be recorded, this variable was not available in the data, and extricating this measure from the available longitudinal and latitudinal coordinate system was not possible within the scope of this study. Instead, the location of the community – whether in an urban or rural area – is used in this analysis as a proxy for proximity of the population to a facility offering family planning services. To try and address the possible limitations arising from not completely matching the individual and health facility datasets, two separate probit regressions of contraceptive use as dependent variable are made: one with the merged individual-woman and community-level data (for which the matching was perfect as the identifying cluster numbers are recorded in each), the other comprising only the 1998 KDHS individual dataset.

Summary

As a first step in the examination of the three specific objectives of this thesis, exploratory analysis of the trend patterns in fertility and its proximate determinants will be conducted. This will be achieved by the use of three methods. The first consists of demographic analysis in the form of period and cohort fertility analysis, parity progression ratios, and life table techniques. The resulting descriptive statistics are expected to pave way to more focussed analysis. Consequently, for the second objective of this study – examining the factors associated with progression to the second and third births in Kenya – survival analysis is conducted. First, it consists of preliminary analysis with life-table techniques and Kaplan-Meier survivor functions.

Secondly, Cox regression is used to analyse the risks of transition to the second and third births. Methods used to analyses data to attain the third and last specific objective of this thesis – examining the determinants of contraceptive use in Kenya – consist of ordinary, probit, and multinomial regression. This chapter sets the stage for the next three, which might be considered to be the main, substantive and analytical section of the thesis. In chapter five, a descriptive and exploratory analysis of trend patterns in fertility and its proximate determinants is conducted. Chapter six is devoted to the factors associated with the transition to the second and third births in Kenya; chapter seven examines the determinants of contraceptive use in the country.

CHAPTER 5: TREND PATTERNS IN THE FERTILITY TRANSITION

Introduction

Unlike the previous four which addressed introductory issues, literature review, data quality, and methodology respectively, this chapter and the next two, presents the findings of data analysis. Turning to the present chapter specifically, its objective is to carry out an exploratory analysis of the trend patterns in the fertility transition at the national and sub-national levels using descriptive statistics and demographic techniques as methodology. The chapter begins with a display of the distribution of the sample of women in each of the five surveys in section 5.1. Findings on trend patterns in fertility and related determinants follow next, in sections 5.2 and 5.3 respectively, while in 5.4 the trends in fertility preferences are presented; it concludes with a summary of the findings.

5.1 Distribution of the Samples

The re-grouping of the samples by reproductive stage, shown in Table VII, brings out three characteristics in the age structure of the Kenyan population (CBS 1980; NCPD 1989; NCPD 1994 ; NCPD 1999; CBS et al. 2004). The first is the young age structure of the women interviewed, and the contrastingly smaller sample size of older women, particularly in the urban areas. For example, at the national level, whereas women aged 15-24 and 25-39 years comprise between 40 to 45% of the respondents, only 14 to 17% are aged 40-49 years. The second observation is the predominance of the rural population; the third is the higher distribution of younger women in the urban sub-samples, suggesting rural-urban migration among these entrants into the job-market (Oucho and Gould 1993).

Table VII: Sample Sizes in the Study Datasets, Kenya 1977/78-2003

	Weighted Percentage			Number
Stage	15-24	25-39	40-49	15-49
Year/Region				
1977/78:				
National	41.5	42.8	15.7	8025
Nairobi	57.1	36.6	6.3	717
Other Urban	48.7	42.8	8.5	901
Central Rural	38.8	43.5	17.7	1156
Other Rural	40.3	43.1	16.7	5251
1988/89:				
National	39.4	44.9	15.7	7150
Nairobi	48.9	42.7	8.4	859
Other Urban	48.5	43.9	7.6	1058
Central Rural	41.7	41.0	17.3	1147
Other Rural	36.6	46.2	17.2	4086
1993:				
National	45.0	40.8	14.2	7540
Nairobi	50.1	40.6	9.3	367
Other Urban	48.8	43.9	7.3	794
Central Rural	42.8	40.3	17.0	1017
Other Rural	44.3	40.4	15.3	5362
1998:				
National	43.1	42.5	14.4	7881
Nairobi	47.0	42.5	10.5	419
Other Urban	46.8	44.3	8.9	1047
Central Rural	36.9	48.0	15.1	732
Other Rural	42.7	41.3	16.0	5683
2003:				
National	43.5	40.6	15.8	7601
Nairobi	45.6	43.4	11.0	1169
Other Urban	43.7	43.2	13.1	1434
Central Rural	38.9	42.1	19.0	1112
Other Rural	44.1	39.2	16.7	3886

Note: Although the KFS 1977/78 Survey covered the reproductive span of 15 -50 years, as in the other surveys, here the reproductive period is bounded by the ages 15 and 49 years.

5.2 Patterns in the Change in Fertility

Changes in Period Fertility

In this sub-section, findings on the trends in fertility are presented under period fertility, consistency check, and cohort fertility. To estimate the total fertility rates (TFRs), a measure of

period fertility, the age specific fertility rate (ASFR) was first estimated for each respective reproductive stage and geographical level. The estimates were calculated as the weighted number of births by age of mother for the four years preceding each survey divided by the woman years of exposure (Rutstein and Rojas 2003). The TFRs were then calculated as the sum of the ASFRs, all calculations being performed using the SPSS syntax for fertility estimation already developed by the DHS survey program.

The resulting well-known trends in the Kenyan fertility transition are captured in Table VIII, and can be summarized in a number of observations. At the national and sub-national levels alike, the total fertility rate (TFR) declined from high to relatively low levels. At the national level, this decline was from a TFR of 8.2 in 1977/78 to 4.9 in 2003. In each survey, the TFR is much higher in other rural areas and lower in the urban areas and rural Central Province. However, the transition has been most marked in rural Central Province, where fertility has declined from the highest TFR of 8.6 in 1977/78 to among the lowest, 3.7, in 2003 – a decrease of 57% over the 26 years.

Table VIII: Current ASFRs, Four Years before the Survey, Kenya 1977/78-2003

Stage	Early	Middle	Late	TFR
Survey Yr /Region				
1977/78:				
National	260.5	295.3	111.5	8.2
Nairobi	219.0	227.7	19.0	5.8
Other Urban	241.0	219.0	52.5	6.2
Central Rural	240.5	320.3	135.5	8.6
Other Rural	271.5	298.3	111.5	8.3
1988/89:				
National	234.0	241.3	66.5	6.6
Nairobi	187.0	157.0	27.5	4.5
Other Urban	192.5	173.3	18.5	4.7
Central Rural	193.7	226.7	55.8	5.9
Other Rural	259.5	259.3	73.9	7.2
1993:				
National	192.0	204.0	61.5	5.6
Nairobi	127.0	110.7	40.5	3.3
Other Urban	134.5	138.0	11.5	3.5
Central Rural	162.5	145.3	26.0	4.1
Other Rural	217.5	233.3	74.0	6.4
1998:				
National	178.5	171.3	37.0	4.7
Nairobi	114.0	96.7	0.0*	2.6
Other Urban	155.5	124.7	7.5	3.5
Central Rural	155.5	130.0	39.5	3.9
Other Rural	199.5	197.3	42.0	5.4
2003:				
National	179.0	182.3	37.0	4.9
Nairobi	105.5	112.3	2.5	2.8
Other Urban	143.0	133.7	31.0	3.7
Central Rural	153.5	134.0	18.0	3.7
Other Rural	209.0	218.7	46.5	5.8

Notes: E= Early Reproductive Stage; M=Middle Stage; L=Late; TFR=Total Fertility Rate

*: The dataset suggest, in error, that there were no births to women aged 40 years and above in Nairobi in 1998. Similarly, low ASFRs are noted for Nairobi at the late stage for the 2003 survey.

The conversion of these absolute changes in fertility into percentages in Table IX, and their graphical portrayal in Figure 4, brings out two trends in fertility. The first concerns fertility change among older women, and the second is with respect to time. Previous studies on the European fertility transition found that fertility declines were non-existent below age 25, small but increasing with age thereafter, and large, over 30%, beyond age 40 (Caldwell et al. 1992). The results of this study generally support this hypothesis. Figure 4 shows that the decline in fertility from one survey period to the next is as a whole greater among older women aged 40-49 years at all geographical levels. The decline is greatest and most consistent in rural Central Province, where it remained below minus 51% most of the time. Nevertheless, as some of the period results for age group 40-49 are puzzling and possibly suffer from deficiencies in age misstatement and sample size, the question of age-dependent fertility control is further addressed from the cohort perspective.

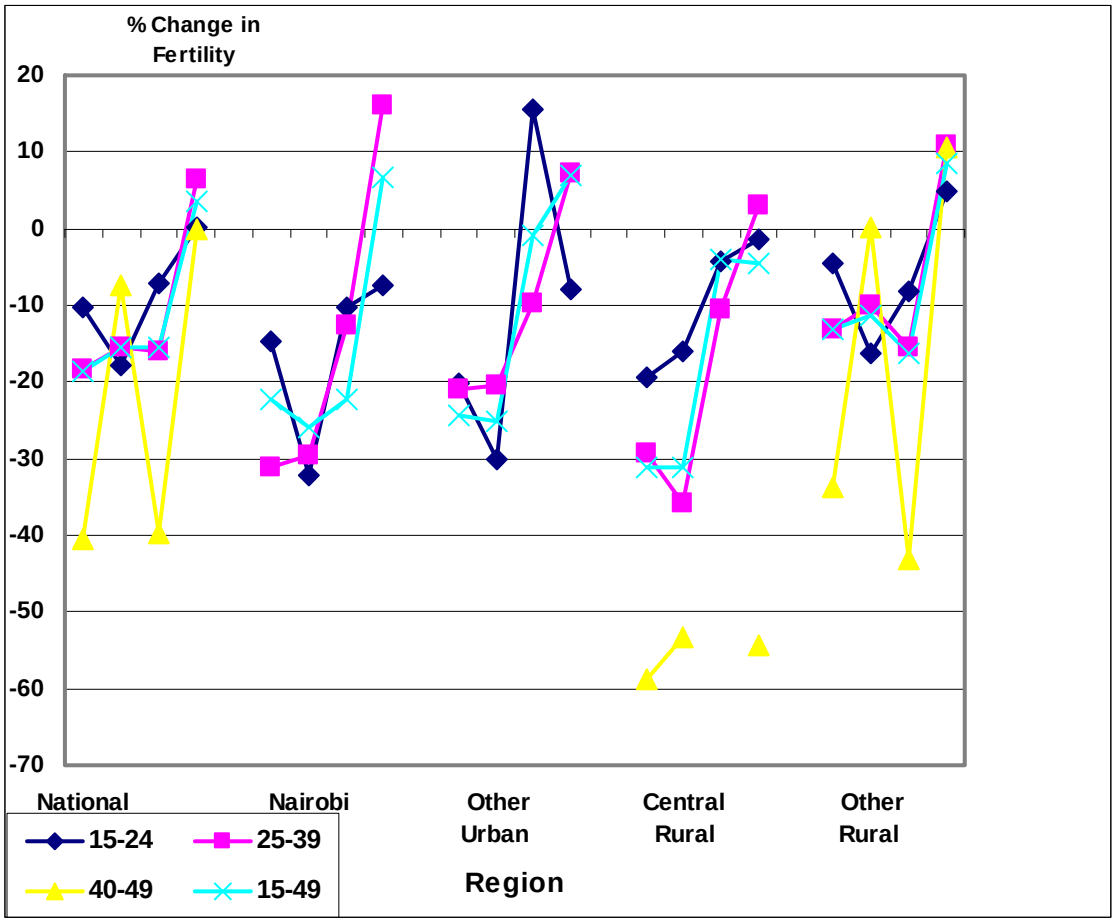
Table IX: Percentage Change in ASFRs from One Survey to the Next, Kenya 1977/78-2003

Reproductive Stage	Early	Middle	Late	Total
Survey/Region				
1977/78-1988/89 :				
National	-10.2	-18.3	-40.4	-18.7
Nairobi	-14.6	-31.0	44.7	-22.3
Other Urban	-20.1	-20.9	-64.8	-24.3
Central Rural	-19.5	-29.2	-58.8	-31.2
Other Rural	-4.4	-13.1	-33.7	-13.0
1988/89-1993 :				
National	-17.9	-15.5	-7.5	-15.5
Nairobi	-32.1	-29.5	47.3	-25.9
Other Urban	-30.1	-20.4	-37.8	-25.1
Central Rural	-16.1	-35.9	-53.4	-31.0
Other Rural	-4.4	-13.1	-16.2	-10.0
1993-1998 :				
National	-7.0	-16.0	-39.8	-15.5
Nairobi	-10.2	-12.7	-100	-22.3
Other Urban	15.6	-9.7	-34.8	-0.8
Central Rural	-4.3	-10.6	51.9	-4.1
Other Rural	-8.3	-15.4	-43.2	-16.2
1998-2003 :				
National	0.3	6.4	0.0	3.6
Nairobi	-7.5	16.2	*	6.8
Other Urban	-8.0	7.2	313.3	7.0
Central Rural	-1.3	3.1	-54.4	-4.5
Other Rural	4.8	10.8	10.7	8.6

Notes: E= Early Reproductive Stage; M=Middle Stage; L=Late; T=Total

* According to the dataset, there were no births to women aged 40 years and above in 1998. Hence, it is not possible to estimate the percentage change in fertility over the period 1998-2003 for Nairobi city.

Figure 4: Changes in Period Fertility by Reproductive Stage, Kenya 1977/78-1988/89 to 1998-2003



Notes: Figures for the late reproductive stage (ages 40-49) for Nairobi and Other Urban areas have not been included in the graph as they showed erratic trends. This may be due to small sample size of births. Missing data could also be a cause, as indicated in notes to Table IX above. Similarly, the change in fertility between 1993 and 1998 among women aged 40-49 years in rural Central Province appeared extraordinarily high (Table IX, column 4) to be included in the graph.

As with older women between 40 and 49 years, the declines in fertility are substantial among women aged 25-39 years, and relatively less among the young women aged 15-24 years old. Figure 4 also shows that starting generally with the period 1988-1993, the declines in fertility among women younger than 39 years follow a linear pattern that slopes upwards from left to right. A comparison can be made with the observations regarding the recent levelling off in fertility in the country (CBS et al. 2004; Westoff and Cross 2006). It appears that the constant

fertility observed may be a continuation of a decrease in the decline of fertility since 1988 at all geographical levels. While this decline was negative between 1977 and 1998, it remained at the threshold zero percent mark or turned positive between 1998 and 2003 at the national level and rural areas.

Consistency Check

To assess the reliability of these fertility estimates, parallel calculations were derived for an earlier period based on a later survey, and the results compared with those derived directly from the previous survey (Brass and Jolly 1993). Due to truncation however, fertility estimates back-dated to the past are not available for the whole reproductive life-span. Rather, they extend up to age group 35-39 years only. For example, fertility estimates for the 1974-1977 period based on the KDHS 1988/89 survey (which represents fertility for women 11 to 14 years before the 1988/89 KDHS) can only be estimated up-to age-group 35-39. Comparisons can therefore be made only with fertility estimates from the KFS 1977/78 survey up-to the same age-group.

The two results, shown in Table X, are as a whole close to each other. Estimates for the 1988/89, 1993, and 1998 periods match closest, while those for the 1977/78 and 1988/89 periods exhibit slightly wider differences. This may indicate differences in KFS and KDHS surveys, and greater uniformity between subsequent KDHS surveys, respectively. Greater differences are also noted for Nairobi and to a lesser extent other urban areas, particularly between the earlier surveys, beginning with the KFS. These disparities also point to possible errors in recall of past events, mis-reporting of dates of birth and age (of both the mother and the child), sampling, and for Nairobi, migration (Brass and Jolly 1993).

Table X: Births per Woman for Various Surveys and Alternative Estimates for the Same Time Period, Kenya 1977/78-1998

Year	**1977/78**		**1988/89**		**1993**		**1998**	
Survey Date	77/78	88/89	88	93	93	98	98	2003
Region								
National	7.0	7.5	6.1	6.0	5.2	5.0	4.6	4.4
Nairobi	5.6	4.7	4.2	3.5	2.9	3.1	2.6	2.7
Other Urban	5.7	5.5	4.5	3.9	3.4	4.0	3.4	3.5
Central Rural	7.2	7.5	5.3	5.5	3.8	3.9	3.5	3.5
Other Rural	7.2	7.8	6.5	6.7	5.7	5.9	5.0	5.5

Cohort Fertility

Compared to the cohort perspective, the period approach to fertility analysis has been found to be more sensitive to period effects. Several studies (Ní Bhrolcháin 1987; Newell 1988; Bongaarts and Feeney 1998; Preston et al. 2000; Siegel et al. 2004) comprehensively treat the subject of period and cohort fertility. Suffice it here to highlight but the definition, merits, and limitations of each. In the period perspective, the fertility experience of different birth cohorts of women is examined. While the advantage of this synthetic or hypothetic cohort approach is that it is up to date, it has been criticized for being an artificial measure that may bias real fertility. Thus, it is often argued that it may be subject to frequent variations over time when there are rapid changes in timing effects. In the cohort approach however, the reproductive experience of the same birth cohort is examined over time in order to assess temporal variations in fertility. Although its advantage is that it is a real measure of fertility, it does not convey recent fertility trends. The two, period and cohort fertility, can however be reconciled by the process of translation, an undertaking that is beyond the scope of this dissertation.

To complement shortcomings in the period approach, the cohort perspective is applied to trace the evolution of fertility in Kenya. As in other studies in the past (Foote et al. 1993; Rutstein and Rojas 2003), the results are presented up to age 40-44 due to truncation, with completed family size as the measure. As to their calculation, the method is similar to that used for estimating period fertility. The difference is that fertility of the cohorts who have almost completed their childbearing, i.e. those aged 45-49 by the time of the survey, is calculated by summing over a sequence of four years (0-3, 4-7, etc.) in the past until the time they started childbearing, namely when they were 15-19 years old.

The results, in Table XI, show that nationally, cohort fertility declined from 8.1 births for the 1933-1937 birth cohort to 5.7 among the 1959-1963 cohort. Two patterns are evident at the sub-national level - first an initial rapid fertility decline, and then a slowing-down particularly in the other rural areas. Secondly, in rural Central Province, the trend observed at the national level of a continuous fall from high fertility can be discerned. The range of the fertility decline is also greater in rural Central Province. Whereas the family size for the 1933-1937 birth cohort was 8.4 births, this reduced by 46.4% to 4.5 for the 1959-1963 cohort. In the other rural areas in contrast,

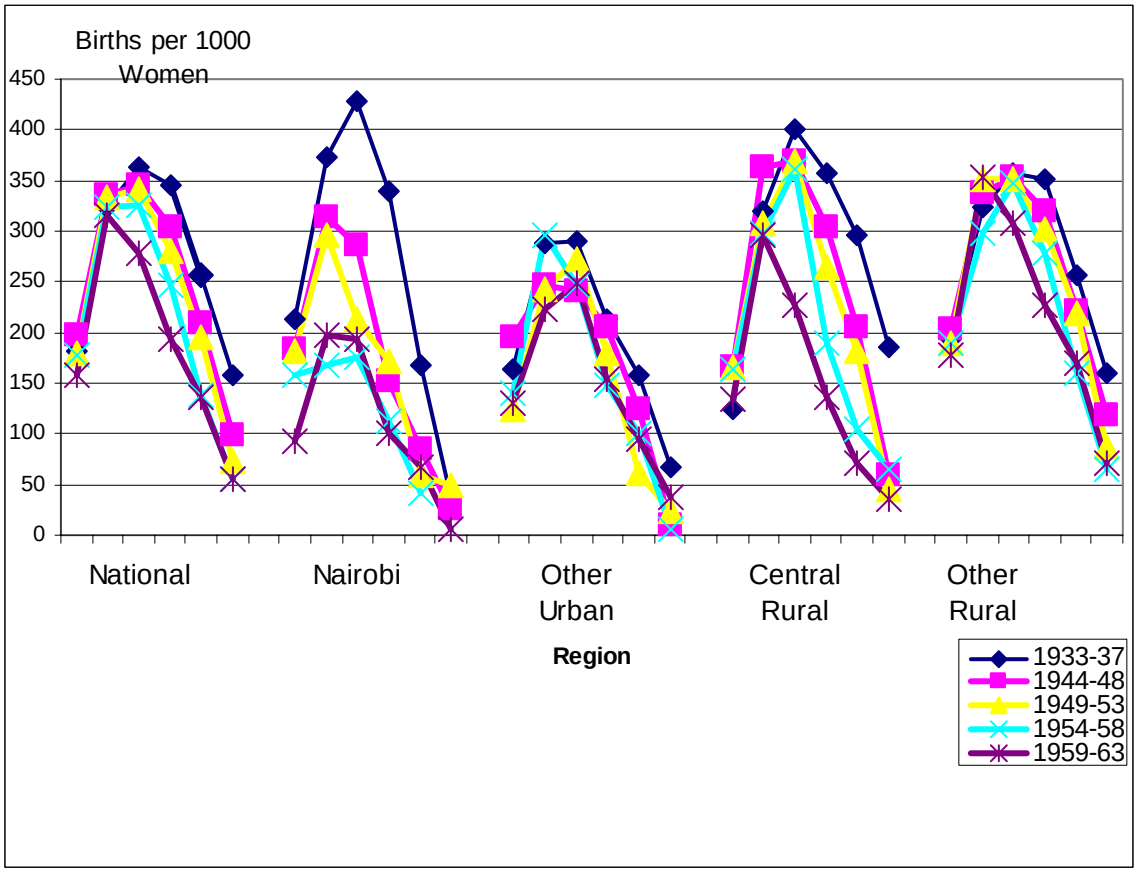
the decline was less, by 20.7% from 8.2 to 6.5 births for similar cohorts at the respective periods. For Nairobi, the results however show that there were no births to women aged 40-44 for the four-year period preceding the 1998 KDHS survey, suggesting that this may be an error in the data.

Table XI: Cohort Fertility Based on KFS and KDHS Surveys, Kenya

Birth Cohort	1933-37	1944-48	1949-53	1954-58	1959-63
Region/Age					
National:					
15-19	182	197	180	177	158
20-24	323	335	334	324	315
25-29	364	346	342	326	278
30-34	345	304	281	247	193
35-39	256	210	195	138	136
40-44	158	99	73	56	56
Total	8.1	7.5	7.0	6.4	5.7
Nairobi:					
15-19	213	184	182	158	92
20-24	373	314	296	168	197
25-29	429	287	214	176	194
30-34	340	152	171	112	100
35-39	167	84	59	42	68
40-44	38	25	49	*	5
Total	7.8	5.2	4.9	3.3	3.3
Other Urban:					
15-19	164	196	125	141	131
20-24	288	246	243	297	223
25-29	290	240	273	246	249
30-34	213	205	180	149	153
35-39	158	125	61	101	94
40-44	68	10	23	5	37
Total	5.9	5.1	4.5	4.7	4.4
Central Rural:					
15-19	125	166	165	163	135
20-24	319	363	307	299	296
25-29	401	370	369	361	227
30-34	357	304	264	190	137
35-39	297	205	182	104	72
40-44	185	60	45	65	36
Total	8.4	7.3	6.7	5.9	4.5
Other Rural:					
15-19	194	204	190	189	178
20-24	324	337	352	299	354
25-29	358	353	351	347	307
30-34	351	319	301	278	227
35-39	257	222	219	160	169
40-44	159	118	86	65	71
Total	8.2	7.8	7.5	6.7	6.5

When change in cohort fertility by age groups, depicted in Figure 5, is examined, four issues emerge: fertility change among older women, change among younger women, concavity of the fertility schedules, and the direction of change. Regarding the first observation, change in fertility among older women, these results show that at the national level and the rural areas including Central Province, the pattern of change is consistent with the idea of age-dependent fertility decline (Coale and Trussell 1974; Knodel 1977) - the fertility reductions being much higher among older than younger women. There are exceptions however: Although substantial declines are also noted among women in their middle reproductive careers in Nairobi, the reverse is true among women older than 40 years in the same city. The small declines among this older group in Nairobi may indicate effects of either small sample size or intense fertility limitation at this late reproduction stage. Also exempt from this pattern are the other urban areas where decline is uniform among all age groups.

Figure 5: Cohort ASFRs for Women Aged 40-44 Years, Kenya 1977/78-2003



Note: Each curve represents ASFRs for the birth cohort aged 40-44 years at the respective survey

For the second observation, fertility change among women in the early reproductive stage, Figure 5 shows that at the national level and in the rural areas, fertility has departed only modestly from its initial natural level. In the urban areas on the other hand, the suggestion of fertility change among all age groups (Caldwell et al. 1992) is supported, as the declines are large particularly in Nairobi and to some extent the other urban areas. Thirdly, regarding concavity, it is in rural Central Province, Nairobi, and other urban areas that the pattern of parity-dependent fertility control is evident. In these three regions, in contrast to the national level and other rural areas, fertility of the more recent cohorts, those born since 1949, seems to show the concave pattern associated with rapid decline among older women as they try to limit their family size (Knodel 1977).

Fourthly, concerning the direction of change, while change from natural fertility at the national level is negative (meaning a reduction in fertility for each subsequent cohort relative to the initial natural fertility regime of the 1933-1937 birth cohort) when the cohorts were older than 24 years, this is not always true for younger generations. Thus at the national level, in other rural areas as well as in rural Central Province, fertility for the 1944-1948 cohort at age 15-24 years increased over that for the earlier generation born during 1933-1938. The causes of these reversals are not well understood. For Central Province, a baby boom following the Mau Mau independence struggle of the 1950s - a struggle that may have destabilized family systems in that region - could be an explanation (Hionidou 1998 ; Bauni et al. 2000). For the country as a whole, it is similarly noted that the generation related to this increase in fertility started childbearing in the early 1960s just after political independence - a time of prosperity and significant improvements in health (Brass and Jolly 1993). Lastly, it is also observed that the two most recent generations have fertility rates that are almost equal when they were older than 39 years (Figure 4).

Parity Progression

As well as examining the time it takes to move from one birth order to the next using birth interval analysis which represents a timing or tempo effect, it is also useful to look at the quantity or quantum of the family building process. The latter is often addressed through parity progression ratios (PPRs). Nevertheless, application of the classical PPR formula on the available cross-sectional data entails bias for at least two reasons. First, such data are right-

censored, and secondly there is the problem of selectivity of higher parity women. The first of these two problems is addressed through the use of life-table techniques, details of which can be found in a number of papers (Rodriguez and Hobcraft 1980; Smith 1980).

Table XII and Figure 6 below show the distribution of parity progression ratios (PPRs) for cohorts of Kenyan women born over the period 1933 to 1963. The results, derived using life table techniques, show that beginning with the 1959-63 birth cohort, which commenced childbearing during 1974-1978, there was a transition to lower fertility in Kenya. At the national level, this transition is marked at all parities. A similar transition can be observed at the sub-national levels. The difference however is that it begins earlier in the sub-national levels, particularly in the two urban areas. The transition to lower fertility among successive generations of Kenyan women is also more precipitous at higher birth orders. Similarly, this transition to lower childbearing at higher birth orders is more rapid in the urban areas and rural Central province as compared to the rest of rural Kenya.

The results in Table XII and Figure 6 also provide an indication of the evolution of childbearing among women beginning reproduction in Kenya. With regard to the first birth, the results show that for successive generations of women born between 1933 and 1963, virtually all (at least 97%) had a first birth. The exception is in Nairobi, where for the cohorts born between 1954 and 1963, the proportion reduced slightly to between 95 and 96%. Similarly, the proportion of women who go on to have the second child at the national level has been constant at around 90% over successive generations. At the sub-national level however, variations are noted. While this pattern is maintained in the other rural areas and to some extent rural Central Province, the urban areas exhibit a different trend. In Nairobi city, the proportion has decreased from 89% for the 1933-37 birth cohort to 79% among the 1959-63 cohort. In the other urban areas, the proportion first increased from 83% among the earliest birth cohort to 93.6% for the 1949-53 cohort. Then it declined to reach 83% again for the 1959-63 cohort.

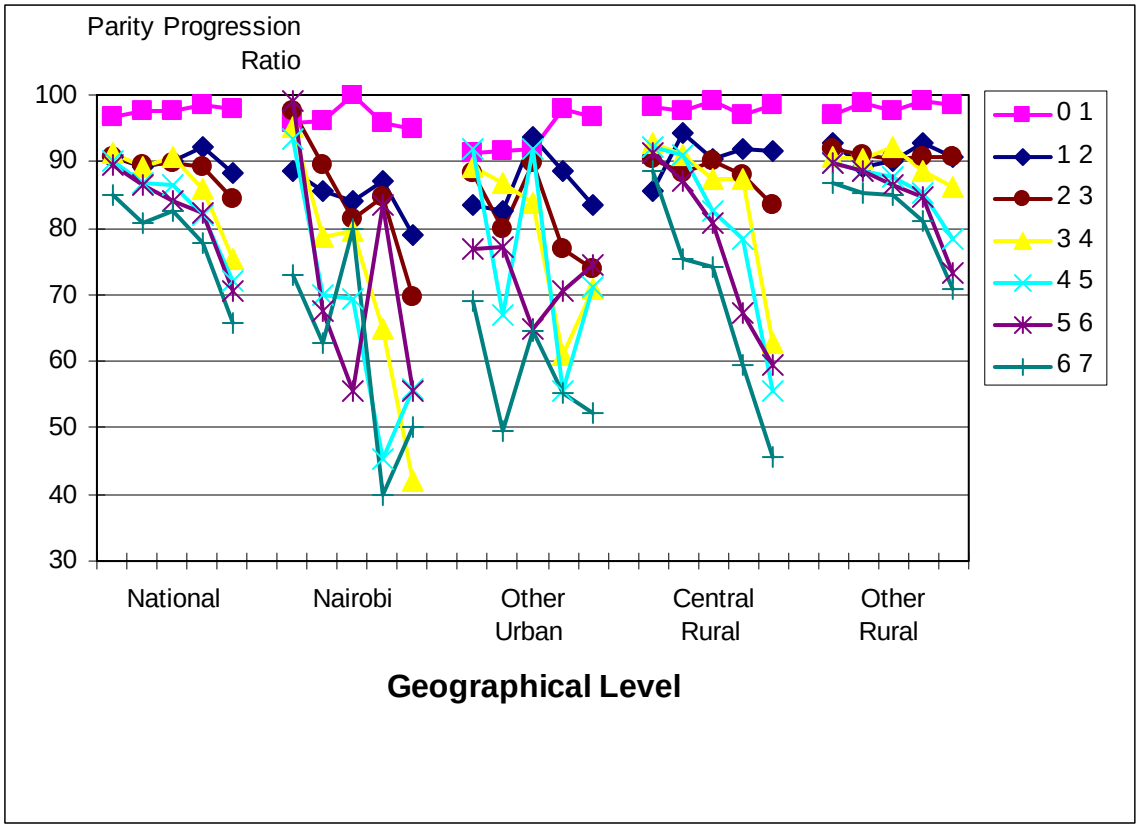
In the other rural areas, unlike in urban areas and rural Central province, the proportion of women progressing to the second and third birth has been constant among more recent birth cohorts. However, like the urban areas and Central Province, there has been a dramatic decline in

the proportion of women progressing from the third to higher-order births. Thus, although early and high childbearing has been a consistent characteristic of rural Kenya - where the majority of the population lives - in the same population however, there was also dramatic change to fertility limitation at higher birth orders, this change being more pronounced in urban areas and rural Central province.

Table XII: Proportion of Women Progressing from One Parity to the Next within Five Years, Kenya, 1933-37 to 1959-63 Birth Cohorts

Birth Order	**0-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-6**	**6-7**
Region/Coht							
National							
33-37	96.7	90.6	90.6	91.2	90.1	89.4	85.0
44-48	97.6	89.2	89.4	89.3	86.8	86.4	80.9
49-53	97.6	90.1	89.8	90.6	86.6	84.1	82.5
54-58	98.6	92.3	89.1	85.9	82.0	82.3	77.9
59-63	97.8	88.2	84.3	75.2	72.0	70.4	65.6
Nairobi							
33-37	95.8	88.7	97.6	95.3	93.3	99.1	73.0
44-48	96.0	85.5	89.6	78.7	70.1	67.7	62.7
49-53	100.0	84.2	81.3	79.5	69.2	55.6	80.0
54-58	95.8	87.0	84.6	64.7	45.5	83.3	40.0
59-63	94.9	79.0	69.5	42.1	55.7	55.6	50.0
Other Urban							
33-37	91.3	83.5	88.2	89.1	91.8	76.8	69.0
44-48	91.5	82.6	80.0	86.7	66.9	77.3	49.6
49-53	91.9	93.6	89.7	83.9	92.0	64.8	64.5
54-58	97.8	88.6	76.9	61.0	55.6	70.6	55.1
59-63	96.7	83.5	73.8	70.8	71.2	74.4	52.3
Central Rural							
33-37	98.1	85.7	90.4	92.8	92.1	91.1	88.6
44-48	97.6	94.4	88.2	91.0	91.0	87.0	75.4
49-53	99.1	90.4	90.0	87.4	82.5	80.6	74.1
54-58	97.0	92.0	88.0	87.5	78.4	67.1	59.4
59-63	98.6	91.7	83.3	62.6	55.4	59.6	45.7
Other Rural							
33-37	96.9	92.8	91.8	90.8	89.8	89.9	86.9
44-48	98.8	89.3	91.1	90.5	88.6	88.6	85.2
49-53	97.6	90.1	90.4	92.3	87.8	86.5	84.9
54-58	99.0	92.8	90.6	88.5	85.2	84.6	81.2
59-63	98.4	90..6	90.7	86.1	78.3	73.2	71.0

Figure 6: Parity Progression Ratios for Kenya, Women Born over 1933-1963



Note: Each curve represents parity progression ratios are for cohorts born during 1933-1937, 1944-1948, 1949-1953, 1954-1958, and 1959-1963 respectively.

5.3 Change in Proximate Determinants

Age at First Marriage

In this section, patterns in the change in fertility are compared to those in proximate determinants; it is useful to briefly recount the components of proximate determinants. Variation in fertility takes place through the proximate determinants, which can be grouped into three - exposure factors, marital fertility control, and natural marital fertility (Bongaarts 1978). Age at first marriage and at first birth fall under exposure, which represents the proportion of women married. Contraception and induced abortion fall under the second group. The third group comprises lactational infecundity, frequency of intercourse, sterility, spontaneous intrauterine mortality, and duration of the fertile period.

Of the proximate determinants, age at first marriage and contraception are examined in this sub-section. Studies conducted in the past (Westoff 1992) have shown that the first (age at first marriage) influences fertility decline substantially, with an increase of one year of age at first marriage leading to a decrease of five to six percent in the TFR. It should also be noted that the relationship between age at first marriage and fertility is derived from the relationship between the concepts of nuptiality and natural marital fertility (Coale and Trussell 1974; United-Nations 1983). In natural fertility populations, marital fertility is independent of age at marriage. The fertility of women at any reproductive age is therefore a product of their marital fertility and the proportion currently married at that age group. The proportion married in turn is a function of the age at which first marriage begins. As reporting of first marriage and first births at older ages has been found to be a problem (Ferry and Page 1984; Goldman et al. 1985; van de Walle 1993) this analysis was restricted to women aged 15-24 years.

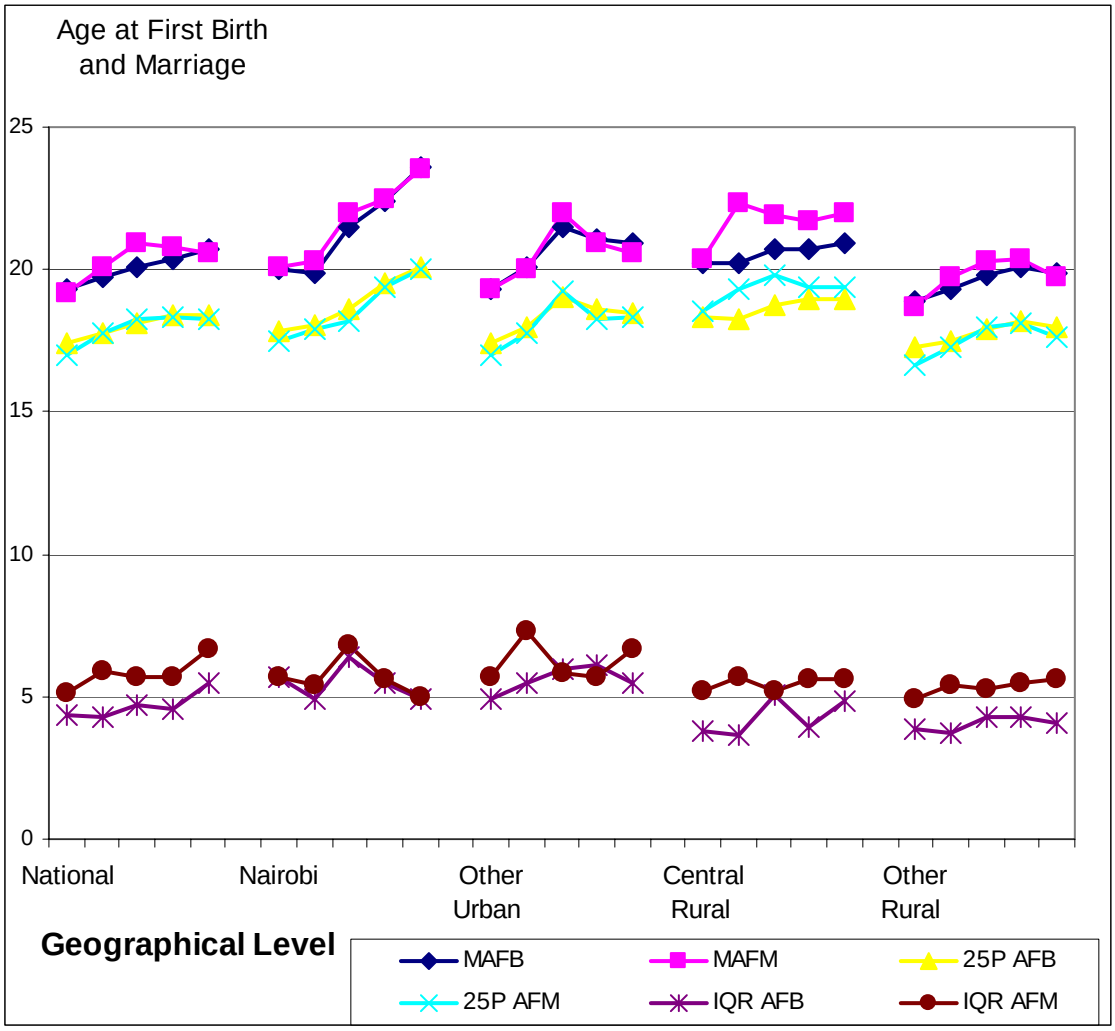
For age at first marriage and at first birth, three measures of central tendency - the 25^{th} percentile, 50^{th} (median), and the 75^{th} percentile (not shown) - were initially estimated. A simple measure of dispersion, the inter-quartile range (IQR), was similarly calculated. These estimates were derived using life table techniques, and details of the methodology can be found in a number of references (Rodriguez and Hobcraft 1980; Cleves et al. 2004). These descriptive statistics are shown in Table XIII and illustrated in one graph, Figure 7 below.

Table XIII: Age at First Birth and First Marriage for Various Quartiles, Kenya 1977/78-2003

Factor	Age at First Birth			Age at First Marriage		
Age Grouping	15-24		15-49	15-24		15-49
Percentile	25P	50P	50P	25P	50P	50P
Year/Region						
1977/78:						
National	17.4	19.3	19.1	17.0	19.2	18.4
Nairobi	17.8	20.0	19.6	17.5	20.1	20.1
Other Urban	17.4	19.3	19.1	17.0	19.3	19.7
Central Rural	18.3	20.2	19.7	18.5	20.4	20.0
Other Rural	17.3	18.9	18.9	16.6	18.7	18.3
1988/89:						
National	17.7	19.7	19.1	17.8	20.1	19.0
Nairobi	18.0	19.9	19.9	17.9	20.3	20.1
Other Urban	17.9	20.1	20.1	17.7	20.0	19.7
Central Rural	18.2	20.2	20.2	19.3	22.3	20.0
Other Rural	17.5	19.3	19.3	17.3	19.7	18.3
1993:						
National	18.1	20.1	19.5	18.3	20.9	19.5
Nairobi	18.6	21.5	21.0	18.2	22.0	21.4
Other Urban	19.0	21.5	20.7	19.2	22.0	21.0
Central Rural	18.8	20.7	19.7	19.8	21.9	20.7
Other Rural	17.9	19.8	19.2	18.0	20.3	19.0
1998:						
National	18.4	20.4	19.8	18.3	20.8	19.7
Nairobi	19.5	22.4	22.1	19.4	22.5	22.1
Other Urban	18.6	21.1	20.6	18.3	20.9	20.5
Central Rural	18.9	20.7	20.3	19.4	21.7	21.1
Other Rural	18.2	20.1	19.5	18.1	20.4	19.3
2003:						
National	18.4	20.7	20.3	18.3	20.8	20.3
Nairobi	20.1	23.6	22.7	20	23.5	22.9
Other Urban	18.4	20.9	20.8	18.3	20.8	20.8
Central Rural	18.9	20.9	20.4	19.4	21.3	21.3
Other Rural	18.0	19.9	19.5	17.6	19.8	19.3

Notes: 25P: 25th percentile; 50P: Median

Figure 7: Trends in Age at First Marriage and at First Birth, Kenya 1977/78-2003



Notes: MAFB= Median Age at First Birth; MAFM=Median Age at First Marriage; 25P AFB= 25th Percentile of the Age at First Birth; 25P AFM=25th Percentile of the Age at First Marriage; IQR = Inter-quartile Range; In the trends, the first point corresponds to the estimate obtained from the 1977/78 survey, and so on, with the last representing the estimate from the 2003 KDHS.

The first observation to be made from Figure 7 is the apparent contradiction between age at first marriage and at first birth; the median for the two (at the national level) is used to illustrate this observation. While in the 1977/78 survey age at first marriage is shown to precede first birth as expected, for the remaining surveys, the ages are about the same or the former takes place after the latter. This gives an impression of exceptionally high out-of-marriage births, and implies that the statistics might be misleading. The same pattern can be observed at the sub-national level (particularly rural Central Province) and with the other measure, the inter-quartile range.

Previous studies (van de Walle 1993) observed that in Zimbabwe, when asked in survey interviews about the date of first marriage, women tend to report the date of official registration of the union; this date often turns out to be later than that at which the couple started living together or had their first birth. These observations from Zimbabwe could also help in explaining this contradiction for Kenya, which seems to suggest that age at first marriage is biased upwards.

The second observation from Figure 7 is the rise in the median age at first marriage over time and at all geographical levels; a similar trend can be discerned with regard to the 25th percentile, for age at first marriage and at first birth alike. At the national level, the median age at first marriage rose from 19.2 years in 1977/78 to 19.8 in 2003. The increase was however greatest in Nairobi, from the higher level of 20.1 years in 1977/78 to 23.5 in 2003. The 25th percentile also increased most in the capital city – from 17.5 years in 1977/78 to 20.0 in 2003. In contrast, at the national level, the 25th percentile increased from 17.0 years to 18.3 over the same time period.

Thirdly, as with fertility, the trend in the median age at first marriage shows that it first increased and then stabilised or marginally reversed. As can be seen in Figure 7, all the two measures of central tendency for age at first marriage followed this trend at the national level, other rural areas, and urban areas. For Nairobi, in contrast, a continuous increase in median age at first marriage prevailed. Thus, areas associated with greater fertility declines such as Nairobi, are also associated with greater increase in age at first marriage. Nevertheless, while fertility also continuously and drastically decreased in rural Central Province, the median age at first marriage has been constant there at between 21.9 and 21.3 years over the period 1993-2003.

Contraception

Along with marriage, contraception is another proximate determinant of fertility (Davis and Blake 1956; Bongaarts 1978; Brass and Jolly 1993), and the trends in its evolution are shown in Table XIV and Figure 8 below. According to the seminal work on the subject of the age pattern of fertility (Knodel 1977; United-Nations 1983) contraception is any parity-dependent method used to prevent conception. Its absence implies natural fertility, the case in which there is no fertility control that depends on the number of children already born. Natural methods which also

affect fertility but are not dependent on parity, such as breastfeeding, and post-partum abstinence due to lactation or temporary separation are considered part of natural fertility.

The results presented here refer to the prevalence of modern contraception, where prevalence is defined as the percentage of married women using a contraceptive method (Rutstein and Rojas 2003). Modern methods are as defined in the survey data and reports (CBS 1980; NCPD 1989; NCPD 1994 ; NCPD 1999; CBS et al. 2004). They include pills, IUD, douche, diaphragm, (male) condom, female condom, female sterilization, male sterilization, injection, norplant implants, and emergency contraception. Traditional methods comprise withdrawal and abstinence.

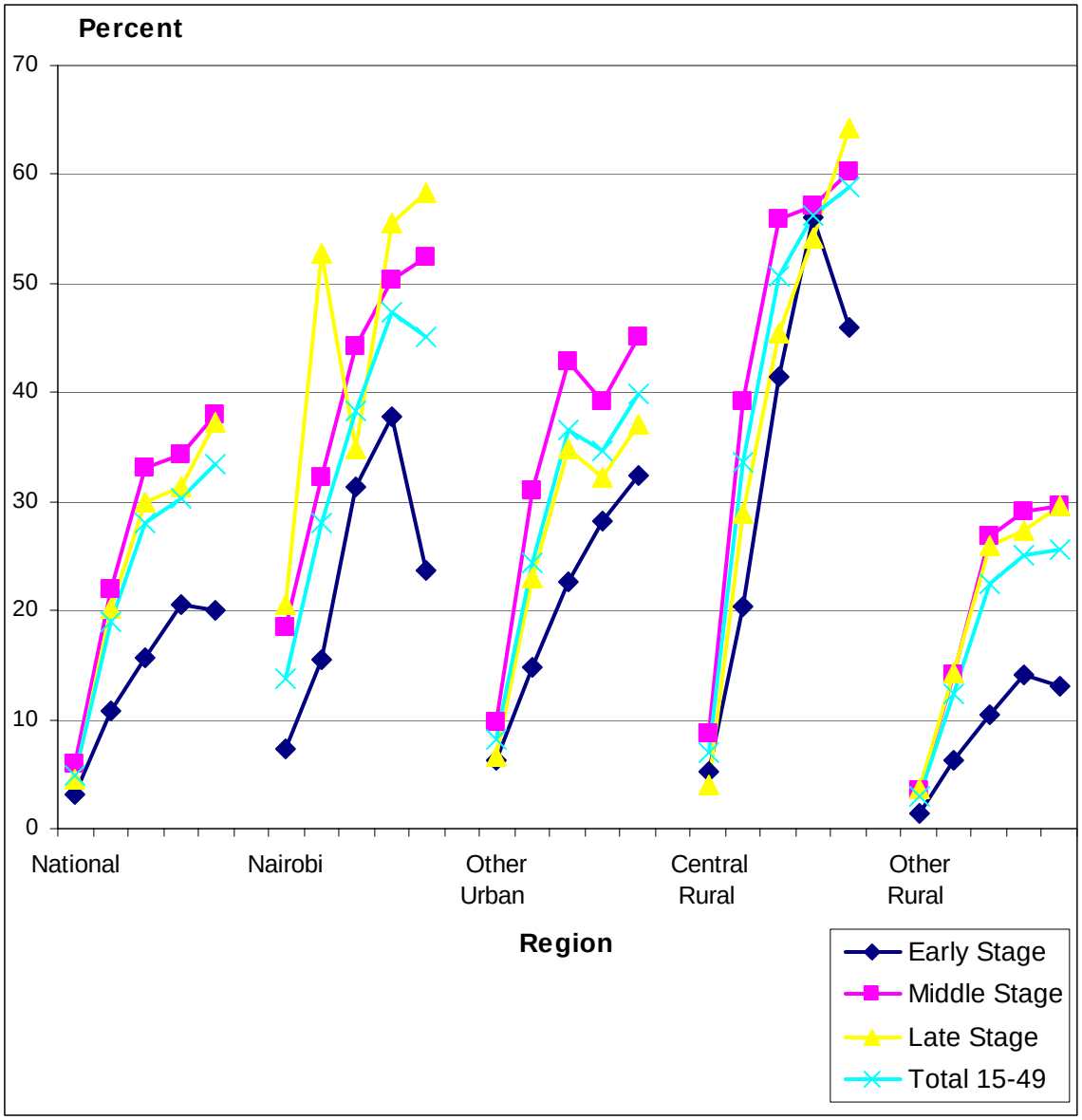
A number of observations can be made based on Table XIV and Figure 8. First, contraceptive prevalence generally increases with time at all geographical levels. This trend was initially rapid, then slower. In Nairobi Province however, contraceptive prevalence declined more recently. Thus, at the national level, contraceptive prevalence for modern methods increased from 4.9% in 1977/78 to 18.9% in 1988/89, 28.1% in 1993, 30.3% in 1998, to reach 33.4% in 2003.

Table XIV: Current Contraceptive Use (%) among Married Women Aged 15-49 Years, Kenya 1977/78–2003

Level	National			Nairobi			Other Urban			Central Rural			Other Rural		
Method/Number	M	T	N	M	T	N	M	T	N	M	T	N	M	T	N
Year/Age															
1977/78:															
15-24	2.6	2.1	1577	6.5	2.1	190	5.8	1.3	223	5.3	3.2	136	1.5	2.1	1028
25-39	5.1	2.2	3020	19.1	2.1	217	9.1	2.0	306	8.7	1.6	449	3.3	2.3	2048
40-49	4.4	3.5	1018	25.2	0.0	34	4.9	2.5	60	4.2	5.4	173	4.0	3.2	751
15-49	4.3	2.4	5615	13.9	2.0	441	7.5	1.8	589	7.1	2.8	758	2.9	2.4	3827
1988/89:															
15-24	10.6	7.7	1112	15.5	3.6	194	14.8	2.3	216	22.6	4.2	103	7.0	10.2	599
25-39	20.7	10.0	2579	32.2	7.7	261	31.0	7.1	326	32.1	10.7	403	16.4	10.4	1589
40-49	20.2	8.4	869	52.7	3.6	55	22.9	2.1	48	31.3	6.2	183	16.0	9.4	583
15-49	18.3	9.1	4560	28.0	5.7	510	24.4	4.9	590	30.2	8.4	689	14.4	10.1	2771
1993:															
15-24	16.1	5.1	1094	31.4	1.4	70	23.9	0.0	106	41.7	5.4	99	10.0	6.3	819
25-39	32.5	5.8	2401	44.2	10.5	95	45.5	6.1	247	53.9	6.3	320	25.8	5.3	1739
40-49	29.5	5.7	834	34.8	13.0	23	35.7	4.6	43	47.3	5.9	143	25.0	5.4	625
15-49	27.7	5.6	4329	38.3	7.5	188	38.7	4.3	396	50.0	6.1	562	21.6	5.6	3183
1998:															
15-24	21.3	6.9	1170	37.7	4.9	61	31.0	6.9	192	54.3	4.8	82	13.0	7.5	835
25-39	35.8	8.2	2579	50.4	11.0	127	41.6	9.3	314	56.8	5.5	261	29.6	8.1	1877
40-49	32.6	6.8	882	55.6	11.1	27	36.9	5.9	62	49.8	10.4	96	27.8	6.1	697
15-49	31.6	7.7	4631	47.4	9.3	215	37.5	8.1	568	54.9	6.4	439	25.2	7.6	3409
2003:															
15-24	20.0	5.1	985	23.7	5.3	130	32.5	2.9	191	45.9	6.9	96	13.0	5.4	568
25-39	38.0	9.4	2219	52.3	7.7	302	45.0	10.5	372	60.3	8.2	345	29.6	9.7	1200
40-49	37.0	9.4	840	58.4	7.3	81	37.1	13.1	117	64.3	11.0	143	29.6	8.7	499
15-49	33.4	8.4	4044	45.1	7.0	513	39.8	8.7	680	58.9	8.6	584	25.5	8.4	2267

Notes: Legend for the columns: M=Modern Methods; T=Traditional Methods; N=Sample Size.
The percentages using a modern method, a traditional method, and Not Using add up to 100.

Figure 8: Trends in Prevalence of Modern Contraceptive Methods, Kenya 1977/78-2003



Secondly, it can be observed from Figure 8 that regions registering the highest increase in contraceptive prevalence are also those in which period and cohort fertility declined most over time. This is true for rural Central province where prevalence of modern contraception for women older than 24 years rose from below 9% in 1977/78 to over 60% in 2003. Although a substantial decrease in period and cohort fertility occurred in the capital city as well, the corresponding increase in contraceptive prevalence is lower than in rural Central Province at all age groups. Similarly, in the other rural areas, where the decline in fertility was least among the

sub-national levels, increase in contraceptive prevalence in all reproductive stages was also lowest. Thus, while age at first marriage increased most in the capital city, remaining constant but at an equally high level in Central Province, contraceptive prevalence increased most in rural Central Province.

The third observation in the trend in contraceptive prevalence relates to its association with age. As a corollary of the idea of parity-specific fertility control, it would be expected that contraceptive prevalence increases with age. The results show that this is not always the case. This pattern (of an apparent association between increasing contraceptive prevalence and age), is most evident only in the capital city. In contrast, contraceptive prevalence for women aged 25-39 years is higher than that for those older than 40 years at the national level as a whole, other rural and other urban areas, and rural Central Province. Higher contraceptive prevalence in Nairobi city among this group relative to the younger can be understood from the basis of higher motivation for fertility control in the city. Nevertheless, the situation is not as clear-cut for their counterparts in the rural areas at this late stage of reproduction. Terminal abstinence in a situation of motivation for fertility control among these older women in rural areas is one possible explanation (Ferry and Page 1984; Caldwell et al. 1992).

Fourthly, lower contraceptive prevalence is noted for women aged 15-24 years in comparison to those who are older at all levels, except in rural Central Province where the estimates are closer to each other for all three reproductive stages. It is also noted, in making comparative reference to Figure 4 (on changes in period fertility over time), that the decrease in the decline of period fertility among women aged 15-24 is most consistent, almost linear, in rural Central Province; this is unlike in other regions where it is more unstable. Historically however, cohort fertility among young women in rural Central Province, like that at the national and other rural areas, has changed less over the past, unlike in the capital city, where there have been substantial reductions from the natural fertility levels (Figure 5). Together with the increasing and constant trends in nuptiality in rural Central and Nairobi provinces respectively shown in Figure 7, these observations may reflect the influence of different transitions to parenthood and adulthood (working life). In rural Central Province as in other rural areas, among young women aged 15 to 24 years, direct transition to parenthood after completing school may be playing a more

important role. In Nairobi city on the other hand, both the motivation to possibly stay longer in school and formal employment may combine to bring about a higher and rising age at first marriage and first birth (Bledsoe and Cohen 1993).

The last observation on the trends in contraceptive prevalence relates to the starting pattern in the 1970s. At the national level and other regions except Nairobi, low and almost equal contraceptive prevalence is noted for the late 1970s at all reproductive stages. In the capital city in contrast, use of modern contraceptive methods was already higher then among women older than 24 years compared to those who were younger. The decline in period fertility over 1977/78-1989 was similarly higher at all age groups in the urban areas, and in rural Central Province as well. This pattern, of comparatively higher contraceptive use observed in Nairobi in 1977/78 is also repeated in the relatively higher age at nuptiality in the capital city and rural Central Province. These observations may suggest the start of contraceptive diffusion and innovation in most rural areas then, when women in the capital city and rural Central Province were already being counted among early adopters (Watkins 2000).

Two observations can be made regarding traditional methods. First, although, as with modern methods, use of traditional methods has generally increased, the range is much lower, and is confined to between 2 and 10%. Secondly, if modern contraceptive methods were an innovation in Kenya, only introduced in the 1950s during the colonial period, first in the capital city (Jain 1998; Watkins 2000), the results similarly show the extremely low or negligible level of use of traditional methods in those formative years. For example in 1977/78, use of traditional methods among women in the three reproductive stages was only between 2.2 and 3.2 percent. Combined with the similarly low level of use of modern contraceptive methods, this implies that the cohort fertility schedules shown in Table XI and Figure 5 for the oldest generation - those born between 1933 and 1938 - could generally represent natural fertility and hence serve a useful reference for evaluating departures towards controlled fertility.

5.4 Stopping and Spacing Behavior

Fertility Preferences

The idea of stopping behaviour is a major linchpin in the theory of fertility transition. Under this concept, couples decide early in their reproductive life how many children to have, and will start practicing voluntary fertility control when this desired family size is achieved. This implies that desire for no more children should be positively related with age (Knodel 1977; Hionidou 1998).

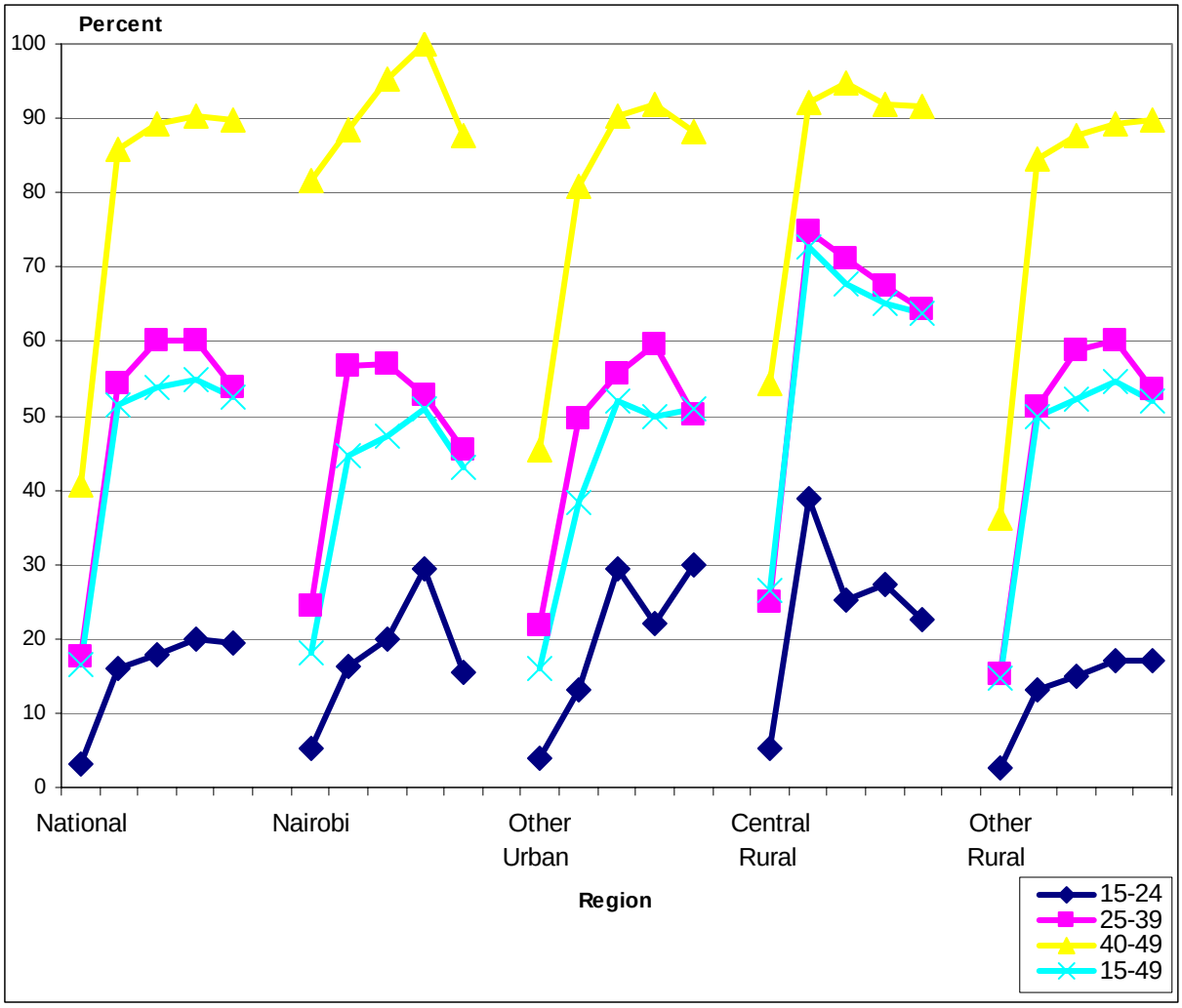
It can be seen from Table XV and Figure 9 that, as with other factors thus far examined in this chapter, the trend over time in the change of the proportions of women wanting no more births can be divided into two phases. These are an initial increase, and then a stagnation or decline in the more recent past at all stages of reproduction and at all geographical levels. For example, among all women of reproductive age, this percentage rose from 16.6 in the 1977/78 KFS to 51.5 in the first KDHS implemented in 1988/89. Thereafter, it remained at the 1988/89 level until the most recent KDHS survey in 2003. Thus, it is to be noted that between 1998 and 2003, fertility preferences in the form of desire for no more children followed a trend that is similar to that of current and cohort fertility – a levelling off. Given conclusions from a number of studies (Bongaarts and Watkins 1996; Bongaarts 2006; White et al. 2007) that point to a relationship between fertility and family size norms (fertility preferences), the trends in these two factors might provide a clue to the constant fertility experienced in the country between 1998 and 2003.

Table XV: Fertility Preferences among Married Women Aged 15-49, Kenya 1977/78-2003

Level	National				Nairobi				Other Urban				Central Rural				Other Rural			
Preference	W	S	U	N	W	S	U	N	W	S	U	N	W	S	U	N	W	S	U	N
Year/Age																				
1977/78:																				
15-24	89.6	3.3	7.1	1551	88.3	5.3	6.4	185	90.6	3.9	5.5	221	93.8	5.3	0.9	136	89.2	2.7	8.1	1009
25-39	64.3	17.6	18.1	2828	59.5	24.5	16.0	201	66.9	21.8	11.3	290	64.3	24.8	10.9	435	64.4	15.3	20.3	1902
40-49	37.5	40.6	21.9	675	5.6	81.6	12.7	20	33.0	45.3	21.7	38	31.5	54.2	14.3	132	39.8	36.3	23.9	485
15-49	68.0	16.6	15.4	5054	70.7	18.0	11.3	406	74.3	16.1	9.6	549	64.0	26.5	9.5	703	68.0	14.7	17.3	3396
1988/89:																				
15-24	78.3	16.0	5.7	1103	75.8	16.3	7.9	190	82.2	13.1	4.7	213	55.3	39.0	5.7	103	81.5	13.0	5.5	597
25-39	38.5	54.4	7.1	2528	37.5	56.6	5.9	256	44.0	49.7	6.3	320	21.4	74.7	3.9	398	41.0	51.1	7.9	1554
40-49	10.4	85.9	3.7	803	9.6	88.5	1.9	52	19.0	81.0	0.0	42	7.0	92.2	0.8	176	10.9	84.6	4.5	533
15-49	42.4	51.5	6.1	4434	49.2	44.6	6.2	498	56.4	38.4	5.2	575	23.9	72.6	3.5	677	43.4	49.9	6.7	2684
1993:																				
15-24	75.8	17.8	6.4	1089	68.6	20.0	11.4	70	60.5	29.3	10.2	105	74.4	25.2	0.4	98	79.0	15.0	6.0	816
25-39	32.7	60.0	7.3	2353	40.0	56.8	3.2	95	36.2	55.7	8.1	239	25.9	71.2	2.9	317	32.9	58.8	8.3	1702
40-49	7.2	89.2	3.6	735	0.0	95.2	4.8	21	5.0	90.2	4.8	39	4.0	94.6	1.4	128	8.4	87.6	4.0	547
15-49	39.7	53.9	6.4	4177	46.2	47.3	6.5	186	39.8	51.9	8.4	383	30.2	67.7	2.1	543	40.8	52.2	7.0	3065
1998:																				
15-24	76.3	19.8	3.9	1169	62.3	29.5	8.2	61	73.4	22.0	4.6	190	70.0	27.2	2.8	82	79.6	17.1	3.3	834
25-39	35.4	60.2	4.4	2549	42.4	52.8	4.8	125	34.6	59.5	5.9	311	29.8	67.4	2.8	258	35.5	60.1	4.4	1855
40-49	5.7	90.3	4.0	795	0.0	100.0	0.0	22	5.3	91.9	2.8	54	3.9	91.8	4.3	95	6.4	89.2	4.4	624
15-49	40.9	54.9	4.2	4511	43.7	51.0	5.3	208	45.0	49.8	5.2	555	31.9	65.0	3.1	435	41.2	54.7	4.1	3313
2003:																				
15-24	78.2	19.5	2.3	982	84.2	15.4	0.4	129	69.3	30.0	0.7	190	72.7	22.7	4.6	96	80.0	17.2	2.8	567
25-39	42.7	53.9	3.4	2200	50.6	45.5	3.9	301	45.6	50.0	4.4	368	32.7	64.4	2.9	344	43.1	53.7	3.2	1187
40-49	8.8	89.7	1.5	779	11.4	87.6	1.0	76	11.9	88.1	0.0	111	6.7	91.5	1.8	134	8.4	89.9	1.7	458
15-49	44.7	52.6	2.7	3961	54.6	42.9	2.5	506	46.5	51.0	2.5	669	33.3	63.8	2.9	574	45.2	52.0	2.8	2212

Key: W= Want more children; S=Do not want any more (Stopping); U=Undecided; N=Sample Size

Figure 9: Trends in Desire for No More Births, Kenya 1977/78-2003



When individual reproductive stages are examined in Figure 9, it emerges that it is the level of stopping that is different. The proportion of women not wanting any more births is highest, as expected, among women aged 40-49, and lowest among those aged 15-24; with those in the middle reproductive stage lying between the two extremes. These results are in concert with the findings on fertility and proximate determinants, where levelling off in the decline of period fertility was observed at the late and middle reproductive stages in all regions except rural Central Province, and increased contraceptive use observed in all geographical settings. They are also consistent with earlier findings on fertility and nuptiality at the early reproductive stage. As desire for no more births remained constant at the national level and other rural areas among

young women aged 15-24 years, age at first marriage, and period fertility similarly changed little in these geographical settings. In the urban areas however, fertility preferences for no more births showed a decline in the recent past.

Spacing Behaviour

The findings presented in Table XV also allow examination of spacing behaviour. The results show that spacers, as distinct from stoppers, form a substantial proportion of women aged 40-49 and 25-39 years. For example, at the national level between 1988 and 2003, spacers comprised between 5.7 and 10.5 percent of married women aged 40-49, and between 32.7 and 42.7 percent of those aged 25-39. Also, as with desire for no more births (stopping behaviour), proximate determinants and period fertility, the trend in desire for more children shows the two phases in all three reproductive stages. This time though, the trend (in the proportion of women who want more children) begins with a decline, followed by an increase.

Conscious Choice

It is also useful to examine results on the changes in the proportions of women who are undecided or ambivalent towards the number of children they would like to have. This idea, also known as numeracy in the theory of the fertility transition, is premised on the assumption that couples do not think about or are unaware of an ideal family size before the change from a natural to a controlled fertility regime (van de Walle 1992; Mason 1997; Castle 2001). The results in Table XV show that the percentage of women who were undecided about whether they would want more children or not in the future has substantially declined from 15.7% in the late 1970s to less than 3% by 2003. This might imply that as the fertility transition evolved from a natural to a controlled fertility regime, women adopted more concrete positions on their fertility choices.

Summary

In this chapter, data from five sample surveys carried out in Kenya over the period 1977-2003 were used to explore the trends and patterns of fertility and its proximate determinants at the national and sub-national levels. The results can be summarized in a number of observations. First, above age 25, the departure of fertility for successive birth cohorts from the natural regime

is characterized by pattern rather than level, implying fertility limitation among older women. Secondly, a concave fertility schedule, which signifies parity-specific fertility control, is most evident in rural Central Province. These age patterns of fertility on the one hand and fertility control on the other are most evident in the urban areas and rural Central Province. Thirdly, when all the four sub-national levels are considered, it is only in Nairobi that the idea of a new type of fertility transition that is marked by a decline in all ages, including among women aged 15-24 years, is most apparent. A childbearing pattern of relatively later nuptiality (family formation) and lower fertility in urban areas accounts for this observation.

CHAPTER 6: TIMING OF THE SECOND AND THIRD BIRTHS AND THE FERTILITY TRANSITION IN KENYA

Introduction

In the previous chapter, findings on the trend patterns in fertility and associated proximate determinants were presented. One of the observations made was that the fertility decline followed an age pattern above age 25: the departure of fertility for subsequent birth cohorts from that of the natural regime increases with age, implying fertility limitation among older women. On the other hand, fertility among successive generations of younger Kenyan women aged 15 to 24 years did not change as much, except in the capital city. A basic question then arises: "Is the difference in fertility decline in the urban as compared to the rural areas due to a lack of fundamental change in fertility determinants in the rural areas, or caused by independent trends (change in behaviour) in the urban areas?" Basing on these results and question, this chapter addresses the second objective of the dissertation – factors related to the rapid fall and the reduced speed of fertility decline in fertility among women in the early stage of childbearing, and in particular, the covariates of the transition to the second and third conceptions leading to live births over the twelve-year periods 1977-1989 and 1991-2003. The two periods represent respectively, the time when fertility declined rapidly in the country, and when the rate of decline slowed down.

The objectives and arguments related to the change to the second and third births were presented in sections 1.6 and 1.7.3 (on research objectives and justification respectively). However, a recapitulation of the conceptual relationships between the Kenyan fertility transition and progression to second and third births is useful. To the extent that the Kenyan fertility transition can be broken down into the previous phase of a rapid decline, and then one where it levelled off, it can be taken that the recent constant fertility is part of the fertility transition. The components of this fertility change can be viewed from the perspective of timing (tempo) and volume (quantum) (Preston et al. 2000). This chapter examines the transition to second and third births, and by so doing, addresses the timing effect.

The elements of the birth interval comprise the postpartum period, variations in the duration of breastfeeding, waiting time to conception, and gestation (Bongaarts 1978; Trussell et al. 1985). Changes in socio-economic factors, e.g. education and health, as well as deterioration in prospects for child survival, comprise factors that could lead to changes in the duration of the birth interval (Lloyd and Ivanov 1988; Hill 1993). There have been a number of pertinent changes in the health system in Kenya (for example cost-sharing for health services that were previously provided freely) as well as in education (the introduction of the 8-4-4 system of education being an example). A number of studies have also shown the physiological and replacement effects of child mortality in increasing fertility (Lloyd and Ivanov 1988; Ainsworth et al. 1998; Magadi and Agwanda 2007).

Since the majority of Kenyan couples would not yet have fulfilled their desired family size with just one child, it is expected that the progression to the second birth should be almost universal, and this points out the relevance of the old idea of parity-specific fertility control and of desire for a fixed family size (Knodel 1977). Increasingly however, there is a growing drift in the fertility literature towards a study of specific birth intervals and emphasis of context and processes surrounding each interval, and more so birth-spacing during early childbearing (Watkins 2000; Johnson-Hanks 2004); the analysis in this chapter is carried out with this view of modern birth-timing equally in mind.

There are additional merits for studying the second birth interval: studies show that first births are important in African culture (Kuaté Defo 1998; Gyimah and Fernando 2004). Also, investigating transitions from first to second and from second to third births is important because systematic changes in early birth intervals may be pointers to more fundamental changes in family building strategies, fertility, and investment in children. Similarly, a justification for examining the third birth interval - the progression from the second to the third birth – is that it marks the level of replacement fertility which is usually taken to be 2.1 births per woman (in contexts where there is low infant, child, and young adult mortality, and a fixed sex ratio at birth). It is therefore interesting to analyse research results in order to determine the circumstance that might persuade Kenyan couples to be content with two children or progress to higher parities.

Survival analysis is the main method used to accomplish the objective of this chapter, details of which were explicated in chapter four. Although hypotheses to be tested in this chapter were similarly presented in chapter one, it is useful to recapitulate them here. Two sets of hypotheses are tested in this chapter. First, for the transitions to both the second and third births, it is expected that results will show regional differences which reflect variations in the levels of development and culture between the provinces within a given time period and also over time. Given these hypothesized temporal disparities in development and culture, it is also expected that the variations will be more marked during the more recent period relative to the earlier, when fertility fell rapidly. This is because of the increasing effect of modernization with time, and possibly because different regions react differently over time to new ideas - some regions adopting change promptly, while others lag and embrace it only later. Secondly, following research results from several countries in sub-Saharan Africa (Kuaté Defo 1998; LeGrand et al. 2003; Gyimah and Fernando 2004), it is hypothesized that the number and sex composition of surviving children affect the timing of transition to the third birth.

This chapter is divided into basically two parts. In the first, section 6.1, preliminary examination of the data is conducted by presenting descriptive statistics for the respective covariates. The distribution of median waiting times to the second up to the sixth birth, as well as the graphical presentation of survivorship in the states of first and second birth are also presented. Section 6.2 presents the results of multivariate regression using the Cox model.

6.1 Univariate Analysis

6.1.1 Distribution of Covariates

The absolute and percentage distributions of covariates for the second birth interval are shown in Table XVI below, and the results indicate that the sample sizes are for the most part large enough for analysis. A corresponding distribution of covariates for the third birth interval is shown in Table XVII. For this interval, the distribution of both the first and the second child having died comprises only 19 cases each for the 1988/89 and 2003 datasets respectively,

meaning that there is relatively little information available to accurately estimate the impact of previous child deaths on the length of the birth interval.

Table XVI: Distribution of Women Having 1st Birth During 12 Years Preceding the Survey, Kenya

Observation Period	**1977-1989**		**1991-2003**	
Percentage/Number	Percentage	Number	Percentage	Number
Region :				
Nairobi	9.3	252	10.6	316
Other Urban	11.9	325	15.7	472
Central Rural	13.9	378	12.5	374
Other Rural	65.0	1770	61.3	1835
Total	100.0	2725	100.0	2997
Period of First Birth:				
High Fertility (1977-1983)	47.5	1293		
Falling Fertility (1983-1989)	52.5	1432		
Start of Stagnation (1991-1997)			43.9	1316
Stagnation Underway (1997-2003)			56.1	1681
Total	100.0	2725	100.0	2997
Age at First Birth:				
10-17	36.3	988	26.9	807
18-24	59.4	1620	65.1	1951
25+	4.3	117	8.0	240
Total	100.0	2725	100.0	2998
Educational Level:				
None	13.6	369	6.9	206
Primary	58.5	1591	63.9	1913
Secondary+	28.0	762	29.3	878
Total	100.0	2721	100.0	2997
Survival of First Birth (by interview time):				
1 Girl	47.0	1280	45.0	1347
1 Boy	44.0	1199	47.0	1403
0 Survivor	9.0	246	8.0	247
Total	100.0	2725	100.0	2997
Ever Married at First Birth:				
First Marriage after First Birth	31.0	703	26.4	687
First Marriage before First Birth	69.0	1560	73.6	1915
Total	100.0	2263	100.0	2602
Ethnic Group: Kikuyu	22.9	623	22.9	685
Luhya	17.4	475	15.7	470
Luo	14.8	402	12.2	366
Kalenjin	8.7	238	11.8	354
Other	36.2	987	37.4	1122
Total	100.0	2725	100.0	2997
Religion: Catholic	34.1	927	24.4	730
Protestant	57.8	1571	66.8	1999
Muslim	3.3	89	6.0	181
Other	4.8	131	2.8	83
Total	100.0	2718	100.0	2993
Ideal Family Size: ≤3	26.7	725	49.8	1493
4-5	56.4	1538	38.0	1138
≥6	14.6	398	8.4	251
Non-numerical	2.3	64	3.8	114
Total	100.0	2725	100.0	2997

Table XVII: Percentage Distribution of Covariates for the Third Birth Interval

Period of Observation	1977-1989		1991-2003	
Percentage/Number	Percentage	Number	Percentage	Number
Covariate				
Sex of Second Birth				
Male	51.9	1280	49.9	1204
Female	48.1	1186	50.1	1209
Total	100.0	2465	100.0	2413
Survival of 2nd Child				
Yes	91.9	2265	91.2	2201
No	8.1	200	8.8	212
Total	100.0	2465	100.0	2413
Period of Second Birth				
High Fertility (1977-1983)	51.6	1193		
Falling Fertility (1983-1989)	48.4	1272		
Start of Stagnation (1991-1997)			43.2	1043
Stagnation Underway (97-2003)			56.8	1370
Total	100.0	2465	100.0	2413
Sex Composition of Surviving Children				
One son and one daughter	45.8	1130	44.4	1072
Two daughters	21.5	531	22.4	541
Two sons	21.9	540	22.1	534
One son	4.7	116	4.9	118
One daughter	5.3	130	5.4	130
All died	0.8	19	0.8	19
Total	100.0	2465	100.0	2413

Note: In the results presented in this table, survival of the second child is evaluated at the time of the interview, while that for the two children is at the beginning of the third birth interval (less than or equal to one month). In the results of the Cox regressions for the second and third birth intervals (Tables XX and XXI) however, survival status of the first and second births are considered as time-varying.

6.1.2 Median Time to Conception

Medians for the second, third, fourth and subsequent durations to the next conception - up to the sixth - were first estimated in order to compare the trends in the intervals between the two decades of falling and reduced pace of decline in fertility. These results are presented in Table XVIII, which shows the cumulative percentage distribution of women proceeding to the next conception for the second through the sixth intervals. The distributions have been estimated

using life table techniques in order to take into account the censoring that arises from the experience of women who have not yet had their next birth. Thus, for each birth (first to sixth) that started no earlier than 12 years before the 1988/89 and 2003 KDHS surveys, the respective percentile duration to (next) conception was estimated. This life-table estimation procedure takes into account both the durations that result in conception, and those which are censored by the time of the 1988/89 and 2003 interviews respectively. To arrive at the duration to the next conception, nine months of gestation were subtracted from the inter-birth interval.

From the cumulative durations of the second to sixth intervals shown in Table XVIII, the medians for the second and third intervals have been represented in Figure 10 for visual purposes. One striking contrast that can be observed in Table XVIII relates to the 75th percentile of the duration of the fourth and higher birth intervals based on the 1988/89 dataset and that for the 2003 KDHS. It can be seen that for fourth and higher intervals that started 12 years or later since the date of interview for the 2003 KDHS survey, the last cumulative quarter of respondents had intervals that were very long (at least 84 months). In contrast, for women who had their fourth and higher births 12 years or later preceding the time of the 1988/89 KDHS survey, the length of the last cumulative quarter of intervals is relatively shorter – around 40 months. This may be an indication of increasing stopping behaviour with time.

The information shown in Figure 10 (the median time to conception for the second to sixth intervals) is extracted from Table XVIII. These medians have been calculated using the life-table technique – births starting within the 12 years before the 1988/89 and 2003 surveys respectively being followed up until a conception occurs or until they are censored by the date of interview. The table shows that at the national level, the medians increased during the 12 years of a reduced pace of fertility decline (1991-2003) compared to those of falling fertility (1977-1989). Thus, for the time-period 1977-1989, the median for the second interval was 21.7 months, increasing only marginally to 23 months by the sixth interval. For 1991-2003, the median for the second interval was higher at 28.5; it increased by about three months to reach 31.2 by the sixth interval. The lengthening of the intervals is consistent with the decline in fertility between the two decades; however it is distinct from the constant fertility observed

between 1998 and 2003. As can be observed from Figure 10, there is an overwhelming increase in the median length of intervals for all parities.

That the changes in the length of intervals in all the three percentiles represented in Table XVIII, and not just variations in the median, are important is also evident. When the medians for the 1977-1989 and 1991-2003 observation periods are compared, it is noted that there are important and overwhelming increases in all parities. The same trend is noted for some parities for the first quartile, particularly the fifth and sixth. It is in the third quartile that real evidence of stopping behaviour starts to emerge in this sub-sample, a behaviour that is more evident during 1991-2003 compared to 1977-1989. Nevertheless, these changes in the third quartile are not enough to greatly affect the medians.

In principle, change in two proximate determinants could explain the observed increase in the length of the intervals between the two decades – an increase in the period of post-partum amenorrhea due to a similar change in the duration of breastfeeding, and an increase in the duration to conception through contraceptive use. Between these two, increased use of contraception is the more plausible, as prevalence of modern contraceptive methods increased from 4.3% in 1977/78 to 31.4% in 1998, and rose marginally to reach 33.4% in 2003. In contrast, the median durations for breastfeeding, post-partum amenorrhea, and sexual abstinence were 19.4, 10.8, and 2.6 months respectively by the time of the 1988/89 KDHS. In the 2003 survey however, they had only marginally changed to 20.1, 9.7, and 2.9 months respectively (NCPD 1989; NCPD 1994 ; NCPD 1999; CBS et al. 2004). Thus, these results indicate a possible association between increased length of intervals and use of modern contraceptives for spacing.

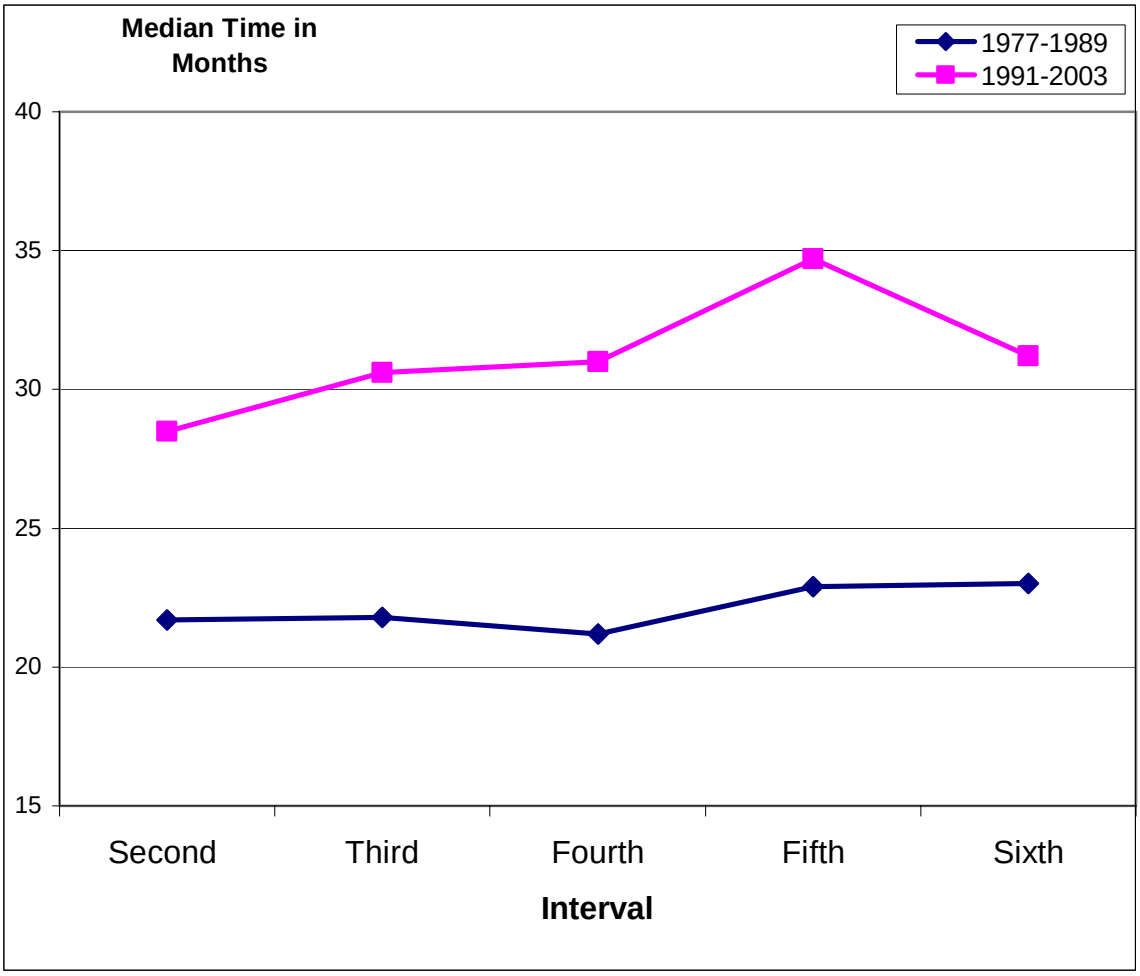
Table XVIII: Percentile Distribution of Time from Birth to Next Conception in Kenya

Observation Period:	**1977-1989**			**1991-2003**		
Percentile	P25	P50	P75	P25	P50	P75
Birth Interval:						
Second	14.0	21.7	38.0	17.5	28.5	58.3
Third	14.9	21.8	37.5	17.7	30.6	70.1
Fourth	14.4	21.2	42.4	17.5	31.0	84.1
Fifth	15.2	22.9	42.3	20.1	34.7	94.1
Sixth	15.3	23.0	40.4	18.5	31.2	97.3

Notes: The respective percentiles (P) represent the duration in months in which the first 25, 50, and 75 percent of the women who gave a respective birth within twelve years of each survey took to proceed to the next conception (defined as nine months less from the time of next birth).

Figure 10: Median Time to Conception, for Second to Sixth Intervals

According to Year of Survey



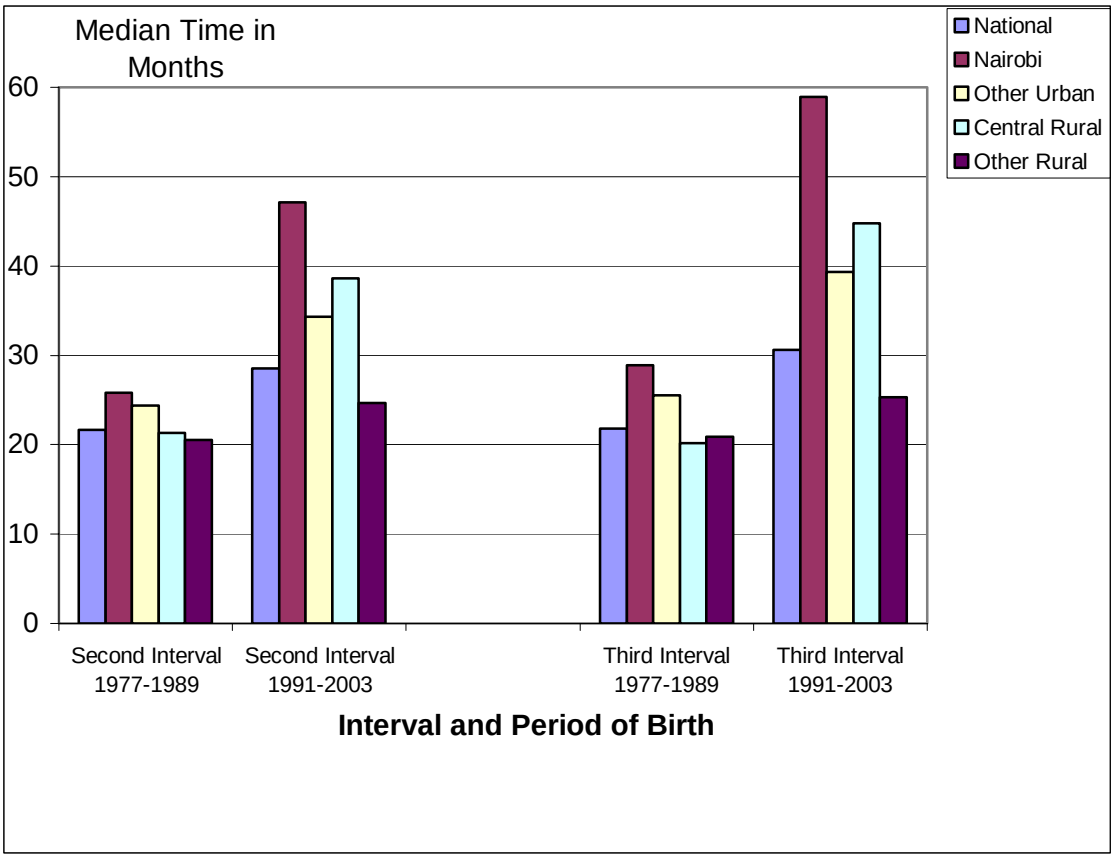
Examination of the medians for the second and third intervals at the sub-national level (Table XIX and Figure 11) shows an important change in rural Central Province. For the second interval, the medians and percentage change (from 1977-1989 to 1991-2003) are largest in Nairobi; the percentage change in rural Central Province being the second largest (81.6% against Nairobi's 82.6%). For the third interval however, rural Central Province registers the largest increase of 121.8% compared to 103.8% for Nairobi.

Table XIX: Median Time from First and Second Birth to Next Conception by Region, Kenya

Interval		**Second**			**Third**	
Year/%Change	1977-1989	1991-2003	%Change	1977-1989	1991-2003	%Change
Region						
National	21.7	28.5	31.3%	21.8	30.6	40.4%
Nairobi	25.8	47.1	82.6%	28.9	58.9	103.8%
Other Urban	24.4	34.3	40.6%	25.5	39.3	54.1%
Central Rural	21.3	38.6	81.2%	20.2	44.8	121.8%
Other Rural	20.5	24.7	20.5%	20.9	25.3	21.1%

Note: Time of conception estimated as nine months less given date of next birth.

Figure 11: Median Duration of the Second and Third Intervals by Region



6.1.3 Survivorship in the States of First and Second Birth

Figure 12 below shows Kaplan-Meier (KM) survivor functions - the proportion of women who, having given birth to the first child, have not yet progressed to the second conception. A similar curve, for the proportions that have not yet had the third conception, is represented by Figure 13. A question that arises is whether the curves are significantly different from each other or the apparent differences are merely due to random error. To answer this question, the Cox univariate test for equality of survivor functions was applied to the second interval. The results indicated that the chi-square values (for curves covering the periods 1977-1989 and 1991-2003 respectively) are highly significant ($p \leq 0.000$), so that we are led to reject the null hypothesis that the four survivor functions for region of residence are the same. Instead, we accept the alternative hypothesis that in fact the four are significantly different.

Coupled with this significance, the survivor functions in Figure 12 show that, in comparison to the rural areas, residence in the city or other urban areas tends to reduce the probability of progressing to the second birth and this pattern strengthened during the 1991-2003 period. For both the 1977-1989 and 1991-2003 periods – when fertility declined rapidly and the fall was less rapid respectively, this widening in the probabilities is particularly apparent after the duration of 24 months. For births which occurred during the earlier period (1977-1989) particularly, this may be indicative of the importance of natural fertility factors (breast-feeding, amenorrhea, and abstinence), in both the urban and rural areas for birth intervals of less than twenty-four months. After the two years however, there might be more deliberate fertility control in terms of modern contraceptive use in the urban areas, and specifically in the city relative to other rural areas.

A similar partitioning is observed with regard to rural Central province and the two urban areas: upto about 48 months, the three curves are close to each other and the probability of not yet having had the second conception is way above that for other rural areas. Subsequently, the probabilities for rural Central province trail behind those for the urban areas but remain above those for other rural areas. It is possible that this divergence represents family building behaviour of two groups of women in rural Central province – one which is traditional and proceeds rapidly to have the second child, and the other which is modern which takes more time to transit to the second conception.

The test for equality of the survivor curves was similarly applied to the third interval, and as for the second interval, the results implied that the four curves are different from one another in a highly significant way. An examination of the proportions remaining in the state of second birth (Figure 13) however shows more marked contrasts. For second births that took place between 1977 and 1989, the grouping of the proportions into an urban block (Nairobi city and other urban areas), and a rural one (Central Province rural and other rural) is evident. If the grouping for second births occurring during the 1977-1989 period is between urban and rural areas, this is no longer true for 1991-2003. The probability of not having progressed to the third conception has substantially risen in rural Central Province, joining the urban group of Nairobi city and other urban areas, but at the same time higher than probabilities for other urban areas. In

contrast, the proportions of women not having yet made the transition to the third conception lags in other rural areas.

Figure 12: Kaplan-Meier Survival Functions for Probability of Remaining in the Primiparous Sate by Region in Kenya

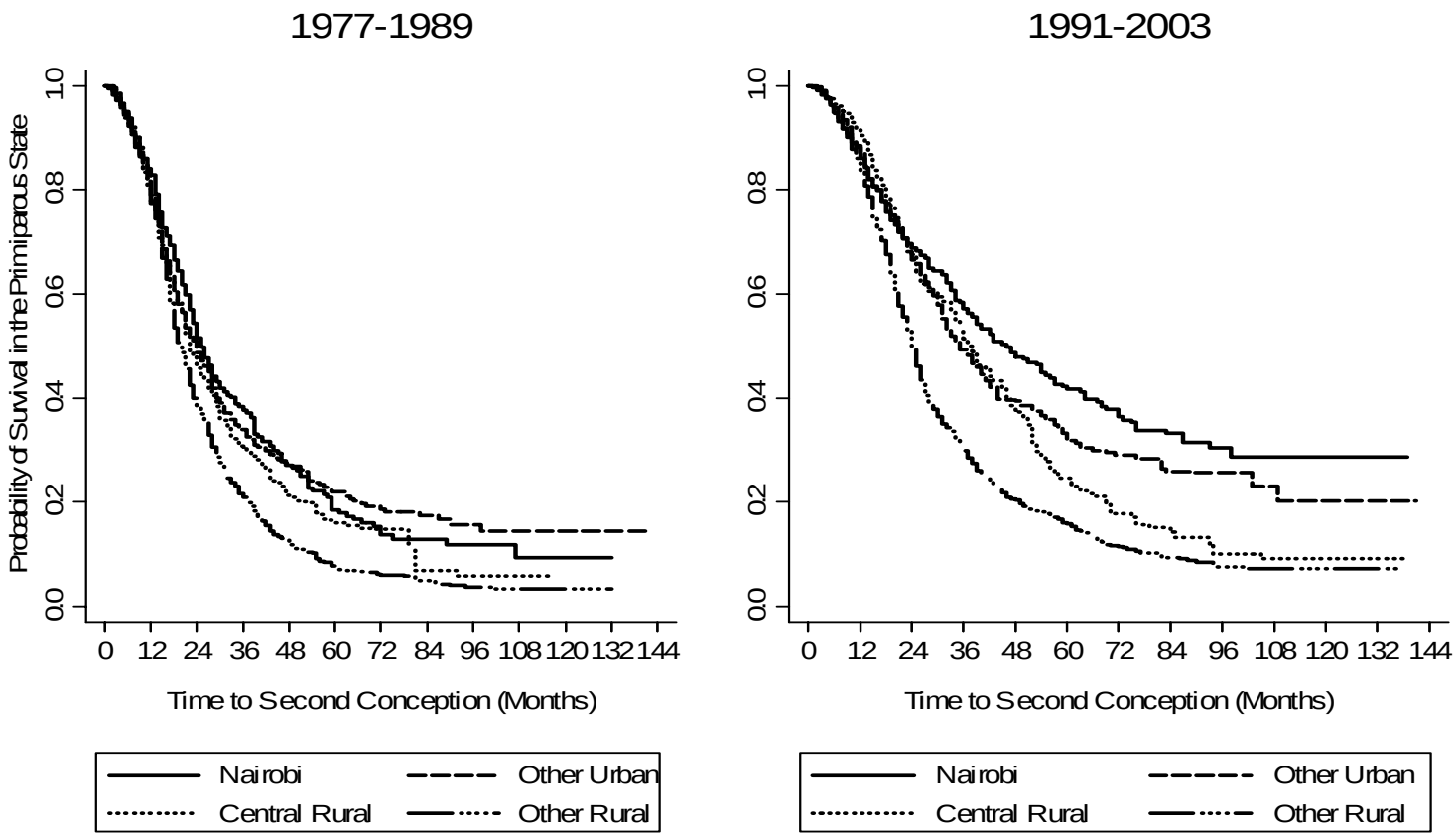
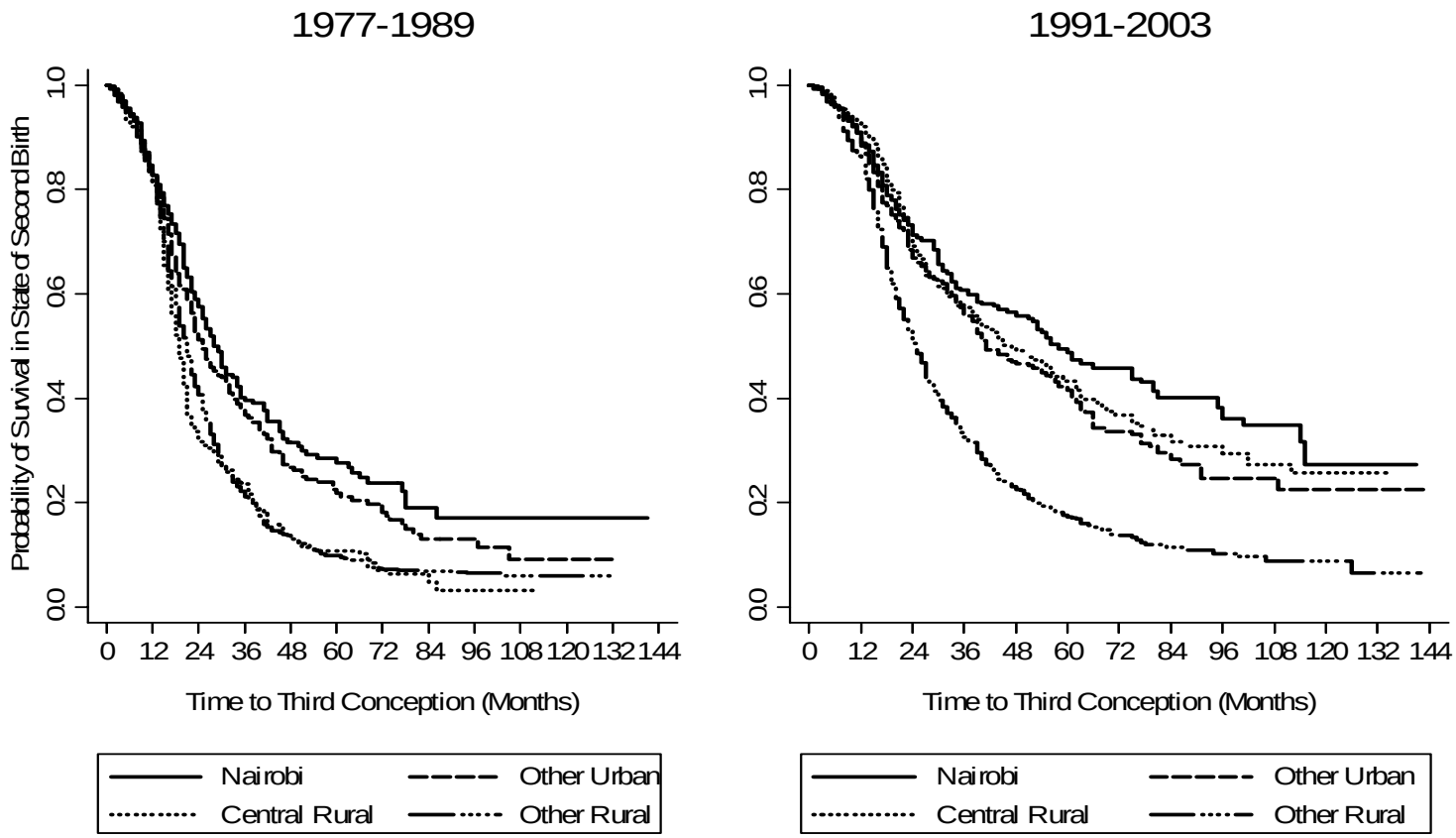


Figure 13: Kaplan-Meier Survival Functions for Probability of Remaining in Sate of Second Birth by Region, Kenya



6.2 Multi-variate Analysis

6.2.1 Effects of Covariates for the Second Interval

The Effect of Region of Residence

Cox regression results for the relative risk of progressing to the second conception leading to a live birth are presented in Table XX below. For region of residence, it had been hypothesized that there would be differences in hazards between the regions, associated with variations between the provinces in the levels of development and culture, effects which would only be partially captured by other individual-level covariates. The results are partly as expected and show that for the observation period 1977-1989 first, Nairobi relative to other rural areas is associated with a significantly lower hazard ratio of a second conception, this difference widening and remaining highly significant during the 1991-2003 period. Thus, while the hazard ratio for Nairobi over 1977-1989 is 0.7 of that for other rural areas, during 1991-2003 it reduces further to 0.5, both results being very highly significant – at the 0.001 level. A similar trend can be observed with regard to other urban areas. Table XX also shows that this relationship persists in the two other models – when other explanatory variables are added into the initial model, and with the inclusion of the interaction of the period of first birth with three covariates (age at first birth, survival status of the first birth, and having been married).

Although the relative hazards for rural Central province are significant in the basic model, being 0.815 during 1977-1989 and reducing to 0.647 over 1991-2003, in models two and three (where more variables are added and interactions applied) they become non-significant. Considered together with results for urban areas (Nairobi and other urban), it is evident that while the introduction of additional factors slightly raises the hazard ratios for the urban areas, their effect on rural Central province is to render the relative hazard non-significant. This might imply that the relative hazards for the urban areas are not driven by the same set of factors that alter those for rural areas, such as rural Central province. In particular, it is apparent that while individual characteristics such age at first birth, educational level, child survival, and marriage might explain the differences in relative hazards between other rural areas and rural Central province, it is not these individual-level factors but others unique to urban areas (such as change in

reproductive behaviour associated with distinct urban lifestyles and the consequent emergence of new family building strategies) that explain the changes therein.

An issue that needs to be clarified is that of the comparability of the relative hazards for the two time periods (1977-1989 and 1991-2003) for region of residence, and indeed for all other covariates. To the extent that these are hazard ratios which do not contain the baseline, the two are not absolute and cannot be compared side by side as such. These are also separate regressions, with two distinct datasets, which do not start from a common reference period. There is an intervening period that separates the two timeframes of observation – the years between 1989 and 1991 – whose events are not directly taken into account in the distinct regressions. Rather, it is the difference in the relative hazards (between the targeted category and the reference group) that can be assessed side by side for the two time periods. The description of Cox regression results for the remainder of the covariates and transitions (to second and third conceptions) are therefore presented in the light of this approach - of viewing the hazard ratios between the two time periods as differences in the relative risks – in mind. This clarification made, it is to be emphasized that the results show that the increased divergence in the relative hazards for region of residence (between the reference category, other rural areas, and the other regions) might be due to more rapid change in the urban areas and rural Central province.

Table XX: Cox Regression Hazards of Transition from First Birth to Second Conception, Kenya

Observation Period	**1977-1989**			**1991-2003**		
Model:	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Region						
Other Rural	1.000	1.000	1.000	1.000	1.000	1.000
Nairobi	0.700***	0.789**	0.790**	0.500***	0.675**	0.677**
Other Urban	0.714***	0.769**	0.770**	0.560***	0.726**	0.727**
Central Rural	0.815*	1.078	1.086	0.647***	1.102	1.105
Period of First Birth:						
1977-1983	1.000	1.000	1.000			
1983-1989	0.737***	0.774***	0.685**			
1991-1997				1.000	1.000	1.000
1997-2003				0.881	0.870*	0.933
Age at First Birth:						
10-17	1.000	1.000	1.000	1.000	1.000	1.000
18-24	0.964	0.920	0.960	0.977	0.998	0.998
25+	0.843	0.674*	0.689	0.654**	0.754	0.753
Age at First Birth x Period:						
10-17 x Earlier Period			1.000			
10-17 x Recent Period			1.086			
25+ x Recent Period			1.037			
Education:						
None		1.000	1.000		1.000	1.000
Primary		0.816*	0.814*		0.842	0.846
Secondary+		0.822*	0.822*		0.675*	0.681*
Survival of First Birth:						
1 Boy		1.000	1.000		1.000	1.000
1 Girl		1.063	1.074		1.033	0.867
0 Survivor		1.316*	1.502*		1.542**	1.374
Survival of First Birth x Period:						
1 Boy x Earlier Period			1.000			1.000
1 Boy x Recent Period			1.018			0.831
1 Girl x Earlier Period						1.176
No Survivor x Recent Period			0.809			
Socio-economic Status:						
Low		1.000	1.000		1.000	1.000
Medium		0.930	0.925		0.745**	0.743**
High		0.914	0.912		0.817*	0.813*
Religion:						
Catholic		1.000	1.000		1.000	1.000
Protestant		1.026	1.028		1.011	1.015
Muslim		0.922	0.919		1.258	1.261
Other		0.721*	0.725*		0.971	0.983
Ethnic Group:						
Kikuyu		1.000	1.000		1.000	1.000
Luhya		1.157	1.148		1.842***	1.842***
Luo		1.107	1.108		1.704***	1.707***
Kalenjin		1.116	1.121		1.555**	1.546**
Other		1.077	1.075		1.310*	1.312*
Ever Married: No		1.000	1.000		1.000	1.000
Yes		1.974***	1.809***		1.563***	1.449***
Ever Married x Period:						
Never Married x Earlier Period			1.000			1.000
Ever Married x Recent Period			1.169			1.132

Note: ***: $p<0.001$; **: $p<0.01$; *: $p<0.05$; Reference category is indicated with a relative hazard of 1.000

The Influence of Period of First Birth

To test the possibility that there might be differences in the hazard ratios of progressing to the second birth even within the same period of observation, the twelve years (1977-1989 and 1991-2003) were divided into two equal (six-year) durations each. With such a division into two parts, the 12-year period now becomes a time-varying covariate: it is therefore necessary to accommodate the possibility that the conception which follows the first birth may not be experienced in the first six years. The creation of this time-varying covariate was accomplished by splitting the episodes of the duration from first birth to second conception (and later similarly for the time from the second birth to the third conception). Thus, for first births starting not earlier than 12 years before the 1988/89 survey, the observation episode was split at the year 1983, thereby forming two episodes around this year. Similarly first births starting 12 years or less before the 2003 survey were split after the year 1997. This conveniently assisted in testing the hypothesis about the risks of progressing to the second (and third) conception during the period 1998-2003, when fertility change was constant in the country.

For this time-varying covariate - period of first birth - results for the years 1977-1989 are clearly the most significant. The findings in Table XX show that the relative risk of transition to the second conception is always lower in the six years immediately preceding the 1988/89 survey relative to the earlier six year period; this result being true no matter which of the three models (basic, inclusion of other explanatory variables, and addition of interaction effects) is considered. This would be as expected: the period 1977-1983 was one of higher fertility. In contrast, over 1983-1989, fertility was falling rapidly in Kenya and so the relative risk of transition (to the second birth) would be lower relative to the earlier period when fertility was higher and presumably the risk of transition equally higher. Consideration of 1991-2003, which brackets the time of constant fertility, on the other hand provides contrasting results. As can be seen in Table XX above, the risk of progressing to the second birth for the six years preceding the 2003 survey (the period when fertility decline levelled off) decreases significantly only in the model in which other explanatory variables are included. Thus, it appears that over the period of constant fertility (1997-2003), although couples proceeded to have their second child at a lower rate as compared to that when the levelling off in fertility started (1991-1997) this lower difference in relative risk was not as strong as that for the period 1977-1989. When the

three models are compared, it is also apparent from Table XX (especially for the observation period 1977-1989) that the introduction of individual-level covariates does not change the relative hazards much. This is in line with the observation that the reduction in the relative hazards is not due to these individual covariates but possibly due to other determinants of birth interval length.

Age at First Birth

As Table XX shows, the effects of age at first birth on the risk of the second conception are weak and for the most part non-significant. Nevertheless, the significant results are restricted to women who are at least 25 years old at the time of the first birth relative to those who were aged 10 to 17 years when they had their first baby; the relative hazards (for both 1977-1989 and 1991-2003 periods) decreasing up to about 67.4% for this group, relative to women who are 10-17 years old at the time of first birth. For the 1977-1989 period, the relative hazard of transition to the second conception for women aged 25 years or more with reference to those aged 10 to 17 years at the time of their first birth is significant (at the 5% level) only in the model that comprises other explanatory variables; for the 1991-2003 period on the other hand, it is significant (at the 1% level) only in the basic model that contains two other covariates – region of residence and period of first birth. Thus, the results show that later age at first birth relative to early first birth is associated with a lower transition to the second conception, the relative hazard for 1991-2003 being more significant.

The Effects of Additional Explanatory Variables and Interactions

The effects of a number of interesting variables – education, socio-economic status, survival status of the first birth, ethnic group, and having been married before - entered in the second model provide further insights into the timing of second conceptions leading to live births during the periods 1977-1989 and 1991-2003. Relative to women with no education, the effects of primary and secondary or higher education respectively during the period of declining fertility (1977-1989) are to decrease the risk of progression to the second conception, both in the model with additional explanatory covariates as well as in the one with interaction terms. During 1991-2003 on the other hand, it is only among women with secondary-school or higher education that the relative risk of transition to the second conception is significant. Thus, during 1991-2003,

for the model comprising interactions, the risk of transition to the second conception is 68.1% among women with at least secondary-level education, relative to those who have no education. For the 1977-1989 period on the other hand, the respective relative risks are 81.4% and 82.2% for women with primary and secondary education respectively.

For survival status of the first child, the child having passed away relative to one boy being alive is significantly associated with increased risk of transition to the second conception during both periods, in model two (with additional variables). The significant relative risk for 1991-2003 is higher than that for 1977-1989: an increase of 54.2% in 1991-2003 as opposed to 31.6% over 1977-1989. Examination of the hazard ratios for another covariate, socio-economic status shows a number of results, the index of socio-economic status having been developed from a combination of dummy variables representing household access to safe water, type of floor of the household's dwelling unit, and ownership of durable goods which comprised electricity connection, radio, television, refrigerator, bicycle, and car. The effects of socio-economic status are only significant over 1991-2003, and in the downward direction. In addition, there is a big difference between the reference group (low socio-economic status) and the other two categories. The depressing effects of medium and high socio-economic status on the relative hazard of the second conception are also enduring even in the face of the addition of interaction terms, being 74.3% and 81.3% respectively of the reference category during 1991-2003.

For the ethnic groups, a surprising result is that the effects of belonging to ethnic groups other than Kikuyu are highly significant during the more recent period (1991-2003) and not the earlier period (1977-1989). Hailing from Luhya, Luo, and Kalenjin communities is each associated with a highly significant and increased relative hazard of progressing to the second conception, with other groups also being significant at the 5% level and in the same direction. There are also big differences between the reference risk group (being Kikuyu) and that for each of the ethnic groups. As can be seen from Table XXI, the Luhya, Luo, Kalenjin, and other groups are associated with risks of progressing to the second conception that are 84.2%, 70.4%, 55.5%, and 31% above those for the reference community. This result may indicate the wide difference between the Kikuyu community and the others in terms of reproductive behaviour that is particularly related to the transition to the second conception. It is not clear what this

reproductive behaviour might be, but given the higher contraceptive prevalence in rural Central Province, home to the Kikuyu community, that difference might be marked by the level of contraceptive use for spacing purposes.

Lastly, having been married by the time of the first birth not only significantly increases the relative risk of the second conception in both the model with additional variables and with interaction terms, the differences in relative risk are also big. Thus, for 1977-1989, having been married by the time of the first birth is associated with a significant relative risk that is almost twice as high as that for women who have never been married by the time of their first birth. Similarly, for the more recent period, 1991-2003, the difference in risk, though reduced slightly is still high – about one and half times more than that for the reference category.

A number of variables were interacted with period of first birth. For the observation period 1977-1989, these were age at first birth, survival status of the first child, and having been married by the time of first birth. For 1991-2003 on the other hand, these were survival status of the first birth and ever-married by the time of first birth. None of these interactions turned out to be statistically significant.

Thus, what emerges from the above results for the transition to the second conception is that a number of variables, for the most part systematic and demographic, are important in increasing the relative risk of transition to the second conception during both periods of observation. First and foremost is the hypothesized covariate of residence. Others include child survival, ethnic group, and having been married by the time of the first birth. A number of covariates nevertheless have the opposite effect – reducing the risk of transition to the second conception. Secondary education, and belonging to the two socio-economic groups (medium and high), constitute the variables that contribute to this reduced relative risk of transition, with the effects of socio-economic status emerging only during the 1991-2003 observation period.

6.2.2 The Effects of Covariates for the Third Interval

Effects of Region, Period, and Age at First Birth

As with the transition from the first birth to the second conception, the results for region of residence for the third interval (Table XXI) are very highly significant and decreasing for the urban areas; they also show big differences between the reference category (other rural areas) and each of the two urban groupings. These findings are true for both periods of observation, and within each observation period, in general for all three models – the addition of covariates and interaction terms not changing the size of the relative risks much over 1977-1989 but somewhat slightly during 1991-2003. The second observation is that for rural Central province, the relative risks of progressing to the third conception are only significant during 1991-2003, and in the downward direction, like for urban areas. For example, in the model with interaction terms (column seven in Table XXI below), for the 1991-2003 observation period, residence in rural Central province with reference to other rural areas is associated with a 61.7% reduced risk of transition to the third conception.

The relative hazard for the period of second birth, on the other hand, is only significant when fertility was falling (1983-1989) - in the basic model, as well as with additional explanatory variables added. For example, in the model with additional covariates (column three of Table XXI), having the second child during the six years preceding the 1989 survey is associated with a relative hazard of moving on to have the third conception that is equivalent to a decrease to 76% of the hazard in the earlier six-year period. For age at first birth on the other hand, it is only in the basic model, and during 1991-2003, that the regression results are significant. Furthermore, in this case, the difference in the relative hazard in the transition to the third conception decreases with age at first birth. Thus, having the first birth within the age group 18-24 and at age 25 or above with reference to having the first child between 10 and 17 years are both associated with decreases in the relative hazards of progressing to the third conception (82% and 60.3% of the value of the reference category respectively).

In the final analysis therefore, in the model with additional explanatory variables, period of second birth and age at first birth do not really matter in determining the relative hazard of progressing to the third conception. These are surprising results, particularly when it had been

hypothesized that the relative hazard should vary over the years between 1991 and 2003, becoming more visible during the time when the stall was under way (1998-2003) as compared to the time when it was only beginning (1991-1997). In searching for explanations, it may be useful to bear in mind that fertility was constant beginning three years preceding the 1998 KDHS survey until the time of the 2003 KDHS. Thus, while the two six-year periods, 1991-1997 and 1998-2003, registered constant fertility within themselves, a number of socio-economic covariates may also not have changed much within this broad period, leading to no significant difference in the relative hazards.

Child Survival

It had been hypothesized that the survival status and gender of the first two children affect the relative risk of progressing to the third conception. Analysis of the data confirms this expectation for both periods in general, but more particularly during 1991-2003. For the 1977-1989 period, the results in Table XXI below show that having only one surviving son, only one daughter, or where all two children have passed away are all associated with highly significant increases in the relative hazard of transition to the third pregnancy, relative to the situation where the two children – a boy and a girl - are alive. These observations are particularly true for the model that incorporates additional explanatory covariates (model two). In the model with interaction effects on the other hand, the risk of progression to the third conception is only significant in the case of one surviving son – being 51.3% higher than the reference category.

The significance of the relative risks of the number and gender of surviving children in determining the transition to the third conception is clearer for the 1991-2003 period of observation. First, where all the two children have passed away contributes to a very highly significant increase in the relative hazard of transition to the third conception with reference to the situation where one boy and one girl are alive. Thus, in the model incorporating additional explanatory variables, the risk of having a third pregnancy is over two and a half times higher where all two children have passed away, as compared to the situation whereby both one male and one female child are surviving. Secondly, having two surviving daughters or one are also associated with highly significant and increased relative risks of transition to the third conception; these risks being 27% and 59.3% higher than the reference category for the case of

two surviving daughters and one surviving daughter respectively. Thirdly, having only one surviving son is equally significant, representing an increased relative risk of 51.4% over the reference category.

To recapitulate, the results confirm the hypotheses about the positive influence of child mortality on the transition to the third conception - particularly during 1991-2003. Where one or both children have passed away, the relative risk of transition to the third conception is positive and increasing. In addition, the results also show some gender preference for surviving children. During the 1991-2003 period, having two surviving daughters is associated with a significantly higher relative risk of transition to the third conception. This is in contrast to the relative risks for two surviving sons, which are not significant during any of the two observation periods.

The Influence of Additional Explanatory Variables on the Hazard

Three additional covariates - level of education, socio-economic status, and ever-married status – turned out to be significant in the analysis of the effects of transition to the third conception; and their results are presented in turn. A surprising result regarding the level of education is that during the 1977-1989 period, the relative risk of transition to the third conception for primary education – although being significant – is higher (by 28.5%) than that for the reference category of no education; the inclusion of interaction terms in the model not making a big difference in the relative hazard. Although this effect was unexpected, other studies conducted in the country and based on data for the early 1990s show similar results of an increase in fertility with some level of primary education (NCPD 1994 ; Westoff and Cross 2006). The other grouping for education - secondary or higher – has a significant relative risk only during 1991-2003. This time however, the risk of transition to the third conception for women with secondary or higher education decreases relative to the reference category, being about 60% of the reference category of no education, and again the addition of interaction terms not making any major difference to the relative hazard.

In contrast to education, which is a significant determinant of the relative hazards of progressing to the third conception both over the 1977-1989 and 1991-2003 periods, the relative risk of socio-economic status (the distribution of the wealth index among households in the country) is

statistically significant only during the 1991-2003 period. The details can be seen in column four of Table XXI below. The significant and decreasing hazard occurs among women who hail from households of medium socio-economic status, being 77.6% of the risk of the reference category of women living in households bracketed in the low wealth index; the hazard in the model with interactions remaining practically unchanged.

Lastly, having been married by the time of the second birth is very significantly associated with a relative risk of going on to have the third conception. This is true over 1977-1989 as well as 1991-2003, in the model with explanatory variables as with interactions, the effect always being to increase the hazard. During the 1977-1989 observation period and for the model which embraces the additional explanatory variables, having been married by the time of the second birth leads to an increase of 63.1% in the relative hazard of transition to the third conception. For the time-period 1991-2003, the hazard also increases over the reference group, but at a slightly lower ratio of 59.1%, and remains very significant (at the 0.001 level).

Table XXI: Cox Regression Hazards of Transition, Second Birth to Third Conception

Observation Period	**1977-1989**			**1991-2003**		
Model	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Region:						
Other Rural	1.000	1.000	1.000	1.000	1.000	1.000
Nairobi	0.619***	0.629***	0.628***	0.473***	0.629**	0.617**
Other Urban	0.725***	0.721***	0.717***	0.562***	0.700**	0.682**
Central Rural	1.084	1.154	1.153	0.471***	0.624**	0.617**
Period of Second Birth:						
1977-1983	1.000	1.000	1.000			
1983-1989	0.762***	0.760***	0.720			
1991-1997				1.000	1.000	-
1997-2003				0.936	0.905	-
Age at First Birth:						
10-17	1.000	1.000	1.000	1.000	1.000	1.000
18-24	1.051	1.042	1.042	0.820**	0.902	0.891
25+	0.826	0.868	0.861	0.603**	0.749	0.498
Educational Level:						
None		1.000	1.000		1.000	1.000
Primary		1.285**	1.288**		0.919	0.931
Secondary		1.135	1.139		0.570**	0.585**
Survival Status and Sex Composition:						
One Son and One Daughter		1.000	1.000		1.000	1.000
Two Daughters		1.097	1.103		1.270**	1.171*
Two Sons		0.979	1.107		1.013	1.082
One Son		1.486***	1.513***		1.514*	1.114
One Daughter		1.422**	1.451		1.593**	2.438***
All Died		2.193**	2.069		2.517***	3.722**
Socio-economic Status:						
Low		1.000	1.000		1.000	1.000
Medium		0.885	0.885		0.776**	0.780**
High		0.942	0.950		0.923	0.921
Religion:						
Catholic		1.000	1.000		1.000	1.000
Protestant		0.992	0.992		1.029	1.046
Muslim		0.947	0.924		0.908	0.903
Other		0.922	0.927		1.166	1.174
Ethnic Group:						
Kikuyu		1.000	1.000		1.000	1.000
Luhya		1.076	1.076		1.305	1.304
Luo		1.067	1.061		1.029	1.034
Kalenjin		0.870	0.873		1.188	1.173
Other		0.957	0.958		1.106	1.122
Ever Married:						
No		1.000	1.000		1.000	1.000
Yes		1.631***	1.640***		1.591***	1.956***
Ever Married x Period:						
No x Earlier Period			-			1.000
Yes x Recent Period			-			0.748

Notes: ***: p<0.001; **: p<0.01; *: p<0.05; Reference category has a relative risk of 1.000. Interactions of survival status of children and period of second birth, as well as those for age at first birth and period of second birth are not shown. Interaction of ever-married status and period of second birth was conducted only for the 1991-2003 time period (violated assumption of proportionality). 2. The dash (-) in column seven above indicates that the main effects of period of second birth were dropped due to collinearity. Nevertheless the effects of the interaction terms (for other covariates) with period of second birth are provided in the regression results.

6.2.3 Inclusion of Ideal Family Size in the Models

Prior to presenting results of the regression model that includes the variable "ideal family size", the issues surrounding the covariate, as well as its distribution in the samples considered in this analysis are first outlined. The duration of the birth interval can be considered as a factor in the variation in fertility, and to that extent, it is in turn a function of fertility demand (Easterlin and Crimmins 1985; Trussell et al. 1985). Thus, in principle, where demand for children is higher, couples will tend to have short birth intervals. The same relationship can logically be extended to the risk of transition to the next conception, and to take into account this dependence on fertility demand, a measure of fertility preferences, the ideal number of children desired, was included in this analysis - as an additional covariate of the progression to the second and third conceptions. Nevertheless, measures of fertility preferences, and in particular ideal family size suffer from bias as proxies for wanted fertility (Bongaarts 1990; Pritchett 1994); their inclusion in regression models may therefore lead to bias in the estimates of the parameter coefficients.

With particular reference to first, second, and third births, a number of factors are frequently cited as to why ideal family size is a biased measure of wanted fertility (the number of births beyond which a woman will not wish to have any more) which in turn is a measure of fertility preferences and demand. First, death of a first or second child may lead to underestimation of the wanted family size. This is because, on being asked about the ideal number of (living) children they would like to have, women may respond by citing the number that they actually have, without including those children that have passed away. Secondly, strong gender preferences may manifest themselves following first or second births of a particular sex combination; ideal family size reported in this context will again underestimate the wanted family size. Thirdly, where the desire for a large number of births exists, the non-numerical response may be recorded more often, thereby leading to underestimation of wanted family size again. Fourth, changes in the timing of first or second births may lead to over or under-estimation of wanted family size. For example, later age at first birth and a longer second or third birth interval would lead to lower wanted family size, leaving ideal family size intact (Bongaarts 1990). The result of these and other biases (both above and below the wanted family size) is that regression results will likewise be biased and inconsistent (Kmenta 1997; Kennedy

2003), a reason for which outputs from regression models that include ideal family size need to be examined closely.

An examination of the distribution of ideal family size in Table XVI shows that for the 1977-1989 period, 2.3% of the respondents reported a non-numerical response, this increasing to 3.8% for the 1991-2003 period. The proportion for the 1977-1989 being rather low, the higher result for 1991-2003 may possibly be a function of improved interviewing over time. Women who reported an ideal family size of three children or less on the other hand formed 26.7% of the sample for the 1977-1989 period of observation; this increased to 49.8% during 1991-2003. For ideal family size of four to five children, the percentages were 56.4% and 38% of the sample for the 1977-1989 and 1991-2003 periods of observation respectively. There was equally a decrease in the percentage of women who reported an ideal family size of six or more children: from 14.6% during 1977-1989, to 8.4% during 1991-2003. Thus, the results show a big change in attitudes towards desired family size between the periods 1977-1989 and 1991-2003, the trend being towards smaller size.

The regression results presented in Table XXII below show that for ideal family size, more groups face significant relative risks during the 1991-2003 observation period, and less (only one group - wanting an ideal family size of six or more children) during 1977-1989. Thus, for 1991-2003, women who reported ideal family sizes of four to five, six or higher, and a non-numerical response faced highly significant risks of the order of 60.7%, 72.5%, and 74% respectively above the reference category of zero to three children. For the 1977-1989 period on the other hand, the risk (for the group reporting an ideal family size of six or more children) is 38.5% higher than the reference category. Thus, the results are generally as expected – women who report higher fertility demand face significantly higher relative risk of progressing to the second conception than those who express less of it.

The results for the third conception interval (Table XXIII) and for 1991-2003 are similar to those for the same observation timeframe of the second conception interval. For women reporting an ideal family size of four to five, at least six, or that is non-numerical, the risks of progressing to the third conception are significant and increasing – being 32.7%, 71.7%, and

49.9% higher than the reference group. For the 1977-1989 observation period on the other hand, it is the group of women reporting an ideal family size of four to five children that is significant; nevertheless the difference from the reference group is not big at all – only 6.8%. What emerges from the above comparison of the relative hazards, for the 1977-1989 and 1991-2003 periods, is that the risk ratios increased during the more recent period (1991-2003) as compared to the earlier. Thus, during 1991-2003, for the second interval and for women who want six or more children, the relative risk is 72.5% higher than the reference group; for the 1977-1989 period it is only 38.5% above the reference category. Similarly for the third interval: the risk (for women reporting an ideal family size of four to five children) is 32.7% for the 1991-2003 period, and only 6.8% for 1977-1989.

The observation that in general, the difference in risks (between the reference category of a reported ideal family size of three or fewer children and the comparison group) increased during 1991-2003 as compared to 1977-1989 is equivalent to saying that the relative risks for the corresponding groups decreased when the reference group is changed to the largest ideal family size of six or more children. To that extent therefore, the changing relative risks associated with ideal family size may be a proxy for evolving modern attitudes regarding family building strategies and investment in the quantity and quality of children, ideas which are gradually taking root in a number of countries in sub-Saharan Africa including Kenya (Watkins 2000; LeGrand et al. 2003).

A question that arises is, “given the bias in ideal family size as a measure of fertility preferences and demand, to what extent are the resulting coefficients (risks) biased away from the true values of the relative hazards?” While a comprehensive answer is beyond the scope of this chapter and thesis, a closer examination and comparison of the models may nevertheless provide an indication of how much weight to place on the implications of including or not including ideal family size in the previous model (model three). A comparison of the significant relative hazards for region of residence (a variable of main interest in this analysis) in the regression model with explanatory covariates added and interaction terms (model three) on the one hand, and another regression which this time incorporates ideal family size leads to a number of observations touching on significance and magnitude of the differences in the relative hazards.

For the second interval and the 1991-2003 period, the relative hazards (for the regression with interactions and the one with ideal family size added) for the urban areas remain close and are both significant at the 0.01 level, being 0.677 and 0.687 for Nairobi relative to the reference group, other rural areas. Similarly for 1977-1989, the relative risk in the model with ideal family size included for Nairobi city relative to other rural areas is slightly higher, at 0.812 and lower in the interactions model at 0.790 of the reference group. Therefore, it appears that including ideal family size or not, the hazard of transition to having the second or third conception remains significantly lower in the urban areas as compared to other rural areas, with only small changes in the magnitude of the relative risks. The observation of little change in the significance and difference in the relative risks between the interactions model and one comprising ideal family size also holds true with respect to a number of other covariates, particularly being married by the time of first birth. Thus, adding ideal family size has little effect on other estimated effects, the results remaining robust to this change in the covariate entering the model.

In examining corresponding results for the third interval (Tables XXI and XXIII), similar conclusions result. These slight increases in the relative hazards may be related to the nature of ideal family size as a covariate. First, it may bring in its biasing effects as an inexact measure of fertility demand. Secondly, in models of the determinants of fertility (Easterlin 1975; Easterlin and Crimmins 1985) ideal family size – which may be taken to represent demand for children - may not only be considered to be an intermediate variable, but also an endogenous covariate in the system of factors that determine the length of birth intervals. In this intermediary case, the relative risks for the other covariates may represent the net effect following the accounting for their effects through the pathway of motivation for fertility control. This question, where motivation for fertility control is considered as an intermediate and endogenous variable, is nevertheless pursued in more detail in the next chapter.

Table XXII: Cox Regression Hazards Including Ideal Family Size for the Second Conception, Kenya

Observation Period	1977-1989	1991-2003
Region:		
Other Rural	1.000	1.000
Nairobi	0.812*	0.687**
Other Urban	0.785**	0.782*
Central Rural	1.086	1.192
Educational Level:		
None	1.000	1.000
Primary	0.814*	0.951
Secondary	0.830	0.822
Age at First Birth:		
10-17	1.000	1.000
18-24	0.942	1.014
25+	0.670	0.762
Survival of First Birth:		
1 Boy	1.000	1.000
1 Girl	1.047	0.902
0 Survivor	1.194	1.383*
Period of First Birth:		
1977-1983	1.000	
1984-1989	0.712*	
1991-1997		1.000
1998-2003		0.929
Socio-economic Status:		
Low	1.000	1.000
Medium	0.919	0.777**
High	0.919	0.874
Religion:		
Catholic	1.000	1.000
Protestant	1.038	0.961
Muslim	0.886	1.096
Other	0.734*	0.886
Ethnic Group:		
Kikuyu	1.000	1.000
Luhya	1.055	1.803***
Luo	1.015	1.606**
Kalenjin	1.029	1.538**
Other	1.035	1.338*
Ever-married:		
No	1.000	1.000
Yes	1.771***	1.396**
Ideal Family Size: ≤3	1.000	1.000
4 -5	1.098	1.607***
≥6	1.385**	1.725***
Non-numerical	0.680	1.740**
Age at First Birth x Period:		
10-17 x Recent Period	1.045	
25+ x Recent Period	1.044	
Child Survival x Period:		
1 Boy x Recent Period	1.004	0.872
No Survivor x Earlier Period	1.294	
1 Girl x Earlier Period		1.074
Ever-married x Recent Period	1.187	1.150

Note: ***: p<0.001; **: p<0.01; *: p<0.05; Reference category is marked with a relative risk of unity (1.000).

Table XXIII: Cox Regression Results Including Ideal Family Size, Third Interval, Kenya

Period of Observation	1977-1989	1991-2003
Covariate		
Region:		
Other Rural	1.000	1.000
Nairobi	0.651***	0.605***
Other Urban	0.729***	0.712**
Central Rural	1.149	0.608**
Education:		
None	1.000	1.000
Primary	1.315**	1.063
Secondary	1.187	0.716
Age at First Birth:		
Age 10-17	1.000	1.000
Age 18-24	1.052	0.871
Age 25+	0.880	0.900
Survival Status and Sex Composition:		
One son and one daughter	1.000	1.000
Two daughters	1.111	1.163
Two Sons	1.122	1.108
One Son	1.531***	1.120
One Daughter	1.476*	2.388
All Died	2.001	4.315***
Period of Second Birth:		
1977-1983	1.000	
1983-1989	0.730	
1991-1997		-
1997-2003		-
Socio-Economic Status:		
Low	1.000	1.000
Medium	0.878	0.806
High	0.948	0.985
Religion:		
Catholic	1.000	1.000
Protestant	0.980	1.054
Muslim	0.905	0.858
Other	0.886	1.083
Ethnic Group:		
Kikuyu	1.000	1.000
Luhya	1.028	1.192
Luo	1.018	0.932
Kalenjin	0.824	1.065
Other	0.947	1.072
Ever Married:		
No	1.000	1.000
Yes	1.569***	1.819**
Ever Married x Period:		
No x Second Period		1.000
Yes x Second Period		0.756
Ideal Family Size:		
≤3	1.000	1.000
4-5	1.068**	1.327**
≥6	1.321	1.717***
Non-numerical	1.244	1.499*

Notes: ***: p<0.001; **: p<0.01; *: p<0.05; Reference category has relative risk of 1.000.

Summary

In this chapter a number of hypotheses, concerning the transition to the second and third conceptions, three of them being about the change in both intervals were tested. First, it was predicted that there would be differences in the relative hazard to the second and third conceptions in region of residence, due in part to differences in levels of development and culture. Secondly, for both intervals, it was expected that the hazard ratio of a second or third conception would be greater during the six-year period of constant fertility (1997-2003) compared to that when the levelling off in fertility was just beginning (1991-1997). Thirdly, it was hypothesized that the relative risk of changing to the second and third conceptions would differ by age group at first birth, being lower for the higher age groups, when compared to the younger age categories. A summary of findings for each hypothesis follows.

As expected, relative to residence in other rural areas, living in the urban areas is associated with significantly reduced relative hazards of transition to the second conception over both twelve-year periods (1977-1989 and 1991-2003). Nevertheless, for rural Central province, this relative risk is significant only in the basic model that contains the three hypothesized covariates. The difference in risks between the reference region of residence (other rural areas) and the urban areas is also remarkable – it is higher during 1991-2003 than 1977-1989. For the third interval, the hypothesis is again confirmed, but in a slightly different way from the second interval. While both urban groupings show a significant hazard of transition to the third conception during 1977-1989, for the 1991-2003 period rural Central province joins the group. During this period, the relative risk for rural Central province reaches levels that are either equal to or slightly lower than those for the urban areas, indicating that there were major changes in reproductive behaviour in rural Central province.

To the extent that regional differences in the spacing of births are determined by the proximate determinants of fertility, it may be useful to examine the changes in contraceptive use and breastfeeding in the regions. In 1977, use of modern contraceptives among women of reproductive age in rural Central Province was at 7.1%, and lower at 2.9% in the rest of rural Kenya. By 2003, the gap had widened considerably: 58.9% of women aged 15-49 years were using a modern method of contraception in rural Central Province, against less than a half

(25.5%) in other rural areas (details in Table XIV, chapter four). Thus, there was more intense adoption of contraceptive use in rural Central Province compared to other rural areas. In addition, more recent studies (Magadi and Agwanda 2007) indicate that those other rural areas which registered reduced breastfeeding also experienced a levelling off or marginal increase in fertility.

The hypothesis that the risk of transition to the second or third conception would be higher over the period of constant fertility (1997-2003) is not confirmed. Instead, for the second interval, the six-year period of falling fertility (1983-1989) is associated with a reduced transition to the second conception; the same observation is true with regard to the six years during which constant fertility was underway (1997-2003), but the risk being less significant (only at the 5% level). For the third interval, the risk is again highly significant over the period of falling fertility (1983-1989); but non-significant when fertility levelled off (1997-2003).

The proposition that increasing age at first birth is associated with a reduced risk of transition to the second or third conception is partly confirmed for both twelve-year periods. However, this is only true among women who were 25 years old or more by the time of their first birth relative to those who had their first baby when they were 10 to 17 years old. For the period 1977-1989, it is in the model with additional explanatory covariates that this finding is true; during 1991-2003 it is only true in the basic model. For the third conception interval, age at first birth again turns out to be a weak predictor of the transition to the third conception. Thus, while it is not significant for the period 1977-1989, age at first birth is only statistically significant in the basic model that comprises the three covariates over 1991-2003. In this case, in comparison to women who were 10 to 17 years old when they had their first birth, the risk is significantly reduced among women who were aged 18 to 24 years, as well as among those at least 25 years old by the time of their first birth. Variation in age at first birth is often associated with educational level attained and age at first marriage; the fact that primary and secondary or higher education are significant predictors of the transition to the second and third conception possibly suggest that some of the influence of age at first birth on the risk of a second or third conception might be affected by transitions in education, the marriage market, and employment (Caldwell et al. 1992).

In addition to the three hypotheses which apply to the second and third intervals, that the number and sex composition of surviving children might influence the transition to the third conception was a main proposition tested for the third interval. Before summarising the findings for this hypothesis however, it is useful to begin with observations on child survival for the second interval. Whether during the 1977-1989 or 1991-2003 period, the relative loss of the first child is definitely associated with an increased transition to the second conception; the risk of losing a son or a daughter, relative to a surviving male child, being one and a half times higher for the 1991-2003 period, and only one and one third higher for 1977-1989.

For the third interval, the influence of child survival on the relative risk of a third conception is similarly clear; nevertheless it is more evident during the more recent period (1991-2003). For this period, and in the model with additional explanatory covariates, losing all the two children, one daughter, one son, or having both daughters alive leads to a significant increase in the hazard ratio of a third conception. The results are most striking for the group of women who have lost both children, representing a very highly significant risk that is two and a half times higher than that for the reference group - one surviving son and one surviving daughter. In contrast, over 1977-1989, the same observations hold except that having both daughters alive is not significant. Also, at two and one fifth, the difference in risk between the reference group and both children having passed away is lower compared to that for 1991-2003, which is higher at a relative risk of two and a half. The results additionally show that the significance and intensity of gender preference is more evident during 1991-2003. Finally, it is useful to note that the significant results of the effects of child survival coincide with increased infant and child mortality that was registered during the 1990s in the country (NCPD 1989; NCPD 1994 ; NCPD 1999; CBS et al. 2004).

This chapter has examined the factors associated with the timing of births for women in their early reproductive stage (having had one to three births) over the periods 1977-1989 and 1991-2003. One of the findings for 1991-2003 or 1977-1989 is the significant association between residence in the urban areas as well as in rural Central province relative to other rural areas with decreased risk of a third conception. Also, the length of birth intervals increased overall during the 1991-2003 period compared to 1977-1989: nevertheless the highest increase was observed in

rural Central Province. Contraceptive use - although not explicitly entered into the regressions conducted for this chapter - emerges as a possible determinant of the spacing of births that may well explain many of the observed differences among regions. In line with the conceptual framework for this dissertation (Figure 2 in chapter 1) that seeks to understand fertility dynamics for all three reproductive stages (early, middle, and late), the next chapter examines in greater detail the role of this proximate determinant of fertility in Kenya's fertility transition.

CHAPTER 7: THE DETERMINANTS OF CONTRACEPTIVE USE IN KENYA AND THE FERTILITY TRANSITION

Introduction

In the last chapter, the factors associated with the transition to the second and third conceptions were examined. This part of the thesis takes over from where the previous left, with findings from chapter five also being pertinent. Among earlier findings, it is observed that two demographic variables - marriage and child mortality - are associated with increased relative risk of transition to the second and third conceptions (both during the 1977-1989 and 1991-2003 periods). Socio-economic status and education on the other hand relate to significantly reduced relative hazards of progression to the second and third conceptions.

Contraceptive use is a determinant of the length of birth intervals (Trussell et al. 1985), and in chapter five, in which the trend patterns in the fertility transition were addressed, it was observed that substantive differences exist in contraceptive use in Kenya - by region, over the entire 1977-2003 period. The possible role of contraceptive use in explaining this changing fertility is therefore worthy of further investigation, and will now be examined further. In line with this focus, the purpose of this chapter is to explore the determinants of increased contraceptive prevalence and hence decline in fertility by examining the role of two factors widely believed to cause such a rise in prevalence. These are increased motivation for fertility control, and improved access to contraceptive information and services. In addressing this objective, first, an overview of the conceptual issues involved in the fertility transition and of the hypotheses to be tested is presented. Then the context of fertility decline in the country is examined, after which the statistical model applied in the analysis is developed. Univariate and multivariate results are next presented, before concluding with a summary of the findings.

Three ideas that are particularly useful in the explanation of why fertility falls are the demand for children, the supply for children, and access to family planning services. Granted that there has been a decline in fertility in Kenya, there has also been a corresponding increase in contraceptive prevalence. In such a situation, a question arises: “what are the factors responsible

for this increase in prevalence (Feyisetan and Casterline 2000)?" The supply and demand framework for the analysis of the fertility transition helps in answering that question (Easterlin and Crimmins 1985). Thus, contraceptive prevalence varies not only due to changes in access to family planning services and fertility demand, but also due to variation in the supply of surviving children. Among the three concepts of fertility demand, supply, and access, interest is also focussed on how to measure fertility demand. Several measures have been proposed, and desire for more children is considered as the least biased (McClelland 1983; Bongaarts 1990) – the significance of this observation on the choice of one of the proposed dependent variables (motivation for fertility control) in the model becoming clear further on.

To take into account the possibility that fertility demand and contraceptive use might be endogenously determined, in this chapter, factors that might influence contraceptive use are first modelled by a simple probit, and then with the instrumental variables approach (Bollen et al. 1995; Guilkey and Jayne 1997). As part of this process, a number of procedures and tests aimed at assessing the adequacy of using the simple probit on the one hand, and the two-step instrumental variables technique on the other to determine factors that influence contraceptive use are applied (StataCorp. 2007). Lastly, a multinomial logit regression that models use of contraceptive methods (modern, traditional, and none) as a function of different types of motivation for fertility control (desire more children after two years, within two years, no more, and undecided) and other independent variables is applied.

Hypotheses concerning the determinants of contraceptive use were outlined in section 1.7.3 of chapter 1; they are restated here as a reminder. First, age and region of residence are expected to be significantly related to contraceptive use: older women being positively related to contraceptive use, and women from more developed regions being more likely to use a contraceptive method. Secondly, women who report an ideal family size that is lower than the number of living children (which is taken as a proxy for greater motivation for fertility control) are more likely to use a family planning method. Thirdly, factors that are related to the family planning program, and in particular having been exposed to a message about family planning, and proximity to sources of family planning services are also expected to be significantly and positively associated with contraceptive use.

7.1 Context of the Kenyan Fertility Transition

7.1.1 Trends in Fertility, Preferences, and Proximate Determinants

Before embarking on the analysis of results for the determinants of contraceptive use, it is useful to provide the background against which the process of contraception adoption, or non-adoption, has been taking place. This context, which is provided in the next sections, consists of a recapitulation of the trends in fertility and some of its determinants, the policy as well as socio-economic factors associated with the decline in fertility, and the provision of family planning services in the country.

Details regarding the trends in fertility, motivation for fertility control, and the proximate determinants were presented in sections 5.2 to 5.4 of chapter 5; suffice it here to highlight but the most salient observations, which are restricted to the period 1977-1998. First, while fertility declined nationally from the high level of 8.2 births per woman in the late 1970s to 5.4 in 1998, examination of the trends at the sub-national level shows regional variations. For example, it is striking that in rural Central province, fertility declined from a high of 8.6 births per woman in 1977/78 to 3.9 in 1998, while in other provinces, this decline was more modest (NCPD 1999).

Secondly, with regard to stopping intentions, at the national and sub-national levels the trend has been that of an increase, with the percentage of women who want no more children rising from 16.6% in 1977/78 to 51.5% in 1988/89; thereafter the rate of increase was restrained, reaching 54.9% of women aged 15 to 49 years by 1998. Thirdly, two proximate determinants of fertility - age at first marriage and contraceptive use – are observed to follow a similar, increasing, trend. Thus, at the national level, the median age at first marriage increased from 20.1 years in 1977/78 to 22.5 in 1998. Sub-nationally, it is observed that while a pattern of relatively early family formation prevailed in the other rural areas, in the urban areas and rural Central Province, family formation started later. Similarly, the percentage of women using a modern contraceptive method rose from 4.3% of all women aged 15 to 49 years in 1977/78 to 31.6% by 1998. Among the regions, rural Central Province stands out with regard to contraceptive use: while in 1977/78 7.1% of married women of reproductive age were using a modern contraceptive method, by 1998 this had profoundly changed, the province emerging as the one (at 54.9%) with the highest level of prevalence in town or country-side.

7.1.2 Socio-economic and Policy Factors

Variations in economic factors affect fertility (Kelley and C. E. Nobbe 1990; Hill 1993), and a review of the evolution of the Kenyan economy from the time of political independence in 1963 was provided in section 1.2. Suffice it here to highlight the salient and relevant aspects of these economic trends to the transition in fertility. During the 1990s, performance of the Kenyan economy stagnated or declined, and this could have had the effect of raising the costs (quality) of childrearing and by implication, the number (quantity) of children as well (Easterlin 1975). The effects of the economy on fertility can also be perceived through women's activities: among women in the labor force, time for childbearing and rearing becomes critical. It is possible that in the urban areas, particularly Nairobi city, and neighboring rural Central Province, these economic factors have played a part in shaping fertility levels and trends.

Beyond the macro and micro economics of fertility, the fertility transition in Kenya is closely related to the evolution of family planning in the country. In Kenya, this movement began in the 1950s – during the pre-independence period - when a group of volunteers modestly inaugurated what was to become the Family Planning Association of Kenya (FPAK). Nevertheless, it was not until 1967 that a national family planning programme was launched. Under this programme, family planning was integrated into the maternal and child health division of the Ministry of Health, through which it was provided in a growing number of health facilities throughout the country.

In 1984 the Government ratified a set of population policy guidelines to assist in the implementation of the population program, resulting in the creation of the National Council for Population and Development (NCPD), now named the National Coordinating Agency for Population and Development (NCAPD). In addition to considerable declines in the population growth rate, total fertility rate, and ideal family size, a number of other achievements were recorded under this population policy. For example, knowledge and use of family planning methods increased considerably between 1984 and 1998. Similarly, the District Population program was implemented in 14 (priority) districts targeted for intensified population activities in the country, and selected on the basis of high infant mortality, high population density, or an already-established high demand for fertility control. These priority districts and the provinces in

which they are located are Kilifi (Coast province), Machakos and Meru (Eastern province), Nyeri, Muranga, and Kirinyaga (Central province), Kericho and Uasin Gishu (Rift Valley province), South Nyanza, Kisii, and Siaya (Nyanza province), Kakamega and Bungoma (Western province).

Following the International Conference on Population and Development (ICPD) of 1994, the 1984 population policy guidelines were further revised to give rise to the Population Policy for Sustainable Development, issued in the year 2000. The new policy focuses on ensuring population growth that is commensurate with the country's resources, and growth that would also improve the wellbeing and quality of life of individuals, the family, and the nation as a whole.

In the implementation of this population program, the most commonly used methods of modern contraception in 1998 were injectables (used by 12% of married women of reproductive age), the pill (9%), female sterilization (6%), periodic abstinence (6%), IUDs (3%), condoms (1%), and implants (1%). Although use of modern methods was generally higher in urban areas compared to the rural, it was highest in Central province, as already mentioned. On the other hand, use of natural methods was higher in rural areas (NCPD 1999; Magadi and Curtis 2003).

The sources from which family planning services were obtained, which are shown in Table XXIV below and which are based on calculations from the KDHS 1998 and 1993 datasets, provide an idea of the comprehensive network of the national family planning program. In 1998, Government health facilities were the most widely used source, serving 58% of all contraceptive users. Private and NGO health facilities served 33% of the clientele, other private sources such as shops (5%), while Community Based Distributors (CBDs) supplied 3% of family planning users. Relative to many other African countries, this level of prevalence and distribution is high. A question that however arises is what role increased motivation for fertility control, and what part the family planning program, particularly access to services, have separately played in these increased levels of contraceptive use.

Table XXIV: Percentage Distribution of Women Using a Modern Family Planning Method by Source, Kenya 1993 and 1998

Region	Nairobi	Other Urban	Central Rural	Other Rural	National	Total No
Year/Facility						
1993						
Public Facility	53.1	55.6	77.5	71.4	68.7	1030
Private Facility	42.5	44.4	19.7	24.2	27.9	459
CBD	1.8	0.0	2.5	3.4	2.5	38
Other	2.7	0.0	0.4	1.1	0.9	13
Total%	100	100	100	100	100	
Total No	113	200	348	879	1540	1540
1998						
Public Facility	44.8	55.0	59.4	62.1	58.1	1030
Private Facility	54.6	43.9	38.0	32.5	38.4	672
CBD	0.0	1.1	2.6	5.2	3.4	74
Other	0.7	0.0	0.0	0.2	0.2	3
Total (%)	100	100	100	100	100	
Total No	143	281	290	1065	1779	1779

Notes: The majority of public health facilities comprise Government - but also parastatal, city, town or urban council - hospitals, health centres, and dispensaries. Private facility embraces mission or church hospitals, FPAK clinics, other private hospitals or clinics, pharmacies, private doctors, shops, friends or relatives. CBD refers to Community-based distributor or worker. Other sources refer to mobile clinics, additional sources not mentioned above, and where respondents stated that they did not know the source.
Source: Based on own calculations from the 1998 and 1993 KDHS datasets.

7.1.3 Delivery of Family Planning Services

The provision of family planning services in the country can be viewed as being operated from static clinics or service delivery points (SDPs) including mobile outreaches, and from the community. Regarding the last group of family planning services, there are approximately 8,000 community health workers (CHWs) and 12,000-20,000 community-based distributors (CBDs) operating through 25 different types of CBD programs – the largest of any country in Africa (Chege and Askew 1997; Kaler and Watkins 2001). Besides these CBD agents, traditional birth attendants (TBAs) also provide health services that extend to reproductive health and family planning, while traditional healers form a potential group for the provision of similar services, in particular family planning.

There are over 4,700 health facilities in the country (MOH 2005; NCPDA et al. 2005), 51% of which are managed by the public heath sector, most of which are operated by the Ministry of Health, parastatal organizations, and the Nairobi City Council. The organisation of the Government health system comprises the national referral hospitals, provincial general hospitals, district hospitals, health centres, and dispensaries: most of these facilities providing integrated maternal and child health, including family planning services. Non-governmental organizations (NGOs) and religious or faith based organizations (FBOs) form another group of service providers, managing health institutions that they own. There are also a number of privately-operated maternities or nursing homes and clinics (Chege and Askew 1997; MOH 2000; MOH 2005; NCPDA et al. 2005). In the urban areas, most people live within four kilometres of a health facility; in rural areas, this extends to five to eight kilometres in areas of high agricultural potential. In the semi-arid and arid areas on the other hand, the distance ranges between 20 and 25 kilometres. Although cost-sharing was introduced in all Government-operated health facilities in the late 1980s (meaning that there would be at least a registration fee to be paid), family planning services are not charged in this system.

Alongside the provision of family planning services, another important role played by the family planning program is the provision of family planning information, education, and communication (IEC), with studies showing that exposure to family planning messages is positively associated with – but does not necessarily cause - contraceptive use in Kenya (Westoff and Rodriguez 1995). In this regard, studies suggest care in attributing the direction of causation: women who are using contraceptive methods may be more receptive to family planning messages, so that in this case it is contraceptive use that motivates exposure to family planning messages. The above study on the mass media and family planning in Kenya notes that a major family planning mass media campaign had been launched before the 1989 KDHS survey, and this may provide some evidence of causation. In addition, women who are motivated to limit their fertility might be more likely to remember media messages about family planning. In the analysis and interpretation of results, the caution about the endogeneity between exposure to family planning messages and contraceptive use will be borne in mind.

Information, education and communication (IEC) activities from part of the operations of the family planning program through static and outreach clinics, as well as community-based services. It is through a variety of channels, including print, electronic, and personal media that these activities are implemented; the print media comprising newspapers, billboards, posters, brochures, and booklets. The most common electronic media are radio and television, with personal communication conducted in the clinics through health talks, while CBD agents provide motivational talks. This national IEC program is to a large extent motivational: through the different types of media, prospective and current parents are educated on the benefits of family planning (NCPD 2000).

In 1998, radio and television were the most popular sources of family planning information, with 16% of the female respondents and 30% of the men interviewed reporting that they had heard about family planning through the radio or television in the six months immediately preceding the survey (NCPD 1999). Variations are observed in exposure to these two electronic media by area of residence: women residing in urban areas, as expected, show greater exposure to family planning messages than their rural counterparts. Among the provinces, exposure to family planning messages is highest in Nairobi and lowest in Nyanza province. Exposure also varies by educational level, women with no education being least exposed, in contrast to those with secondary or higher education who are exposed the most. Variations can also be observed with regard to exposure to other types of media (newspapers or magazines, billboards, live drama, or other community events). Women in the middle of their reproductive careers (20-39 years), those with higher as opposed to lower levels of education, and residing in urban versus rural areas are all associated with greater exposure to the other, non-electronic media. In contrast, community media such as drama are more frequently watched by rural residents.

These IEC activities, together with the provision of family planning services, constitute the family planning program. That their implementation should lead to increased contraceptive use is expected - the question is how. Based on the methodological model for this chapter which was outlined earlier (Figure 13 in section 4.3), the results of data analysis are next presented

7.2 Descriptive Statistics

The two datasets (at the individual, community and health-facility levels) were finally matched; analysis commenced with an exploratory examination of the descriptive statistics (means and standard deviations) for the exogenous and endogenous variables. In particular, the means for variables which form the basis of the regressands later used in the analysis - ideal family size, current contraceptive method, number of births and deaths – are presented in Table XXV below. The results show that for ideal family size, 120 women (5.6% out of the selected sub-sample) reported that they were undecided about their ideal family size. Similarly, while 30.8% of the women in the selected and weighted sub-sample (of 2,043 women out of the total KDHS sample of 7,881 of reproductive age) are currently using a modern method of family planning, a much smaller proportion - 9.5% - is using a traditional method.

Table XXV: Descriptive Statistics - Ideal Family Size and FP Method Used, Kenya 1998

Percentage/Number	Percentage	Number of Cases
Variable		
Ideal Family Size		
0-3	34.6	667
4-5	45.7	947
6+	14.1	308
Non-numerical	5.6	120
Total	100.0	2042
Current Use of Methods:		
Using Modern	30.8	597
Using Traditional	9.5	170
Not using	59.7	1276
Total	100	2043

To decide on the categorization of the two dependent variables, a number of exploratory model specifications were conducted. One of these comprised grouping the endogenous variable (fertility intentions) into the dichotomy of wanting no more children versus the rest (wanting within two years, after two years, undecided). Contraceptive use was also similarly categorized into the binary categories of currently using a modern method versus a traditional method or not using any. When these and other specifications were applied in the probit regression with instrumental variables, the models would either not converge, or produced disappointing results.

The form of dependent variables ultimately chosen was additional number of children desired (continuous) and contraceptive use (dichotomised into using a modern or traditional method and not using any method). The first choice was made in order to conform to the requirement of continuous or binary variables for solutions of systems of equations that involve endogenous variables (Bollen et al. 1995). For the second, contraceptive use, it is worth noting that in Kenya, traditional or natural methods of family planning are often considered side by side with the modern: funding and implementation of the family planning program officially comprises the two, with the Kenya Catholic Secretariat implementing the natural family planning component in the national program. In the regression analyses that follow, the number of additional children desired is treated as a continuous variable, and is calculated as the ideal number of children reported minus the number of living children. This is in spite of the categorical presentation in Table XXVI, and the bias in ideal number of children as a measure of fertility demand notwithstanding (Bongaarts 1990; Pritchett 1994). The results, in Table XXVI show that among women who report the number of living children they have as being equal to or more than their ideal family size, i.e. those who are content with or have exceeded their lifetime fertility desire, 48.1% are using either a modern or traditional method of family planning. The proportion using a contraceptive method decreases with increasing fertility preferences: for example, only 10% of women who report wanting six or more additional children are using a method of family planning.

Table XXVI: Distribution of Dependent Variables among Currently-Married Women, Kenya 1998

Current Contraceptive Use	No	Yes	Total
Extra Children Desired			
≤0	51.9	48.1	923
1-3	61.2	38.8	833
4-5	81.2	18.8	132
6+	90.0	10.0	34
Total	58.6	41.4	1922

Note: Respondents who reported a non-numerical response for ideal family size are not included in this tabulation.

In addition to the above outcome variables, the means and standard errors of independent variables - most of which are constructed as dummies but a number being continuous – are shown in Table XXVII. Unlike those in the previous table which are based only on currently married women in the 1998 KDHS, these are also linked to the 1999 KSPA community survey. The upper part of the table comprises variables at the individual level – these are age, religious affiliation, spouses' educational levels, births, child deaths, the community child mortality index (at the level of the community, estimated as the ratio of the total number of children who have died divided by the number ever born), the wealth index, the presence of the husband in the household, and exposure to a family planning message (a variable that might be potentially endogenous in motivation for fertility control, but which is nevertheless considered as predetermined here).

Several features of the distribution of the independent variables are worth pointing out. From the age distribution, it is apparent that most of the respondents are concentrated around the peak childbearing ages groups, and in particular between ages 25 and 29 inclusive, which comprises 24% of the women in the sub-sample. When the distribution is examined by religious affiliation, it emerges that Protestants predominate, forming 67% of the women represented. For the educational levels of husband and wife alike, the primary level is most frequent, constituting 47.1% and 57.2% of the respective spouses. While the mean number of children ever born per woman is 3.976, the results also show that if all the number of dead children were distributed to the women interviewed, it would come to about 0.4 child deaths per woman. Subtraction of the means of child deaths from that of the number of children ever born implies a mean of 3.5 surviving children per woman. The table also shows that at the level of the community, about 10% of all children ever born have passed away. Regarding husbands, 26.3% were reported to be away from the household at the time of the interview. In contrast to all women of reproductive age interviewed in the 1998 KDHS, among whom only about 15% had been exposed to a family planning message over the radio or television, a substantial proportion of the women in this sub-sample, 61.2%, have been exposed to a family planning message (through the radio, television, or newspapers) at some point during the six months before the survey. The increased proportion could be related to the selection of only some clusters, as well as to the increased number of media included in the estimation of exposure for this sub-sample.

Table XXVII: Descriptive Statistics for Exogenous Variables, Kenya 1998/1999

Statistic	Mean	Standard Error
Variable		
Age:		
15-19	0.060	0.006
20-24	0.198	0.012
25-29	0.242	0.012
30-34	0.181	0.011
35-39	0.174	0.010
40-44	0.085	0.071
45-49	0.061	0.006
Religion:		
Catholic	0.261	0.017
Protestant	0.670	0.019
Muslim	0.035	0.009
Other	0.034	0.006
Husband's Education:		
None	0.083	0.011
Primary	0.471	0.017
Secondary+	0.445	0.019
Wife's Education:		
None	0.127	0.013
Primary	0.582	0.017
Secondary+	0.291	0.019
Births:	3.878	0.093
Child Deaths:	0.394	0.033
Community Child Mortality Ratio:	0.094	0.007
Wealth Index:		
Low	0.389	0.025
Medium	0.239	0.015
High	0.363	0.025
Husband Away:	0.263	0.014
F.P. Message:	0.612	0.017
Region:		
Nairobi	0.088	0.024
Other Urban	0.133	0.026
Central Rural	0.094	0.019
Other Rural	0.685	0.035
Access to Facility:		
Hospital	0.075	0.023
Health Centre	0.055	0.018
Dispensary	0.076	0.023
Maternity/Nursing Home	0.085	0.022
Clinic	0.101	0.025
CBD	0.311	0.033

In the expectation that community factors also play an important role in influencing motivation for fertility control and contraceptive use, a number of community variables were examined and are shown in the lower part of Table XXVII. Starting with the locality in which the respondent resides, the results show that most of the clusters or villages visited during the 1999 KSPA community and health facility survey, 68.5%, are found in other rural areas, with Nairobi and rural Central Province constituting only 8.8% and 9.4% respectively of the sub-sample. The other community variables relate to whether the health facilities were open by the time the respondent was starting her reproductive career, and current access to family planning services. The first of the health facility variables is measured by whether the nearest health facility was open by the time a woman was 15 years of age, starting in 1963 when the country received political independence and when significant expansion in all development sectors including health infrastructure commenced. Following past applications (Bollen et al. 1995), this set of dummy variables (access when the woman was 15 years old) – together with the community mortality ratio - is used as the exclusion constraint for identifying the contraceptive use equation in the regression analysis. It appears in the regression in which additional children desired is a dependent variable, but not in the contraceptive use equation. It is assumed that once opened (starting in the year 1963 or later) health facilities remain so throughout the period of observation. For current access to a facility, the results show that few of the communities (and hence facilities) are in urban areas.

One of the problems encountered in the health facility data is that it was not possible to determine the date of opening for 51 out of the 388 health facilities. A second problem had to do with the allocation of health facilities to the catchment community or cluster to which each is attached - it was not possible to do this accurately for all the health facilities. As a result of these two problems, in addition to the fact that many health facilities opened much later than the year set here for the start of observation (i.e. 1963), many of the means for the health facility are low, as can be seen in Table XXVII.

Another variable that was used to capture current access to family planning services is whether a community-based distributor (CBD) operates in the community, and the results indicate that

31.1% of the communities have a CBD agent, a figure that seems to be exaggerated in comparison to the 20.7% obtained in the 1993 KDHS (NCPD 1994).

The location of the community - whether an urban or rural area – to which each of the five types of health facilities is associated was used as a proxy for the more accurate measure of access to family planning services, such as distance to the health facility; the assumption being that communities living in urban areas are within closer proximity to the facilities offering family planning services than those living in completely rural areas. In addition to this physical access, people living in urban areas would also be expected to have better access to information (through better education and exposure to media) about family planning services.

7.3 Results of Regression Analyses

7.3.1 Effects on Additional Children Desired

Motivation for fertility control is one of the important variables hypothesized to influence contraceptive use, and it is crucial to understand the factors that determine it. Table XXVIII shows the results of ordinary least squares (OLS) regression on the factors that affect additional children desired, with most regressands having been constructed as dummy independent variables. Several coefficients are worth noting, the focus being on the effects of three variables that were hypothesized to influence contraceptive use – age, region of residence, and exposure to family planning messages. As the table shows, the age effects are strong, significant, and in the expected direction: the desire for additional children decreases with age, being highest among young women, and lowest among the oldest. Whether this significant trend is associated with parity-specific fertility control is however not clear at this point of the analysis. For the other hypothesized relationships, the effect of exposure to family planning messages on desire for additional children is non-significant. For region of residence, living in Nairobi is positively and significantly associated with desire for additional children (possibly because of a younger age structure of women within reproductive age) as the effects of habitation in rural Central province and other rural areas significantly decrease with additional children desired.

Although not among the directly hypothesized relationships, two effects – those for the index of community child mortality and educational level - turned out to be significant. The effect of the

first (child mortality) is big (3.987), highly significant (at the 0.001% level), and in the positive direction. On the other hand, the effect of the wife's primary-level education (-0.824) is in the negative direction, at the 0.01 level of significance, with secondary and higher education being non-significant.

Table XXVIII: Ordinary Least Squares Regression of Additional Children Desired on Independent Variables, KDHS 1998/KSPA 1999

Value of Coefficient	Coefficient
Variable	
Age group:	
15-19	4.340***
20-24	3.587***
25-29	2.600***
30-34	1.843***
35-39	1.278***
Wealth Index:	
Medium	0.266
High	-0.393**
Religion:	
Catholic	-0.521
Protestant	-0.425
Muslim	0.776
Community Mortality Ratio:	3.987***
Wife's Education:	
Primary	-0.824**
Secondary	-0.530
Husband's Education:	-0.001
Region:	
Nairobi	0.583**
Central Rural	-0.376*
Other Rural	-0.365*
FP Message:	-0.177
Access to health facilities at age 15:	
Hospital	0.240
Health Centre	0.072
Dispensary	0.004
Maternity and Nursing Home	0.257
Clinic	-0.282
Constant:	-0.599
R-squared	0.32

Note: ***: p<0.001; **: p<0.01; *: p<0.05. Omitted categories are as follows: Wealth index (low); Religion (Other); Wife's education (None); Region (Other Urban).

7.3.2 Effects on Contraceptive Use

Results for the simple probit regression, in which the problem of endogeneity is ignored, are shown in Table XXIX below. Of the hypothesized effects, those for age, region of residence, and exposure to a family planning message are significant and are discussed in turn. The results show that one of the peak age groups for child-bearing, 30-34 years, is significantly associated with increased contraceptive use. Thus, column two in Table XXIX indicates that age group 30-34 is associated with a 0.270 increase in contraceptive use.

Among the regions, residence in Nairobi city is slightly associated with increased contraceptive use (at the 5% significance level), while rural Central province shows a stronger level of significance – 1%. This confirms the previous observation of the high contraceptive rates in the two regions. Thus, the effect of residence in Nairobi city is to positively change contraceptive prevalence by 0.436 units. For rural Central province on the other hand, the effect is even higher, at 0.594 units. Regarding motivation for fertility control, as expected, contraceptive use significantly decreases with an increasing number of additional children desired; the possibility that this result overestimates the effect of desire for additional children on contraceptive use being treated in greater detail further on in the chapter.

Having been exposed to a family planning message in the past six months before the survey is significantly associated with increased contraceptive prevalence - by order of magnitude of 0.250, which is highly significant at the 0.1% level. Despite the accord, in terms of significance, of this result with other research findings (Westoff and Rodriguez 1995), the effect of exposure to mass media messages on contraceptive use could be underestimated. This is because, in spite of the expectation of increasing use of contraceptive methods with intensification of IEC campaigns, the purposive targeting of regions of low contraceptive use (areas in which fertility desires are high and respondents are unlikely to remember having heard messages in the last six months, information that may not be relevant according to them) with media messages could result in a deflated effect on contraceptive use (Briscoe et al. 1990; Bollen et al. 1995; Wonnacott and Wonnacott 1995; Guilkey and Jayne 1997).

Nevertheless, assuming that ownership of the most popular medium of communication (radio) does not vary greatly between regions with high and low fertility, exposure to messages may be considered to be generally random across the country - in other words, a predetermined or exogenous variable. Given the question of the endogeneity or exogeneity of media messages in the determination of contraceptive use, empirical testing of the endogenous model would help resolve the issue - however this is an undertaking that was not central to this dissertation, and therefore not addressed.

A number of variables which did not form part of the hypothesized effects also significantly affect contraceptive use. These include belonging to a household of high wealth index, and the wife's education. The first, coming from a household of high wealth, has a 0.270 effect on contraceptive use, which is significant at the 0.1% level. On the other hand, the wife's primary and secondary or higher levels of education have much larger effects. A woman with primary education is associated with a 0.414 change in contraceptive use, while secondary or higher education is associated - as expected - with a change that is very significant and of magnitude 0.751 or 81% higher.

Table XXIX: Probit Regression Results of Contraceptive Use on Independent Variables, by Type of Regression, Kenya 1998/1999

Type of Regression:	Simple Probit	Probit With Error Term	IV Probit	Reduced Form Probit
Variable				
Additional Children Desired:	-0.071***	-0.648***	-0.579***	
Residual		0.593***		
Age group:				
15-19	-0.031	2.512***	2.227***	-0.352*
20-24	0.089	2.212***	1.964***	-0.182
25-29	0.164	1.697***	1.480***	-0.031
30-34	0.270*	1.348***	1.163***	0.128
35-39	0.083	0.827***	0.686***	-0.019
Wealth Index:				
Medium	-0.086	0.069	0.105	-0.107
High	0.270**	0.004	0.033	0.298**
Religion:				
Catholic	-0.028	-0.302	-0.132	0.008
Protestant	-0.094	-0.284	-0.095	-0.067
Muslim	-0.176	0.325	0.431	-0.223
Wife's Education:				
Primary	0.414**	-0.091	0.079	0.455***
Secondary	0.751***	0.391*	0.473**	0.775***
Husband's Education:	0.004	0.005	0.012*	0.004
Region:				
Nairobi	0.436*	0.719***	0.719**	0.405*
Central Rural	0.594**	0.360	0.438*	0.627**
Other Rural	-0.072	-0.160	-0.185	-0.054
Husband Away:	-0.092	-0.119	0.014	-0.105
FP Message:	0.250***	0.148*	0.163	0.260***
Access:				
CBD	-0.063	-0.046	-0.087	-0.054
Hospital	-0.167	-0.029	-0.062	-0.163
Health Centre	-0.039	-0.009	0.055	-0.052
Dispensary	-0.016	-0.002	-0.077	-0.019
Maternity and Nursing Home	0.020	0.107	0.028	0.031
Clinic	-0.068	-0.125	-0.046	-0.074
Constant:	-0.953**	-1.194***	-1.503***	-0.897**
Observations	1895	1895	1895	1896

Notes: 1. ***: p<0.001; **: p<0.01; *: p<0.05. Omitted categories: Wealth index (low); Religion (Other); Wife's education (None); Region (Other urban).

7.3.3 Exogeneity of Additional Children Desired

In modeling the effects of the determinants of contraceptive use, the central issue is whether motivation for fertility control (the number of additional children desire in this case) is exogenous or endogenous in the system of relationships. When it is assumed, as in this chapter,

that endogeneity does in fact exist, then the error terms for the equations on additional children desired and on contraceptive use would be correlated, and this would have the effect of rendering the above results of the simple probit regression, to be biased. A method therefore needs to be devised to control for this simultaneity. Column four in Table XXIX above presents some of the results that take into account the problem by using the two-stage least squares approach, which is a modification of the instrumental variables technique. However, first, the question arises as to whether the variable - additional children desired - is really endogenous. This exogeneity or otherwise is tested by including the residuals from the regression comprising additional children desired as dependent variable, in a subsequent regression which has as dependent variable, contraceptive use. In this new regression, the number of additional children desired is also included as an independent variable.

Confidence in this regression is bolstered by the fact that in the first regression, with additional children as the dependent variable, the value of R^2 is quite high, namely 0.32. This means that the independent variables explain quite a substantial amount of variation in additional children desired: a predicted value of the latter would not therefore arise simply out of chance. Secondly, in column three of Table XXIX, the residual term is highly significant, implying that there is a problem of endogeneity; use of the instrumental variables technique can therefore continue. The t-test on the coefficient of the residual was also applied to the equation, and the results were significant at the 0.1% level, with a chi-square of 31.4. This means that the variable, additional children desired, is endogenous in the equation for contraceptive use.

7.3.4 Identification

The functional form of the contraceptive use equation (i.e. that it is non-linear in the dependent variable) means that it is already identified, that the contraceptive use equation has a unique set of solutions. However since further restrictions on the parameters help to improve the efficiency of the estimation process, whether the health facilities were open by the time the woman was 15 years (began her reproductive career) and the community mortality ratio were considered as the identifying set of variables (Bollen et al. 1995; Guilkey and Jayne 1997; Kmenta 1997; Kennedy 2003). This choice as (zero) exclusive restrictions is based on the thinking that because of the temporal separation, past access affects motivation for fertility control, but unlike current access

to family planning services, does not directly influence current contraceptive use (except indirectly through motivation for fertility control) and thus would not affect (lead to a shift in the curve for) contraceptive use. The variables on past access are included in the regression equation in which additional children desired is the dependent variable; but in the equation with contraceptive use as the dependent, they are excluded. Results of the first step in the two-stage least squares estimation (results not shown) indicated that one of the variables that measures past access (clinic) affects motivation for fertility control significantly - at the 5% level, and in the expected direction. Similarly, child mortality is significant at the 0.1% significance level. This means that by being associated (implying correlation) with motivation for fertility control, the two variables meet at least one of the conditions for identifying variables, an observation which (for child mortality) is supported by theory on the determinants of fertility demand (McClelland 1983).

Although community child mortality and access to health facilities at age 15 are used to identify the contraceptive use, they may not be perfect identifying variables. While community child mortality is correlated with motivation for fertility control, it may also be associated with contraceptive use, implying that its inclusion, rather than helping to uniquely identify the contraceptive use equation, may lead to a shift (bias). In a typical rural village in Kenya, women will strive to have a high number of children, with use of family planning methods turning out to be modest. Nevertheless, although family planning programs will be highly targeted to such regions, in this context of high infant and child mortality, women will also use family planning methods little. Thus, in simple regressions on the determinants of contraceptive use, child mortality ends up being correlated with the error term and is therefore somewhat endogenous in the use of family planning services. In spite of this observation, which is highly likely, correcting for the ensuing bias is beyond the scope of this chapter, which is limited to trying to address only the endogeneity due to motivation for fertility control.

7.3.5 Instrumental Variables and Two-Stage Least Squares

The results of the two-step regression (StataCorp. 2007) of contraceptive use on independent variables are shown in column four of Table XXIX above. The Wald test led to the rejection of the hypothesis of exogeneity of the instrumented variable (additional children desired) – the chi-

square value of 32.4 being significant at the 0.1% level. As can be observed in the table, the magnitude of the coefficients in comparison with those in the simple probit (column two) is not the same, and a brief comparison is made of these quantities. For age group 30-34, the coefficient of the two-step regression is higher by over 3.3 times, which is a very big difference. The coefficients for region of residence, particularly Nairobi, show a much smaller amount of increase, i.e. 64.9%. For rural Central province on the other hand, the coefficient of the regression using the instrumental variable technique is lower than that for the simple probit that ignores the problem of endogeneity – by 26.2%. It is also noted that the coefficient of the impact of desire for additional children, while remaining significant as in the simple probit regression, is now much lower in accordance with the model of endogenous placement where it is presumed to be overestimated.

7.3.6 Reduced Form Regression

Column five of Table XXIX shows probit regression results in reduced from, i.e. without the endogenous variable - additional children desired - being included. A number of observations can be made concerning the hypothesized effects. First, among the age groups, only being 15 to 19 years old is significant. Secondly, the coefficients for the two regions of residence - Nairobi and rural Central province - remain significant, in the same direction, and with about the same order of magnitude as in the simple probit regression that ignores endogeneity. Thirdly, similar observations appertain to having been exposed to a family planning message in the six months before the survey.

The four columns of results in Table XXIX help to explain the impact of a number of significant variables such as having been exposed to a family planning message, region of residence (rural Central province in particular), and secondary education on contraceptive use. For family planning messages, it should be noted that in the simple probit regression (significant coefficient of 0.232), desire for additional children is simply one of the independent variables and endogeneity is not taken into account. In column three, which comprises results from the probit regression with the predicted value of additional children desired included, the unobserved effects of endogeneity is removed, so to say manually, and it is not precise enough. Consequently, with the predicted additional children desired included in the model, the

coefficient for the effects of family planning messages is reduced (0.177). In column four of Table XXIX, the influence of endogeneity is removed by the use of a more accurate method, the two-step approach, and the effect of messages attains 0.163 but is not significant. In the last column (results from the reduced form probit) the coefficient for messages increases to 0.260, and represents the total effect of messages on contraceptive use, without separating into the direct and indirect effects (through desire for additional children). The coefficients for rural Central province and secondary education follow a similar pattern. Considered together, these results show that when the endogeneity between motivation for fertility control and contraceptive use is taken into account, a number of variables which comprise region of residence, and education have direct impact on contraceptive use, with exposure to family planning messages surprisingly not being significant in the two-step regression.

7.3.7 Community and Individual-Level Results

Two other probit regressions – first the regression of contraceptive use on independent variables but in which only the individual 1998 KDHS and 1999 community data are used, and secondly one restricted to the 1998 KDHS dataset alone – were conducted. The purpose of running them was to evaluate the 1998 KSPA community and health facility data, and the results are presented in Table XXX below. The findings for the community-level regression show some similarities to the simple probit regression of contraceptive use. First, as in the simple probit, only age group 30-34 is significant. Secondly, both regions of residence which were significant earlier - Nairobi city and rural Central province – remain so. Lastly, exposure to a family planning message is also (very highly) significant.

When the regression is conducted using only the 1998 KDHS data, a number of similarities and differences also emerge. First, the age effects remain significant, but this time extend from age group 20-24 right upto 35-39. The biggest effects nevertheless remain with age groups 25-29 and 30-34. Secondly, the significance of Nairobi city and rural Central province persist, but the magnitudes of coefficients are reduced. Thirdly, the influence of exposure to a family planning message remains very highly significant (at the 0.1% level), however the size of the coefficients is lower than in the simple probit. These findings indicate that the results obtained in the simple probit regression using the 1999 health facility and community data which are merged with the

1998 survey data for the individual woman - on age, region of residence, and exposure to a family planning message as well as education – generally agree with those from other regressions in terms of the significance and directions of the coefficients.

Table XXX: Results of Probit Regression of Contraceptive Use on Independent Variables, by Type of Dataset, Kenya 1998/1999

Type of Dataset:	Including Community Data	1998 KDHS Alone
Variable		
Additional Children Desired:	-0.0707***	-0.073***
Age Group:		
15-19	-0.033	-0.020
20-24	0.098	0.207*
25-29	0.168	0.334***
30-34	0.274*	0.309***
35-39	0.088	0.219*
Wealth Index:		
Medium	-0.092	-0.057
High	0.265**	0.243***
Religion:		
Catholic	-0.583	0.849
Protestant	-0.646	0.771
Muslim	-0.733	0.758
Other	-0.567	0.867
Wife's Education:		
Primary	0.406**	0.347***
Secondary	0.738***	0.795***
Husband's Education:	0.004	0.005
Region of Residence:		
Nairobi	0.365*	0.264*
Central Rural	0.634***	0.591***
Other Rural	-0.029	-0.034
Husband Away:	-0.097	-0.119*
Exposure to FP message:	0.255***	0.236***
Constant	-0.464	-1.945**
Observations	1895	3633

*** p<0.001, ** p<0.01, * p<0.05 ; Omitted categories: Wealth index (low); Wife's education (None); Region (Other urban).

7.3.8 Multinomial Regression

With the probit regressions conducted above, it was possible to take into account endogeneity between exposure to family planning messages and contraceptive use. One of the limitations of

these models is that they do not incorporate the polychotomous nature of the endogenous dependent variables – motivation for fertility control, and contraceptive use. Consequently, a simple multinomial logit regression, which overcomes this problem but nevertheless does not address the problem of unobserved heterogeneity, was applied and the results are shown in Table XXXI. To accomplish this regression, fertility intentions were categorized into: want more children within two years from now, want more children two or more years from now, want no more children, and undecided. Similarly, contraceptive use was categorized into using a modern family planning method, using a traditional method, and not using any.

With respect to the hypotheses set for this chapter, the results of the multinomial logit regression are consistent with those obtained from the probit regression - at least with regard to the direction and significance of coefficients. Wanting no more children, wanting to space after at least two years, and being undecided are positively associated with using a modern method of family planning: this is true with reference to women who are not using any method as well as with those using a traditional. The results of effects for Nairobi and rural Central province on modern contraceptive use, relative to not using any method, also show very high significance, as do those for exposure to a family planning message.

Table XXXI: Results of Multinomial Logit Regression of Contraceptive Method Used on Independent Variables, Ignoring Endogeneity, Kenya 1998/1999

Method:	Modern/ Not using	Traditional/ Not using	Modern/ Traditional
Variable			
Age Group:			
15-19	-0.338	0.347	-0.685
20-24	0.262	-0.274	0.536
25-29	0.292	0.012	0.279
30-34	0.418	0.398	0.021
35-39	0.175	-0.106	0.281
Religion:			
Catholic	0.235	-0.615	0.850
Protestant	-0.012	-0.353	0.341
Muslim	0.241	-1.790*	2.031*
Wealth Index:			
Medium	0.089	-0.601**	0.690*
High	0.632***	-0.172	0.805**
Husband's Education:	0.002	0.010	-0.008
Wife's Education:			
Primary	0.871***	0.376	0.495
Secondary	1.470***	0.807	0.662
Region:			
Nairobi	0.970***	0.316	0.654
Central Rural	1.173***	-0.072	1.246*
Other Rural	-0.198	-0.030	-0.168
Husband Away:	-0.367*	0.205	-0.571*
Fertility Intentions:			
Wants after 2+ years	1.970***	0.361	1.609***
Wants no more	2.335***	0.523	1.811***
Undecided	1.826***	0.617	1.208
Exposure to FP Message:	0.462**	0.373	0.089
Access:			
CBD	-0.021	-0.180	0.158
Hospital	-0.639*	0.170	-0.809
Health Centre	-0.149	0.311	-0.460
Dispensary	0.038	0.098	-0.061
Maternity/Nursing Home	-0.102	0.542	-0.643
Clinic	0.009	-0.547	0.556
Constant	-4.338***	-2.404***	-1.934*

Notes: ***: $p<0.001$; **: $p<0.01$; *: $p<0.05$; For the first two columns bearing the results above, the reference (omitted) category is not using any method. For the third column that presents the results, the reference (base) category is using a traditional contraceptive method. Omitted categories for independent variables: Wealth index (low); Religion (Other); Wife's education (None); Region (Other urban); Fertility intentions (wants within 2 years).

Summary

In this chapter, it was hypothesized that age is positively associated with contraceptive use. Also, it was expected that region of residence, exposure to a family planning message, and motivation for fertility control would be related to contraceptive use. Regression results presented confirm the four hypotheses. Thus, age group 30-34 is associated with an increase in contraceptive use, as is motivation for fertility control. So are the two regions in which contraceptive use was found to be highest - Nairobi and rural Central province. Although it was expected that proximity to family planning services would be positively related to contraceptive use, the results did not show significance. Though not hypothesized, the effects of primary as well as secondary or higher education, and grouping of households by wealth index, also emerged to be significantly positive predictors of contraceptive use. In the next and final chapter of this thesis, these results and those from the two previous analytical chapters are discussed and synthesised together.

CHAPTER 8: DISCUSSION AND GENERAL CONCLUSION

8.1 Proximate Determinants, Stopping Behavior, and the Transition

Objectives

This thesis pursued three objectives, the first of which was to explore the trends in the fertility transition in Kenya at the national and sub-national levels. The second was to determine the factors associated with the transitions to the second and third conceptions during two periods in Kenya's fertility transition – the first of rapidly falling fertility, and the other of a reduced pace of decline. Examining the role of fertility desires and access to family planning services in determining the increased contraceptive prevalence observed in the country was the third objective. This closing chapter briefly reflects on the findings concerning these questions, in the mirror of similar studies carried out in the past, and in so doing provides general conclusions and perspectives for the future of Kenyan fertility. Accordingly, in this section, 8.1, results from the analysis of trends in fertility and its proximate determinants are briefly discussed. The next two sections, 8.2 and 8.3, discuss the results on the analysis of transition to the second and third conceptions, and the roles of fertility preferences and access respectively. Section 8.4 serves as a general conclusion that highlights the contribution of this thesis, while section 8.5 ends with a future outlook on Kenyan fertility.

Overview of Findings on Trend Patterns in Fertility and its Proximate Determinants

In a descriptive analysis of data from five sample surveys implemented over the period 1977-2003 in Kenya, chapter five explored the trends and patterns in fertility, its proximate determinants, and stopping behaviour at the national and sub-national levels, and the findings are briefly restated below. Results on the patterns of fertility decline can be summarized through a number of observations. First, above age 25, the age pattern of fertility – characterised by the departure of fertility for successive birth cohorts from the natural regime with increasing age – is confirmed. When a comparison is made between the fertility of consecutive birth cohorts, the reductions in fertility are progressively higher among older women, implying the possibility of fertility limitation (Knodel 1977). Secondly, a concave fertility schedule, which signifies parity-specific fertility control, is most evident in rural Central Province. Thirdly, the idea of a new

type of fertility transition that is marked by a decline in all ages (Caldwell et al. 1992) including among women aged 15-24 years in all regions is most apparent in Nairobi city.

The trends in the changes in proximate determinants and stopping behaviour correspond with those in fertility. First, age at first marriage among young women - aged between 15 and 24 years - initially increased and then stabilized in most geographical levels except Nairobi, where it increased continually with time. Secondly, levels of contraceptive prevalence increased in all reproductive stages and geographical settings, and were greatest among women older than 25 years in Nairobi and rural Central Province, settings in which fertility and parity progression ratios (PPRs) also declined the most. Thirdly, preference for no more births varies with reproductive stage and is highest, as expected, among older women (40-49 years old) who are in the late reproductive stage. Over time, preference for no more children also exhibits a similar pattern to that for other variables examined – first increasing for a number of years after the late 1970s, then remaining constant or decreasing marginally between 1998 and 2003. In the light of these results, three issues that relate to the trend patterns in fertility merit discussion. These are the shape of the fertility schedules at the older ages, changes in cohort fertility among young women, and the constant period fertility observed between 1998 and 2003.

Explaining Changing Fertility among Successive Cohorts of Older Women

Starting with the more recent cohorts of older women (cohorts aged 40 to 49 years by the time of each survey), a number of comments can be made about the evolution of their fertility. First, given the shapes of the fertility schedules and the parity progression ratios, it might be argued that a controlled fertility regime exists among older women in rural Central Province, and to some extent Nairobi and other urban areas - where in these last two (the urban areas) the higher fertility of rural immigrants might nevertheless be producing a blurring effect (Brass and Jolly 1993). This inference of controlled fertility regimes in the more modernised and developed parts of the country is supported by several studies, which have found that access to and use of contraceptive services is higher in rural Central Province and urban areas (Goldberg et al. 1989; Cross et al. 1991; Hammerslough 1992; Robinson 1992; Magadi and Curtis 2003).

Secondly, the question of why fertility declined so dramatically in regions which formerly had high fertility, such as rural Central Kenya is pertinent. Past studies on the dynamics of Kenyan fertility attributed the fertility transition to nucleation of the family (Dow Jr et al. 1994), and evolution of reproductive attitudes (Watkins 2000) in other rural areas such as Western Kenya where these two studies were conducted, nevertheless this generalization is extendable to rural Central Kenya as well. The idea of differences in political capital between Kenya's ethnic groups, in which contemporary variations in educational opportunities, work status, household wealth, and access to family planning services explain differences in contraceptive use (Weinreb 2001), is another perspective that has been proffered to explain the sub-national differences in the trends in current fertility and fertility control. This is related to the suggestion that more rapid modernization and earlier exposure of the population in Central Kenya to the reproductive behaviour of the British settler community might better explain the lead in contraceptive prevalence and fertility control in this region (Bauni et al. 2000; Chimbwete et al. 2005). Thirdly, in addition to fertility limitation, spacing behaviour that exists alongside, persisting right up to the end of childbearing among older women in other rural areas, might also explain the higher and constant rate of childbearing among older women in other rural areas (Caldwell et al. 1992). This is in contrast to the concave fertility rates observed in rural Central Province and the urban areas – implying fertility limitation and stopping behaviour in these regions.

It is also useful to examine the pattern of cohort fertility further back in the past and particularly the reproductive experience during the pre-independence, colonial period (prior to 1963). For the fertility of the 1954-59 and earlier birth cohorts, two factors have been used to explain the change from traditional to transitional fertility at the national level in Kenya, among women older than 25 years. The first is the desire for a smaller family size, the second being increased fertility control practice (Henin et al. 1982; Mosley et al. 1982). What might explain the differential changes in cohort fertility among older women between the sub-national levels?

In the case of Nairobi city, older women took control of their fertility as they entered the modern sector of the economy. This was facilitated by better access to contraception and resulted in relatively low fertility by the end of childbearing. The level of fertility at the peak of childbearing then (just before and soon after independence) was nevertheless high due to

relatively elevated fecundity in the urban setting. The same factor, aided by better health and some of the most productive agricultural land in the country (Mosley et al. 1982), explained high fertility in rural Central Province. In the rest of rural Kenya, natural fertility prevailed and women were able to carry out childbearing until the end of their reproductive years. Nevertheless, come the late 1970s, fertility started to decline even in the rest of rural Kenya. This was because of rapid modernization, a rational weighing of the costs and benefits of children, and effective government programs (Robinson 1992; Dow Jr et al. 1994).

Changing Fertility among Successive Cohorts when they were Young

In this section, the evolution of cohort fertility among younger women in Kenya is analysed first by considering the substantial declines observed in Nairobi city and to some extent other urban areas, and secondly the smaller changes registered in other regions. For the urban areas, three aspects can be called upon to explain the trends in recent cohort fertility among women aged 15-24 years. These are the marriage revolution, contraceptive use during the early years of childbearing, and fertility behaviour among young women. For Nairobi city, the rising age at first marriage may be related to the marriage revolution taking place in sub-Saharan Africa, particularly in the urban areas. In this model, young women postpone marriage in order to consolidate their careers and income-earning opportunities. This is in response to both hard economic conditions and the marriage market whereby young men, on their part, are not in haste to marry. Thus, there is a linkage between marriage, contraception, and fertility decline. In the urban areas such as Nairobi city, demand for contraception is for delaying marriage among those young women who are single, and for spacing births once childbearing has begun (Caldwell et al. 1992).

For the rural areas, further back in the past, change in fertility among young women has been explained through the idea of modernization. While the effect of rising age at first marriage is to reduce fertility among young women, modernization initially had the opposite effect - of raising fertility - in two ways. First, for women entering the modern sector of society, meaning living or working in an urban setting, a rise in fertility occurred due to better health and shorter birth intervals. Away from the rural areas, where traditional methods of fertility control such as prolonged separate sleeping arrangements between husband and wife following childbirth were

practised, couples in urban areas faced increased exposure to pregnancy. Secondly, for the country as a whole and particularly the rural areas, modernization primarily reduced the effects of traditional constraints to high fertility, namely longer breastfeeding, post-partum abstinence, and polygamy (Mosley et al. 1982). This resulted in an increase in fertility, as observed among earlier cohorts during their early reproductive stage at the national level and the two rural settings.

Period Fertility between 1998 and 2003

The trend in the changes in period fertility, at least at the national level, depicts a slowing-down in the pace of decline with respect to time. It is observed that since the late 1980s and up to at least 2002 when a more democratic and multi-party system of Government was re-introduced, there was a parallel reversal in socio-economic conditions in the country (CBS et al. 2004; Bongaarts 2006; Westoff and Cross 2006). A question that arises is whether, if socio-economic conditions had not deteriorated, the trend in period fertility would have behaved in the same way - or the pace of fertility decline would have been more rapid. In this context, two factors that were identified as being particularly important in explaining the fertility transition in Kenya and elsewhere in Africa are infant mortality and education (Kelley and C. E. Nobbe 1990; LeGrand et al. 2003) and are related to the broader issue of fertility demand during the process of modernization (Bulatao and Lee 1983).

Although infant mortality was initially hailed as being on the decline in Kenya (Kelley and C. E. Nobbe 1990), it has since reversed (CBS et al. 2004; Westoff and Cross 2006). Similarly, rising costs of education and the change to the 8-4-4 system of education, whereby parents shouldered more of the costs, were earlier on identified as important factors in decreasing fertility. Starting in the year 2003 however, the costs for primary education that parents bear have somewhat been alleviated with the introduction of the universal (free) primary education program. The effects of this program on fertility are not yet clear; they are also beyond the scope of this dissertation which is confined to analysis of data collected upto the year 2003. However, holding constant any changes particular to the educational system, the socio-economic situation that worsened in Kenya as in other countries of sub-Saharan Africa in the 1980s and 1990s has been identified as a factor that could lead to a reversal in the fertility transition (LeGrand and Barbieri 2002).

Indeed, a number of studies conducted in the past (Bongaarts and Watkins 1996; White et al. 2007) point to a relationship between human development, fertility preferences, and the pace of the fertility transition in Kenya. That development, measured by conventional human development indicators (HDIs) such as infant mortality has deteriorated in the country since at least the 1990s (CBS et al. 2004) may explain the similar (constant) trends observed in fertility preferences, and hence current fertility between 1998 and 2003. Results from chapter seven of this dissertation, which show significant relationships between development indicators and fertility preferences, seem to lend support to the interconnection between the levels of fertility preferences and current fertility. Thus, in chapter seven, it is found that belonging to a household of high wealth status rather than one of low wealth, having been educated to primary school level as opposed to never having attended any formal schooling are negatively and significantly related to wanting additional children. On the other hand, in communities with increasing infant mortality, the desire for additional children is found to be increasing and significant.

At any stage of the Kenya fertility transition (whether during the period of decline or stagnation) the differences between regions in terms of fertility preferences could be explained by the idea of ability to control fertility. According to the idea of preference theory (Hakim 2003), the contraceptive revolution enabled women to take control of their fertility. Thus, in such circumstances, it is women's values and preferences in life, and not the entire couple's preferences, which changed in greater favour of fertility control. In this regard, recent studies conducted in Kenya (Magadi and Curtis 2003) find increased use of the injectable contraceptive (a method that can be discretely used without an objecting husband's knowledge) among women. If it is assumed that relatively speaking, such change in attitudes has taken place in regions such as Nairobi and rural Central province, then lower levels of fertility (which result to a great extent from higher contraceptive use) in these parts of the country could be explained by the higher motivation among women for fertility control in these regions. It could be argued that women in other rural parts of the country, and particularly the majority who have not been to school, may not have embraced the idea of modern contraception as much, and find themselves (relatively speaking) in a situation of being "home-centred" rather than "career-oriented" as their counterparts in the more modernised sector and regions.

The idea of differences between male and female fertility preferences and attitudes can also be brought in to explain the variations in fertility between the regions. Modernization aside, childbearing is first and foremost a woman's pain and joy. Several studies have pointed out the higher pro-natalist and high fertility preferences among men as compared to their wives in Kenya as in other parts of Africa (Ronno 1998; Andro et al. 2002). These male preferences would be no doubt higher in the other rural areas (and would most likely be related to the relatively high need – even where children go to school - for child services in domestic chores, farm work, old age security, and above all just for their love and company).

Conclusions from Findings on Patterns in Fertility Change

Three conclusions can be made from the results on analysis of trends in the patterns of change in fertility and its proximate determinants. First, the parity-specific pattern of fertility decline, where cohort fertility is assumed to depart from natural fertility above age 25 or so at a pace that depends on the level of fertility control, can be located in either an urban or rural context. What seems to be more critical is that contraceptive use, stopping behaviour, and age at first marriage and at first birth are higher in the particular region. Secondly, the idea of fertility decline at all age groups of reproduction holds better in an urban setting. This would be a context in which age at first marriage and at first birth are consistently on the increase, and transitions to career and employment (for women) more important. Thirdly, proximate determinants and fertility preferences alone do not seem to comprehensively explain the observed changes in fertility; the inclusion of changes in socio-economic conditions might. The effects of these socio-economic changes, and particularly rising infant and child mortality since the 1990s, on the fertility of the more recent (younger) birth cohorts of women emerged as an area for further investigation. Consequently, it constituted an important area of investigation in the next substantive chapter of the thesis, whose results are presented and discussed below.

8.2 Factors Associated with Transition to the Second and Third Conception

Objectives and Hypotheses

In chapter six, the factors associated with the transition from the first birth to the second conception, and from the second birth to the third conception were examined using Cox regression analysis. The observation periods for these analyses were the 12 years preceding the

1988/89 and 2003 KDHS surveys respectively. For the second interval, three suppositions were tested to address this question. First, it was hypothesized that there are regional differences in the transition to the second and third conception, secondly that there is a higher relative risk of progressing to the second and third conceptions during the period of a reduced pace of fertility decline, and thirdly that there are variations in the relative risk of progression to the second and third conception associated with age at first birth. In addition, for the third interval, it was hypothesized that the number and sex composition of the surviving children does influence the transition to the third conception. The results for each of these hypotheses are briefly presented again below.

Findings and Interpretation

First, the hypothesis of a lower relative risk of progressing to the second conception in the urban areas compared to other rural areas was confirmed for both the period of falling fertility (1977-1989) and during the time of a reduced pace of fertility decline (1991-2003). Surprisingly though, rural Central Province, a region of currently high contraceptive prevalence, had a relative risk of progressing to the second conception during 1991-2003 that was equal to or sometimes slightly lower than that for the urban areas. Secondly, over the period of constant fertility (1997-2003), the hypothesis of an increased relative risk of transition to the second conception is not confirmed. Instead, the hazard is lower for the 1983-1989 period relative to 1977-1983, and only marginally so for the corresponding sub-division (into six years) of the 1991-2003 period. For the third interval, while the risk of having a third conception during this six-year period of rapidly falling fertility (1983-1989) is significantly lower than that for the six years earlier, for the 1991-2003 period, the hypothesized effect is non-significant. Thirdly, the proposition that the risk of a second or third conception decreases with increasing age at first birth is corroborated for women who had their first birth when they were at least 25 years old relative to those who had their first child when 10 to 17 years old. For both intervals however, this significance in relative risk is only true in the basic model – containing only the three hypothesized covariates of residential region, period of first or second birth, and age at first birth.

Fourth, the relationship between the number and sex of surviving children and the relative risk of progressing to the next conception is confirmed. For the more recent period (1991-2003), death of all the two children, any one of the two, or having both surviving children as females leads to a significant increase in the relative hazard of transition to the third conception. In addition to this direct association between the number of child deaths and the risk of transition to the third conception, the results also provide evidence of a gender connection between the number of surviving female children and the relative hazard of transition. Having one surviving daughter is a significant predictor of an increased relative transition to the third conception during both the periods 1977-1989 and 1991-2003, the difference from the reference category however being larger for 1991-2003. Nevertheless, where both female children are alive, the increased comparative risk of transition to the third conception is only significant during the time-period 1991-2003. These results are next discussed in the light of other research evidence.

The lower (relative) risks of transition to the second and third conceptions in urban areas observed during the periods of falling fertility (1977-1989) and reduced pace of decline (1991-2003) are consistent with persistently higher fertility in the Kenyan country-side, and conversely lower fertility in the urban areas. To that extent therefore, the greatest contribution to a slowdown in the pace of fertility decline, and particularly the recent levelling off in fertility, would have come from the other rural areas. It had been hypothesized that transitions to the second and third conception would differ by region due to differences in the levels of development and culture. In a sense, the results that relate to this hypothesis, agree with this supposition, and two explanations can be suggested. First, the population in other rural areas, generally being more deprived in terms of socio-economic development would be expected to be relatively averse to limiting the number of children or investing more in their quality. This is coupled with more conservative cultural practices related to reproduction, including relatively longer practice of post-partum abstinence and breastfeeding (NCPD 1999). It is also more likely that change in attitudes towards fertility control in the urban areas outpaced similar changes in the rural areas.

When all the covariates are considered together, the effects of infant and child mortality emerge as an important (but not necessarily the only) factor in the reduced pace of fertility decline

during the 1990s, including the period of constant fertility experienced in the country between 1998 and 2003; justification being based on at least two reasons. First, a number of hypothesized covariates associated with higher infant mortality (particularly region of residence) show higher hazard ratios of transition to the second or third conception during the 1991-2003 period. Secondly, the relative risks of progressing to the second or third conception due to child deaths are significant (and substantial) during the 1991-2003 period as compared to 1977-1989. Thus, the higher relative risks, for the period 1991-2003, coincide with the increase in infant and child mortality in the country since the 1990s. The possibility that compensating effects (a rise, a decrease, and constancy in risks at about the same time) may also have brought about the levelling off in fertility is also considered further on below.

Nevertheless, a question that arises is, "How is increased infant and child mortality, which was experienced since the 1990s in the country, related to a higher comparative risk of transition to the second and third conceptions over the same period of time?" The response seems to lie in the impact of HIV/AIDS on fertility, which at least three studies find to be relevant. First, in a study conducted in neighbouring Tanzania (Ainsworth et al. 1998) the effect of increased mortality among children aged under five years at the community and household levels was found to increase fertility. Secondly, the increased mortality in Kenya in the 1990s was most probably associated with the increase in the HIV/AIDS epidemic (Hill 2004). Thirdly, more recent investigations (Magadi and Agwanda 2007) indicate that by reducing the duration of breastfeeding and possibly increasing fertility preferences, the HIV/AIDS epidemic may have contributed to the observed constant fertility in the country between 1998 and 2003.

Limitations

It is possible that these results, on the covariates of the second and third intervals, may suffer from bias because certain aspects were not taken into account. First, some proximate variables known to influence birth intervals, such as breastfeeding and contraceptive use (Trussell et al. 1985), were excluded from the analysis; this exclusion being justified for several reasons. The method applied in this study, survival analysis, requires the two to be time-varying covariates. Although the two covariates can be obtained in most DHS surveys as calendar data (Baschieri and Hinde 2007), doing so would have meant going beyond the scope of this analysis on the

covariates of the second and third conceptions. Also, contraceptive use can be endogenous in the duration of birth intervals. This is illustrated by baffling results from some studies e.g. (Raajpoot 1996) which show that contraceptive users have a higher probability of a second birth than nonusers. One of the solutions to this problem of endogeneity is the use of simultaneous equations, and was also beyond the scope of the analysis. The failure to take into account this simultaneity may lead to bias in the estimated parameter coefficients. Finally, absolute comparisons in the risks of transition between the two time periods (1977-1989) and (1991-2003) would have required that the baseline hazards be included, an undertaking that was not attempted in this analysis, which is simply based on relative hazards in Cox regression.

Grouping of Factors on the Risk of Transition

The significant factors associated with transitions to the second and third conceptions in Kenya can be divided into two- those which increase the relative risk of transition, and those which reduce it. Residence in other rural areas relative to Nairobi, infant mortality, and having been married by the time of the first birth are associated with persistently increased relative risk of a third birth over 1991-2003 or 1977-1989 periods, with the difference from the reference category being greater during the 1991-2003 period.

On the other hand, a number of factors are significantly associated with reduced relative hazards of a second and third conception during both the 1977-1989 and 1991-2003 periods, being more pronounced over the more recent period. Among these are education - in particular secondary education - and (medium) socio-economic status, not of course excluding residence in urban areas and rural Central province. It is possible that a combination of all these aspects (a rise in some risks, a fall in others, and constancy in some), and not only a rise in infant mortality, could be related to the constant fertility observed over the period 1998-2003.

Given the fertility decline observed over the 1991-2003 period relative to 1977-1989, it is to be inferred that for education and socio-economic status to have the effect of reducing the intensity of transition to the second or third conception, at least one of the proximate fertility determinants would be involved. Among the proximate determinants of fertility, contraceptive use emerges as a possibly important factor that explains the differences in this birth-spacing. In line with the

conceptual framework for this dissertation (Figure 2) that seeks to understand fertility dynamics for all three reproductive stages (early, middle, and late) the role of contraceptive use as a proximate fertility determinant in Kenya's fertility transition was next examined.

8.3 The Determinants of Contraceptive Use in Kenya and the Fertility Transition

Research Question and Hypotheses

The question of what causes increases in contraceptive prevalence, and the pathways through which this increase takes place, was the last of the three considered in this dissertation. On the one hand, it is often argued that the increase in demand for fertility control is responsible for increased prevalence; on the other, some maintain that access matters. To address these two apparently conflicting arguments, in the light of the trends in the fertility transition in Kenya, the determinants of contraceptive use in the country were analysed and results presented in chapter six. The dissertation was designed in such a way that the three research questions are inter-related. The second question examined the covariates of the second and third conceptions that lead to live births - among women in their early reproductive stage - over the period of a reduced pace of fertility decline (1991-2003), in comparison to 1977-1989 when fertility was falling. In so doing, the question explored the fertility dynamics of the first reproductive stage of the dynamic fertility and family building process sketched out in the conceptual framework (Figure 2). To some extent, it also addressed the second of the two movements in the fertility transition – the issue of constant fertility between 1998 and 2003. Similarly, in examining the pathways through which the choice of a contraceptive method is ultimately made, the processes covering all the years of the female reproductive life-cycle, as set out in the conceptual framework, are examined.

To study the pathways by which the decision to use contraception is made, a number of research hypotheses were developed and tested. First, it was hypothesized that age and region of residence each play a significant role in influencing contraceptive use. Secondly, it was expected that women who have higher motivation for fertility control would show higher propensities for contraceptive use. Thirdly, it was hypothesized that access to family planning services – which comprises exposure to a family planning message and proximity to a source of family planning services – is an important variable affecting contraceptive use.

Results and Discussion

The results of the analysis show that one of the peak age groups for childbearing, 30-34, is positively and significantly associated with increased use of contraceptive methods, relative to non-use of any method. That the height of contraceptive use might be related with spacing behaviour is evident from a number of observations. First, the results are not significant among younger women (aged 15 to 30 years) many of whom are in their early reproductive careers. Being older than 35 years, which is expected to be strongly associated with the practise stopping behaviour, is similarly not significant. Nevertheless, it should be noted that women who adopted stopping methods such as sterilization, were excluded from the analysis. Secondly, the most commonly used methods - injections and the pill (Magadi and Curtis 2003) - are for medium and short-term use and would be expected to feature among those used by the women in this statistically significant age group. Thirdly, as observed in the results on the trends in contraceptive use, the level of use of modern contraceptive methods is higher among women in the middle reproductive age groups (ages 25 to 39) and less among those aged 40 years or above, and much less among those aged 15 to 24 years. This goes to support the importance of women aged between 30 to 34 years in contraceptive use. Lastly, the proportion of women who want no more children is highest among women older than 40 years, and lowest among those aged 15 to 24, with those aged 25 to 39 years in between, implying spacing motivations. For these reasons, the bulk of contraceptive use concentrated among women in their mid-reproductive careers seems to be for spacing purposes.

Residence in Nairobi city and rural Central province (relative to other urban areas) is significantly associated with increased contraceptive use relative to non-use of any method, as expected. Several observations support this finding. First, use of modern contraceptive methods is observed to be highest in the two zones. Secondly, motivation for fertility control, which was measured in terms of the proportion of women who want no more children in chapter four of the dissertation, is also highest in the two provinces. Thirdly, earlier, in chapter five, it was also observed that the probability of surviving in the state of first or second birth is highest in the two regions. Most interesting however is the change in median birth intervals between the periods 1977-1989 and 1991-2003 in the two regions. The biggest transformations in median birth intervals over the two periods were in the two regions: 82.6% and 81.2% for Nairobi and rural

Central province respectively for the second interval; increasing to 103.8% and 121.8% for the third interval.

Increasing motivation for fertility control over time would be the most important factor in the statistical significance of Nairobi and rural Central province with regard to contraceptive use. Yet a follow-up question would be what is associated with the increased motivation in the two regions; the reasons are not necessarily the same for both areas. It is women's labour force participation, and urban lifestyles that mainly explain the greater motivation for fertility control in Nairobi. As opposed to their rural counterparts, couples, parents and women in particular residing in the city (whether in the upper class areas of Nairobi city, the middle income estates, or the sprawling slums) have to grapple with two important issues related to childbearing and rearing. These are a time schedule more focussed on work, and the higher cost and quality of children's upbringing in general and education in particular.

In neighbouring rural Central province, three factors – historical context, proximity to Nairobi city, and the industry of Kikuyu women (this last point being based more on personal insight and observation rather than tangible research findings) can be called upon to explain the higher motivation for fertility control in the province, which translates into significantly increased contraceptive use. It is in three ways that the historical context has prevailed in bringing about greater motivation for fertility control. First, loathe as might the Kikuyu community the occupying British settler community and administration in the colonial days, they admired some of their life-styles, and in particular were keen to learn how they managed to achieve smaller family sizes. Interviews with Dr. Mwathi, a pioneer obstetrician and gynaecologist in the family planning movement in Kenya reveal how people from the Nyeri district in Central province were curious about the means of fertility control applied by the white couples (Watkins 2000; Chimbwete et al. 2005). Thus from early on, since the colonial days, the population of Central province was exposed to western ideas about fertility control. Secondly, increasing scarcity of land – a precious factor in the production of lucrative agricultural commodities such as coffee and tea destined for overseas markets or edible farm produce for local consumption – compelled families to change attitudes about family sizes. Not only was land becoming more and more expensive for immediate agricultural and residential use, but also less and less was available for

families to bequeath to children. The problem of land has come about in two ways – first due to increased population growth in the province, but also because of the Mau Mau war of independence and the resettlement elsewhere that followed after the struggle. Thirdly, the political capital of Central province (Weinreb 2001) – the fact that it has been the dominant political community in the country – producing two of the three presidents the country has had so far, has meant that the province has been better supplied with health and related resources and services to ensure that in this case, motivation for fertility control more readily translates into use.

The proximity of Central province to Nairobi city has meant that there is a persistent influence of modern ideas through frequent direct or indirect contacts – through family members, relatives, friends, and the media - with the city. Lastly, regarding the third point (the enterprising Kikuyu woman), to the curious observer, the sight of the Kikuyu woman toiling in the family farm through the afternoon, hawking her farm produce in the city estate but crouching under the weight, or selling behind the counter of the family shop, in a way sets her apart. Like of her equally industrious husband, bystanders will be heard to comment with admiration, "anatafuta". The literal translation of this Kiswahili-language expression into English (she is looking for business), is not exactly faithful to the idea in the woman's mind as she goes about her business. Rather, empowered to a certain extent, she is adding value to - and complementing - the family's wellbeing by generating more income. It is different from the situation painted in the expression "se debrouiller" (getting by) in studies on the effects of the socio-economic context on reproduction in sub-Saharan Africa (Johnson-Hanks 2004). The pre-occupation with development, with the need to get out of the poverty trap, and with child quality has meant that more time has to be devoted to work, and to do so fertility has had to be controlled.

While, contrary to expectations, access to health facilities turned out to be non-significant, exposure to messages on family planning is significant. In this section, several suggestions on why proximity to health services might turn out to be non-significant are provided. Thereafter, possible explanations for the significance of exposure to messages of family planning are offered. Three issues regarding non-significance of access to health services are worth pointing out – definition of access, distinguishing between access and motivation for fertility control, and

reverse causality - each being presented in turn. Access by the population to health facilities was defined by the type of the locality or cluster – whether it is in an urban or rural area. One would have expected that women residing in urbanised communities would show significance in contraceptive use, but this is not the case and other factors might matter much more.

The comprehensive programs for community-based distribution (CBD) of contraceptives that have been set up in Kenya are meant to bridge the social distance between the formal service provision in the clinics (static or mobile outreach) and the informal networks in the community. Studies conducted in the past on the CBD program found that the CBD sites are found in regions where 48% of the population live, and that only about 20% of women report having had contact with CBD agents (Rutenberg and Watkins 1997). Studies also indicate that CBDs, community health workers (CHWs) and health educators (HEs), were positively associated with the increased contraceptive prevalence in some parts of the country, specifically among the Meru community in the Mount Kenya region (Goldberg et al. 1989; Chege and Askew 1997). Yet the non-significant association empirically found in this study raises the question about the effectiveness of the CBD approach. Similar questions have been raised in the past (Kaler and Watkins 2001), but for a different part of the country, Western Kenya, where fertility is higher and contraceptive prevalence lower. In the last study, it is noted that CBD agents are more interested in protecting their prestige in the community and avoiding possible blame for what may go wrong in the use of contraceptive pills and injectable contraceptives, particularly in the climate of ambivalence and suspicion about side effects associated with oral contraceptives and injectables. If the regions in the sub-sample fall in these areas of low contraceptive prevalence, then the presence of a CBD agent in the community can show a significantly negative association with contraceptive method choice.

Studies conducted in the past document a number of findings on access to static family planning facilities in Kenya, and indicate that access should be positively related to choice of modern contraceptive methods. First, the network of health facilities from which family planning and other health services is provided is comprehensive, and comprises over 4,700 service delivery points that range from hospitals, to health centres, and dispensaries, with most of these facilities being managed by the Government (MOH 2000). In addition, maternities, nursing homes, and

clinics also provide family planning services. Apart from the Government, other providers that operate health facilities include Non-Governmental Organizations (NGOs) including faith based organizations (FBOs), and private providers. Secondly, the results of the situation analysis of the functioning of family planning facilities in the country (Ndhlovu et al. 1997) indicate that most of the facilities provide a wide range of family planning services including oral contraceptives, injectables, IUDs, and condoms. The majority of the facilities with contraceptive stock-outs are located in rural areas, and it takes clients about three quarters of an hour to get to a service delivery point. Thirdly, an inventory of health facilities providing family planning services (MOH 2000) indicated that 90% of the facilities surveyed offered family planning services, 88% of which offered at least three methods of family planning. In addition, studies find considerable variation among the provinces in the availability of family planning methods; with only about 33% offering IUDs in Coast or Nyanza provinces, but 60% and 77% in Central and Nairobi provinces respectively.

In view of these past studies, the result of the non-significance of access to health facilities is surprising, and there could be three possible explanations. First, the measure of access applied in this analysis was whether the locality and by implication the health facility is in an urban area or not; a more valid and accurate measure would have been distance to the health facility or travel time, but none of these were readily available from the data. Thus, it will be necessary to build a better indicator of access in future studies on the impact of access on contraceptive use - for example by aggregating individual use of modern family planning services at the level of the community. Secondly, the sub-sample in the analysis may have focussed on communities in the country where fertility is high and contraceptive prevalence low. In such a situation, even if health facilities offering family planning were available nearby, this would not necessarily translate into greater use of these services, given the preferences for high fertility. Thirdly, as the results indicate, access to health facilities may indeed not be the critical factor determining contraceptive use, other factors perhaps being more important.

Even if access to health services turned out to be significant, the question of separating the effect of access from that of motivation for fertility control would remain. Studies conducted in Bangladesh for example indicate that it is not easy to disentangle the two (Phillips et al. 1988;

Simmons 1996). The studies further indicate that in Matlab, a region where fertility demand was initially low, the introduction of contraceptive innovation and technology through the community-based program had the effect of increasing contraceptive use and reducing fertility. This supply-side factor was nevertheless able to act on ambivalent demand and turn it into contraceptive adoption. Focus group discussions later held with women from the program show that supply-side variables, i.e. the availability of contraceptive services, prompted demand-side factors by making people aware that the world around them was changing. Thus, it appears that the issue is not supply versus demand factors, but rather the simultaneous action of supply and demand to affect contraceptive use.

Having been exposed to a family planning message in the six months preceding the 1998 KDHS interview is significantly and positively associated with contraceptive use. Studies have documented a possible positive linkage between the mass media campaigns mounted in the country during the late 1980s and contraceptive use (Westoff and Rodriguez 1995). This suggestion is extended here by recounting the important elements of the Kenyan mass media strategies that might have led to this association with increased contraceptive use: the channels and forums through which family planning messages were relayed being population seminars, the radio, print media, and personal communication.

In the late 1980s and early 1990s, population leaders' conferences and seminars were intensively mounted by the then National Council for Population and Development (NCPD). These sensitization activities, aimed at population policy makers and implementers, started with a National Leaders' conference - political, religious, Government and NGO leaders converged in Nairobi to deliberate on the high population growth in the country and were apprised about the Government's policy and intentions on how it would address the issue. Directly or indirectly, commitment and support of the leaders was sought and to varying degrees, obtained. Then there followed a series of seminars for Government functionaries and NGOs executives - in particular the district population seminars for District Officers, Chiefs, and Assistant Chiefs that were coordinated from the powerful Office of the President. The results were in a way amazing: while it is not clear how the chiefs implemented this Government policy as they held their regular

monthly “barazas” (meetings), many by status polygamous and pro-natalist were heard to say after the seminars that they advise their people to “do as I say but not as I do”.

The second medium by which the family planning message was propagated was through the radio, an effective tool whose reach covers most of the country through the national broadcaster, the Kenya Broadcasting Corporation (KBC), with the message being relayed mainly in the Kiswahili language but in the vernaculars as well. A series of radio programmes on population were continuously mounted on KBC, and included the following radio plays in the Kiswahili language (NCPD 1994): *Panga uzazi* (Plan your family), *Mwenda pole hajikwai* (Those who proceed slowly never falter), *Maisha ya jamii yako* (Your family’s welfare), *Jifunze na uendelee* (Learn, and you will develop), *Maisha bora* (What is a good life?), *Afya yako* (Your health), *Daktari akushauri* (The Doctor is here for counselling), *Kuelewana ni kuzungumza* (Communication is the key to understanding one another as a couple).

The third avenue by which the family planning message was passed was through the print media. The most prominent of the print materials so produced and distributed to households included calendars that bore pictures and printed messages about the advantages of smaller family sizes. Others were t-shirts bearing the NCPD logo and message of a small family size, distributed to and worn mainly by the (younger) men. Posters bearing similar drawings and messages about the disadvantages of large families and merits of smaller ones were also produced and distributed to households and offices. Lastly, personal media, mainly in the form of health talks by health personnel in the clinics but also during mobile outreaches, were equally an effective medium of reaching women with family planning messages and health education in general. The family planning message in the form f the personal medium was also passed by CBD agents in their interactions with women in the villages.

Conclusion

To conclude the discussion on the determinants of contraceptive use, it can be said that motivation for fertility control, measured here by the number of additional children desired, has a positive and significant effect on using a contraceptive method. The same cannot be said about access to health facilities, save that a related aspect, exposure to messages about family planning

is significant and positive. This does not however prove that access is unimportant; the hypothesis has to be tried with other data. Thus, of all the policy variables, three turn out to be important. These are the wife's education, exposure to family planning messages, and motivation for fertility control. They merit continued consideration in family planning policy and programs.

8.4 Contribution of the Work

A primary contribution of this dissertation has been to confirm the existence of a dichotomy in the trend patterns regarding fertility, some of its proximate determinants, and reproductive behaviour at the sub-national level in Kenya. This pattern is not so much along the urban versus rural division; rather it embraces the urban areas and rural Central Province in one group, and the other parts of rural Kenya in another. The declines in period and cohort fertility have been greatest in rural Central Province and urban areas, but more moderate in the rest of rural Kenya. Among the proximate determinants of fertility, age at first marriage consistently increased in the urban areas and rural Central Province, to reach a median of at least 21 years by 2003, while in the other rural areas, it remained below 20 years. This has given rise to a trend pattern of relatively late family formation in the urban areas and rural Central province, and relatively earlier first marriage in the rest of rural Kenya. Similarly, a trend pattern of a more rapid increase in contraceptive prevalence is found in rural Central Province and Nairobi, while a slower, lower rise prevails in other rural areas. Thus, while in 1977/78 use of modern contraceptive methods was at 13.9%, 7.1%, and 2.9% among married women in Nairobi, rural Central, and the rest of rural Kenya respectively, by 2003 this prevalence had substantially risen to 58.9% in Central Kenya, 45.1% in Nairobi, and 25.5% in the rest of rural Kenya.

The second contribution of this work is in showing the association between increased infant and child mortality during the 1990s and the reduced pace of fertility decline that commenced during the same decade, an association which other studies also find. For the 12-year period 1991-2003, loss of both children or just one of them is associated with an increased relative hazard of progressing to the third conception leading to a live birth; this not being the case for the period of falling fertility (1977-1989). In addition, in conformity with the constant fertility observed around the period 1997-2003, the differences in the risks of transition between the periods 1991-

1997 and 1997-2003 are not significant, the two apparently being similar in a number of respects.

The increased contraceptive prevalence observed in Kenya is part of the fertility transition; and within this context, the determinants of contraceptive use were examined. The results of that analysis lead to the third contribution of this work. In the analysis conducted here, the policy variables of education, exposure to family planning messages, and motivation for fertility control in the choice and use of contraceptive methods are found to be important. These three policy factors should form a core set of variables for further policy formulation and program action, even though it was not possible to demonstrate the significance of other access variables such as Community Based Distribution (CBD) and static family planning facilities.

8.5 Future Perspective

A number of limitations, that restrained achievement of the three research objectives for this dissertation, need to be pointed out. First, in seeking to determine the trend-patterns in fertility at the national and sub-national levels, the achievement of robust results that would enable more confident conclusions for some sub-national domains and age groups was hampered by the small sample sizes at some levels, for example other urban areas. Secondly, in trying to determine the factors associated with the relative transition to the second and third conceptions, it turned out that this area of research seemed very broad. A narrower and more specific focus, such as the effects of infant and child mortality, or those of education on the transitions, might have been most appropriate. Thirdly, in accepting results from the simple probit regression that ignores the endogeneity between the number of additional children desired and contraceptive use, bias in the coefficient estimates is introduced.

Results from this dissertation show the need for further research in three areas. The first is a contextual research on the levels, trends, and determinants of contraceptive use and fertility in the Mount Kenya region – that part of the country where historical context and modernization in the form of the struggle for independence and closer contact with British settlement on the one hand, and land scarcity on the other, seem to have played important yet not fully examined influences on fertility control. The second recommended area for further research is survival

analysis of the determinants of birth intervals using several pooled datasets and other regression methods such as piecewise regression. This way, the total risks of transition, and not just relative hazards, from one period to another can be more comprehensively compared. The third is further research on the role of access to family planning facilities – including proximity to community based distribution – on contraceptive use and fertility, this time though with more complete data on the facilities, or based on single but comprehensive survey (such as the 1993 KDHS which includes a community survey component).

This dissertation has examined the factors associated with the fertility transition in Kenya in the past up to 2003; nevertheless a pertinent issue is the projection of fertility into the future. Suggestions on the possible course of fertility in Kenya in the future have been made before (Blacker 2002; White et al. 2006), and most conclude that it is unlikely Kenyan fertility will stabilize at a replacement level that is below three births per woman. Given the levelling off in some of the factors considered in these projections (such as the level of contraceptive use), and most importantly given the prominence of rising infant and child mortality - a major determinant of fertility - one is persuaded to agree that in the short run, Kenyan fertility, at the national level, might not fall below a level of three to four births per woman.

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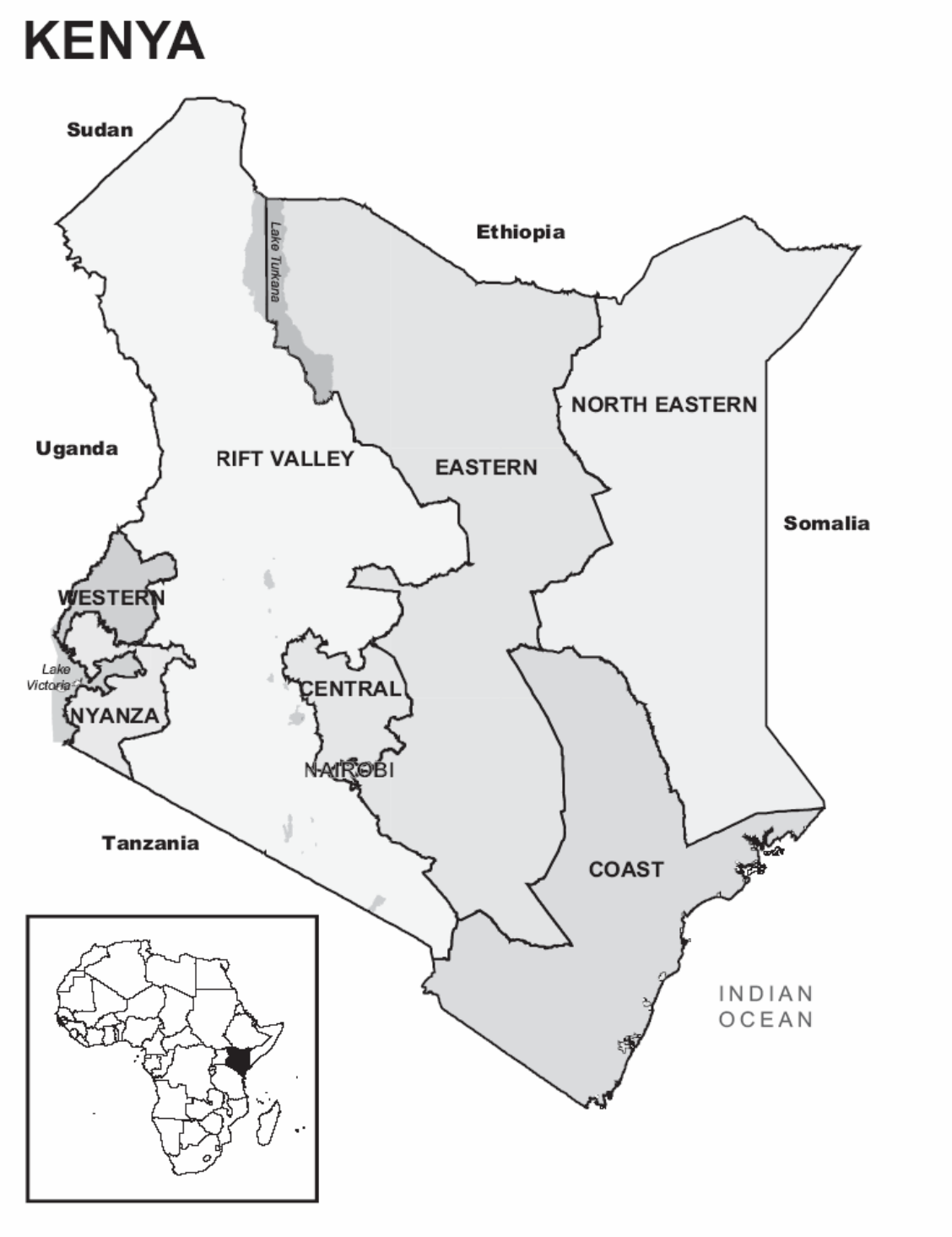
Annexes

Appendix 1: Administrative Map of Kenya Showing Provinces



Source: (CBS et al. 2004) p. xxiv

Appendix 2: Socio-economic Indicators for Kenya

Indicator – Year 2003	Kenya	Sub-Saharan Africa
Pop. (millions)	32.2	703
GNP per capita (US$)	400	490
Average Annual Growth (1997-2003)		
Population (%)	2.3	2.3
Labour Force (%)	2.7	2.4
Most Recent Estimates (1997-03)		
Poverty (% below poverty line)	55	
Urban population (% of total)	21	36
Life expectancy at birth	45	46
Infant Mortality (per 1000 live births)	77	103
Child malnutrition (% children under 5 years)	20	
Access to improved water source	57	58
Illiteracy (% of pop.>15 yrs)	15	35
Gross primary enrolment	95	87
Male	97	94
Female	95	80

Key Economic Indicators:

	1983	1993	2002	2003
GDP in millions US$	6.0	5.8	12.2	14.3
Gross national savings/GDP	16.5	20.5	15.8	12.8
Total debt/GDP	60.7	127.6	50.0	47.2
Average Annual Growth				
	1983-93	1993-03	2002	2003
GDP	4.1	1.9	1.1	1.8
GDP per capita	0.8	-0.6	-1.2	-0.4
Export of goods and services	7.1	0.6	2.6	9.9

Sources: (World-Bank 2004; World-Bank 2005)

Appendix 3: Demographic Indicators for Kenya

Indicator	1948	1962	1969	1979	1989	1999
Pop. (millions)	5,406	8,636	10, 943	15,327	21,397	28, 700
Density (pop./km^2)	-	-	19.0	27.0	37.0	49.0
Percent Urban			9.9	15.1	18.1	19.4
CBR	c. 40	c. 48	50.0	54.0	48.0	41.3
CDR	c. 25	c. 20	17.0	14.0	11.0	11.7
Growth Rate	-	3.34	3.38	3.8	3.4	2.9
TFR	5.5	7.0	7.6	7.8	6.7	5.0
IMR			119	88	66	77.3
e^0	37	43	50	54	60	56.6

Sources: (Brass and Jolly 1993) Tables 2-2 to 2-5; (CBS et al. 2004) table 1-1