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Kenya 1999 Population and Housing Census

The Population Dynamics of Kenya

Analytical Report

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List of Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
CBS	Central Bureau of Statistics
CD	Children Dead
CEB	Children Ever Born
DFID	Department for International Development
DRC	Democratic Republic of Congo
HC	Hypothetical Cohort
ICL	International Computers Limited
IDPs	Internally Displaced Persons
ILO	International Labour Organisation
IMR	Infant Mortality Rates
KDHS	Kenya Demographic and Health Survey
KFS	Kenya Fertility Survey
NCPD	National Council for Population & Development
NDS	National Demographic Survey
NRR	Net Reproduction Rate
PES	Post Enumeration Survey
PSRI	Population Studies and Research Institute
TFR	Total Fertility Rate
UNECA	United Nations Economic Commission for Africa
UNHCR	United Nations Human Commission for Refugees

Foreword

The Kenya 1999 Population and Housing Census was the fourth to be carried out since independence and the sixth since 1948 when the first census was conducted in Kenya. It was carried out on a de facto basis with the night of 24/25 August being taken as a reference date under the provision of the Statistics Act (Cap. 112) of the Laws of Kenya and Legal Notice No. 121 of 11th September 1998 and amendment No. 25 of 22nd February, 1999.

The main objective of this census was to collect demographic and socio-economic data required for policy formulation and decision making in planning processes. This objective was emphasized by the 1999 census theme, "Counting Our People for Development". Basic results of the 1999 census were published in Volumes I and II in January 2001. This second set comprising nine analytical reports addresses topics of Fertility and Nuptiality, Mortality, Migration and Urbanization, Population Projections, Education, Labour Force, Housing and Gender Dimensions. Highlights of the demographic indicators are presented in the Population Dynamics monograph.

Preparation of the analytical monographs involved collaborative efforts of both local and external experts, the Population Studies and Research Institute (PSRI), and various government ministries and departments. The monographs were authored under supervision of a lead consultant. The authors and consultants were recruited on competitive basis, ensuring that such persons had adequate knowledge of the subject they were to analyze and were familiar with Kenya demographic data. For the first time, university students in demography were attached to lead monograph authors.

Scanning technology was used for the first time to capture census data. This method reduced the data processing period to a record 6 months. In an effort to achieve internal consistency and minimize errors to acceptable levels, rigorous editing and validation of the data were carried out before analyzing the results. The information presented in these reports is therefore based on more cleaned data sets, and is to be preferred in case there are differences in the results published in Volumes I and II.

This monograph provides synthesised highlights of findings in the monographs that address the components of population change, namely fertility, mortality and migration. Although these components directly determine the population dynamics the world over, the thrust of it in Kenya is on natural increase (the interplay between fertility and mortality) on grounds that the country's population is "relatively closed" (not influenced much by international migration). The 50 years spanning 1948 to 1999 have witnessed sustained and rapid population growth that was above 3% per annum until the decade 1989-99 when it dropped to 2.9%. Also, enumerated population in Kenya have consistently fallen short of the projected population, partly because of errors inherent in the assumptions, and the demographic doldrums recently caused by HIV/AIDS as well. There are, therefore, strong indications that the country's demographic transition is unstable, in fact less predictable than before the HIV/AIDS epidemic raised concerns. This poses serious challenges for development as more losses occur through the interplay of increasing mortality, rapidly declining fertility, and the apparently increasing emigration.

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Acknowledgement

The Kenya 1999 Population and Housing Census, with the theme "counting our people for development", was conducted in August 1999. It was the sixth national census, after those conducted in 1948, 1962, 1969, 1979 and 1989. Provisional results were released in February 2000, and basic reports were subsequently released in two volumes in January 2001 after a rigorous data processing exercise. This monograph is one of the nine that are a culmination of an ambitious, synchronized and all-inclusive in-depth analysis process addressing various topical areas regarding the demographic, social and economic profiles of the Kenyan population.

The census, being an enormous, complex and costly operation, was accomplished through concerted efforts of many organizations, institutions, government ministries and individuals who assisted in a variety of ways to prepare, collect, compile, process, analyze and publish the results. The Government of Kenya, through the Central Bureau of Statistics of the Ministry of Finance and Planning, wishes to thank them all for their inputs into this noble process.

The Government extends sincere gratitude to the development partners, particularly United Nations Population Fund (UNFPA), United Nations Development Programme (UNDP), United States Agency for International Development (USAID) and the Department for International Development (DFID) for providing technical and/or financial support. Very special thanks are extended to UNFPA and DFID for providing further technical and financial support for the compilation and dissemination of the nine monographs, and also to USAID, in collaboration with the United States Bureau of the Census, for supporting further data processing and the compilation of two sets of United Nations style tables and a census data sheet.

Further gratitude is due to the authors of the nine monographs, the technical support staff and other national and international professionals for their commitment and tireless efforts to successfully undertake the in-depth analysis exercise. Last but not least, all Kenyans deserve special thanks for their patience and willingness to provide the requisite information.

We sincerely hope that the data contained in this monograph will be fully utilized in the national development planning process by all stakeholders for the welfare of the people of Kenya.

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Executive Summary

This monograph provides highlights of detailed information contained in monographs that are devoted specifically to the three components of population change, namely fertility, mortality and migration. The interplay of these three constitutes population dynamics that influence population change and structure. While the difference between fertility and mortality determines natural increase of population, the aggregate outcome of the three is population change. The monograph consists of a brief introduction and six substantive chapters.

Kenya has taken its censuses as scheduled, generating useful demographic statistics on which viable estimates and projections depend. The country has undertaken six censuses (in 1948, 1962, 1969, 1979, 1989 and 1999) with varying degrees of detail and questionnaires mainly on fertility and mortality, but only a few questions on migration. The first four censuses were population censuses *par excellence*, but the last two covered population and housing, thus collecting data on population and an element of socio-economic development. Other sources of demographic data are the Kenya Fertility Survey (KFS) 1977/78 and the Demographic and Health Surveys of 1989, 1993 and 1998. Both census and survey data inherently contain errors of both commission and omission, which analysts have detected, but which in no way mar the high quality of Kenya's demographic statistics. There are also data processing errors that become artefacts of demographic estimates and projections, although the errors do not undermine the consistency of these measures.

Chapter 2 discusses fertility, an input loop of population dynamics. Measures of fertility underpin two perspectives: cumulative fertility (children ever born) and current fertility (births occurring 12 months before the census). They permit analysis of fertility levels, trends and patterns in the period 1969-1999 during which largely similar questions were asked. Application of the El Badry method to make adjustments of average parities of women in the censuses held in 1969 through 1999 produced consistent results. It reveals a declining trend in the total fertility rate (TFR) from about 7.8 in 1969-79 to 5.4 in 1989-1999. The current fertility estimated from the 1999 census gave a TFR of 4.9. That fertility declined is now confirmed and dates back to the 1989 KDHS that reported the first episode of decline, and when Kenya entered a demographic transition. Estimates of fertility from the age-sex distribution of the population give measures of child-woman ratio and TFRs, and the Post-Enumeration Survey 2000 affirms these measures, thus reinforcing the credibility of fertility measures. For instance, the TFR derived from the 1999 census data was 4.9, which compares favourably with 4.8 based on the Post-Enumeration Survey 2000. Moreover, the TFRs from the censuses tally well with those from the KFS and KDHS data. By 2015-2020, Kenya's projected fertility will see further decline to a TFR of 3.2, which implies that it will not have reached the replacement level.

Analysis of mortality, the outflow loop of population dynamics, follows in Chapter 3. Estimates are made of both infant and child (under-5) mortality, followed by adult mortality, using the data on cumulative fertility. Although infant and child mortality declined steadily between 1962 and 1989, from the 1999 census data it is exhibiting an upsurge. Mortality based on the absence of AIDS is lower than that taking into account the effect of the epidemic, whose grip on AIDS is likely to persist given the immature state of the scourge. This is the case of both estimated and hypothetical age-specific infant and child mortality, with females registering higher figures than males.

Evidence from the birth history surveys, specifically the KDHS series, suggest that the levels of infant and under-5 mortality fell between those of the KDHS 1989 and KDHS 1993, taking an upward swing after they had dropped to more promising levels. Adult mortality is increasing, too, largely because of AIDS that has hit hardest the age bracket 15-49 years. The probability of dying at particular ages and the proportions of surviving from hypothetical cohorts show a sex differential in favour of males. Further analysis confirms this differential whether deaths are attributed to AIDS, other causes or both. Again, estimates from the 1999 census data agree well with those of the Post-Enumeration Survey 2000, thus confirming the credibility of mortality data and estimates from them.

Chapter 4 analyses spatial aspects of population, namely migration and urbanisation. Highlights are provided of the estimation of internal migration and both demographic and socio-economic characteristics of the migrants on the one hand, and of internal migration and voluntary immigrants on the other. The regional pattern of both recent (a year preceding the census) and lifetime internal migration persists: Nairobi, Coast and Rift Valley provinces remained net in-migration areas, while the rest, with the exception of North Eastern province whose migration system is unstable, were net out-migration areas in 1999. Regarding voluntary immigration, the vast majority comes from different countries, followed by those from the rest of Africa and Asia in descending order. Refugees were mainly from Somalia, Sudan, Ethiopia¸ Rwanda, Uganda and the Democratic Republic of Congo (DRC). Given the relative peace and tranquillity that Kenya has enjoyed in a politically volatile and insecure region, the country has hosted large numbers of refugees thanks to data by courtesy of the United Nations High Commissioner for Refugees (UNHCR). Unfortunately, lack of data on emigration of Kenya's population constrains the desire to provide the compensating stream of immigration. The urbanisation process continued steadily in the period 1989-99, though the rate of urbanisation dropped from a national average of 5.2% in 1979-89 to 3.2% in 1989-99 with all provinces except Mombasa exhibiting a similar trend. The "core urban" boundaries on average had smaller population sizes than "local authority" boundaries. To place Kenya's urbanisation level in standardised measures, two urban indices – primacy and city population by specified orders – are estimated, further enriching the measurement of urbanisation. Finally, analysis is made of both demographic and socio-economic characteristics of the urban population.

Although the three elements of population dynamics determine the rate of population growth, the thrust of it in Kenya is on the natural increase on grounds that the country's population is "closed" (not influenced by immigration and emigration) or "relatively closed". The fifty years spanning 1948-99 witnessed sustained rapid population growth that was above 3 per cent per annum until the decade 1989-99 when it reached 2.9 per cent per annum. Enumerated census population have consistently fallen short of the projected population partly because of errors inherent in projections and the demographic doldrums recently caused by HIV/AIDS. Projections of population growth adopts two assumptions: (a) TFR= 3 when mortality is falling and when it is easing; (b) TFR=2 and mortality following the opposite scenarios. Nonetheless, the natural increase perspective of population growth is deficient given the increasing emigration from Kenya and spurts of illegal immigration that will most likely affect future population growth. The final chapter of this monograph consists of a summary of salient issues, the main conclusions and recommendations for policy as well as future censuses.

The main conclusions on population dynamics suggest that the country's demographic transition is unstable, in fact less predictable than before the HIV/AIDS epidemic raised concerns. Fertility decline, first reported in the KDHS 1989, persisted in 1989-1999 and it is projected to continue up to a TFR of 3 by 2015-2020, but falling short of the replacement level. The unexpected upsurge of mortality from infancy to adult ages is expected to escalate with the HIV/AIDS pandemic and other causes. The pattern of internal migration persists while the influx of refugees exceeds voluntary immigration; and urbanisation increased but with its rate of increase abating. In 1989-1999, Kenya's population growth rate dropped to 2.9% per annum, for the first time falling below 3%. Thus, the country's unstable demographic transition poses serious challenges for development as more losses occur through increasing mortality and emigration (without definitive data from the census or any other source) feared to be on the increase.

A number of recommendations for policy and the future of censuses as well as other sources of data aim to improve Kenya's demographic accounting, and especially the utilisation of demographic data in development. While the censuses should continue in the future, careful attention should focus on the types of questions to generate data on population dynamics. One shortcoming relates to the questions on internal migration: the questions are inadequate and fail to track a continual phenomenon such as migration, and information on migration one year before the census is less helpful than migration five yeas preceding the event. International migration is even more poorly tracked: while one question generates information on immigration, there is absolutely no question on emigration, an omission that constrains Kenya from knowing where its citizens reside outside the country. There could be a pay off between fertility and mortality on the one hand and migration on the other: as the KDHS series have a plethora of questions relating to fertility and mortality, less questions on them could be included in census questionnaires to provide some room

for salient migration questions.

Kenya's current population policy emphasizes population and sustainable development, which are inter-linked phenomena with a reciprocal relationship. Yet, there is no attempt to relate demographic information to that on socio-economic development, for instance, housing which the 1989 and 1999 censuses covered. By producing separate monographs on population dynamics and housing, analysts miss out an opportunity, namely a monograph on population dynamics and housing. In-depth analyses of future censuses should include such a monograph. Better still, there could be a more rigorously analysed monograph on population dynamics and a host of socio-economic development indices, such as education, labour force, gender and housing. Thus, the ultimate aim of future censuses should be to fulfil the broad objectives of a population and housing census. May be we shall soon see the thrust change to a series of population and development census.

Introduction

This volume is the first in a series of monographs devoted to in-depth analysis of the data on the 1999 Population and Housing Census of Kenya. The first two volumes – Population Distribution by Administrative Areas and Urban Centres (I) and Socio-Economic Profiles of the Population (II) – provide information, which this volume and all others in the series of Analytical Reports examine in detail. The volume limits itself to population dynamics that have received detailed analysis in separate volumes on Fertility and Nuptiality (IV), Mortality (V), and Migration and Urbanisation (V).

Basic Population Concepts

For the sake of the readers, this volume explains some concepts, which, though explained in the different monographs mentioned, need clarification in this introductory part. Three publications easily come to mind as references for population concepts. The first one is the Multilingual Demographic Dictionary (United Nations, 1968), published before demographic issues gained importance in much of Sub-Saharan Africa. Secondly is the Multilingual Demographic Dictionary; English Section (van de Walle, 1982) published for the International Union for the Scientific Study of Population (IUSSP), the global association of population scientists, which made significant contributions to the World Population Conferences held in 1954 and 1965. Thirdly is the Population Reference Bureau's Population Handbook (Haupt and Kane, 1998), which defines concepts and shows the measurement of demographic indices relating to the three components of population change. The authors advise that the publication is "A Quick Guide to Population Dynamics for Journalists, Policymakers, Teachers, Students, and Other People interested in Demographics". Thus, both producers and users of population information would easily find solace in possessing these and many more reference material on population concepts, not least their measurement and interpretation.

The term population dynamics denotes the components of population change that invariably influence population structure in any defined setting – country, part of a country, region or even globally. They are processes, which interplay at different levels and paces, producing discernible trends and patterns that manifest themselves in demographic accounting systems such as a national census. There are three elements of population dynamics: First, fertility –the actual reproductive performance of an individual, a couple, a group or a population (Haupt and Kane, 1998:58) – is an inward loop which sustains population size and growth. It relates only to live births rather than still births, and one incident of it, whether involving twins or triplets, constitutes one fertility event. Secondly, mortality denotes deaths as a component of population change (Haupt and Kane, 1998:59; it is an outward loop that subtracts whatever population exists on account of fertility. Finally, migration is the spatial mobility or geographic mobility by individuals that involves a change

in usual place of residence across well-defined administrative boundaries (van de Walle, 1982: 92). It may involve semi-permanent residence and consists of internal and international (immigration and emigration) types of movement (Haupt and Kane, 1998: 59). In some instances, migration is permanent when migrants do not expect to return to their origins or relocate elsewhere.

The interplay of these elements of population dynamics determines the rate of change or increase/decrease or, in demographic jargon, growth. The term population increase is "the total increase resulting from the interaction of births, deaths and migration in a population in a given period of time" (Haupt and Kane, 1998: 68). However, increase gives the impression that population must always be higher than at a previous period. Yet, this is not necessarily so because population decrease has occurred in certain countries at certain times. The best example today is the effect of AIDS, which is projected to give the most affected countries much smaller population sizes than previously projected. Demographic literature often favours the expression "population growth" because its estimation leads to whether the growth is positive or negative, or even zero. The important thing to bear in mind is that population growth is the aggregate outcome of the interaction of the three elements of population dynamics.

The use of demographic statistics emphasizes measurement, estimation and projections. Measurement involves applying well proven demographic or statistical/techniques to the data to provide tangible results. Demographers often desist from absolute numbers, and instead rely on ratios, rates and proportions to explain levels, trends and patterns of demographic events. The estimated product becomes a measure of the demographic event that is measured. Estimation may be exact or plausible; it is the process of establishing a plausible value where the data are inaccurate or incomplete, the value referred to as "estimate" (van de Walle, 1982: 28). Generally, estimation depends on sound theoretical constructs that mathematicians, statisticians or other natural scientists have propounded. Instead of prediction or forecast, demographers make population projection, defined as "the computation of future changes in population numbers given certain assumptions about future trends in rates of fertility, mortality and migration" (Haupt and Kane, 1998: 61). The assumptions permit three variants of population projection: high, medium and low, implying fastest, moderate and slowest rates of growth respectively. Where immigration or emigration is considered absent or minimal, as in Kenya, projections treat the population as "closed" or "relatively closed", thus limiting themselves to the interplay of fertility and mortality and ignoring international migration. Intra-national population projections are inadvisable because of internal changes that elude measurement and estimation. Recently, a group of population scientists, economists and sociologists, treating population as an integral part of development, have favoured "population forecasting", but their influence is still insignificant in the opening decade of the 21st century.

Yet, it is grossly simplistic to contend that population issues are the result of only these three components of population change. In any country, these three are affected by, or in turn affect, some aspects of development – social, economic and political development. This explains why the interrelationship between population and development has gained importance nationally, regionally and internationally. Indeed, the essence of national development planning is to commit resources to commensurately meet the needs of the population, defined amorphously or in terms of specific attributes. Planning without demographic data often leads to under-or over -deployment of resources; put another way, it leads to wastage or denial of resources intended for the citizenry. Exactly four years after independence, Kenya adopted a population policy, which became the cornerstone of demographically sensitive national development planning, and from which other African countries borrowed immensely. Today, the country boasts some of the best locally trained demographers, civil servants whose training has had a dose of Kenya's demographics and policymakers who are supportive of population and development programmes. Not surprisingly, the country has conducted successive censuses as scheduled, and without the abuse of statistics. The onus is now on the people of Kenya to make use of population and development information in whatever parts they play in their country's national life.

Highlights of Population Dynamics

For the sake of space and in the interest of brevity, this volume omits much of the illustrative material that appears in volumes IV, V and VI of the 1999 census. However, this volume makes cross-references of the relevant monographs for detailed information. It is advisable to read this volume before reading the subsequent volumes that provide detailed information.

Chapter 1

The Demographic Statistics of Kenya

1.1 The Components of Population Change

The term *population dynamics* is generally used as being synonymous with population processes or the mechanisms of population change (United Nations, 1958). Such change is the result of natural *increase*, the balance of births and deaths, and *migration*, the balance of persons moving in and out of the country or area concerned. It can be depicted symbolically by what has sometimes been called the "balancing equation".

$$P_2 = P_1 + B - D + I - E$$

where P_1 and P_2 are the population totals at times 1 and 2, B and D are the births and deaths which occurred between times 1 and 2, and I are the immigrants who moved into and E are the emigrants who moved out of the country between times 1 and 2.

In an ideal world, censuses provide data on the population totals, while those on births and deaths are derived from civil registration and those on immigrants and emigrants from the records kept as people enter or leave the country. In practice, particularly in Third World countries, both the civil registration and migration records are often either non-existent or seriously incomplete. Such is not the situation in Kenya where we are forced to rely primarily on population censuses, supplemented by sample surveys, for determining the components of population growth. Civil registration data are grossly deficient and international migration data poorly recorded, those on emigration evidently lacking. Unless we have the data to up-date the census results from year to year, they will be out-of-date before they are published. Thus high priority has always been given to the special questions on fertility, mortality and migration, which have been included in all Kenya's population censuses. The precise nature of these questions has however changed from census to census in ways, which undoubtedly affected the comparability of the data. A brief review of these modifications is therefore relevant to any survey of Kenya's population dynamics.

1.2 History of Kenya Censuses

The 1948 Census

Kenya has had a total of six censuses. The first two, held in 1948 and 1962, were organised by the colonial government, while the decennial censuses, since 1969, have been carried out in the independence era. That Kenya has held regular censuses implies its commitment to demographic accounting for national development.

The first census of Kenya was held in 1948, more or less simultaneously with those of Uganda, Tanganyika and Zanzibar, all of which were conducted under the auspices of

the East African Statistical Department of the long-defunct East Africa High Commission. The General African Census, conducted in August that year, consisted of a "group enumeration" in which enumerators were required to record the total number of persons in each household, broken down by tribe, sex, broad age group and marital status. The census did not cover the Northern Frontier Province (Garissa, Wajir, Mandera, Moyale, Marsabit, Isiolo and Turkana Districts), Samburu District and the East Suk Division of Baringo District. For these areas, population estimates were made by District Commissioners, based on the number of adult males in the tax registers and multiplied by a factor that purported to represent the number of women and children in every household or homestead.

The General Census was followed by a Sample Census of approximately 10% of the population, in which more detailed questions were asked of each individual in the sample households. The sample areas were not selected by probability sampling, but were designated by District Commissioners as being representative of their districts. The questions asked included (among others) tribe, sex, age group (under 1; 1-5; 6-15; 16-45; over 45), district or country of birth, and the following questions of adult females:

- number of children born alive;
- number of still-births;
- number of children still living;
- number who had died under 1 year of age;
- number who had died over 1 years of age.

Boxes at the foot of the form asked for the numbers of children born since August 1947 by sex, and the numbers of persons who had died since August 1947, likewise by sex.

Unfortunately, no full report on the 1948 census was ever published. Population figures by sex and adults/children down to location level were released in a volume entitled *Geographical and Tribal Studies*. A brief account of the census methodology was given in a paper in the journal *Population Studies* by Mr. C. J. Martin, Director of the East African Statistical Department (Martin 1949), and in a second paper (Martin 1953) he gave some results of the questions on fertility and child mortality. Tables of average parities and percentage parity distributions of women in the two broad age groups, with proportions dying under and over one year of age, were compiled down to district level, but only very limited numbers of copies of these tables were made.

The total population of Kenya found by the 1948 census was 5,407,599, which included an estimated 219,000 in the northern districts specified above and 154,846 non-Africans who had been enumerated in February 1948. A notable omission was information on migration presumably because it was considered unimportant.

The 1962 Census

The second census of Kenya was held in August 1962, and thus preceded Kenya's

Independence by some sixteen months. It was conducted under the auspices of the Economics and Statistics Division of the Kenya Treasury, which had been formed on 1st July 1961 as a result of the reorganization of the East African Statistical Department. Three different census forms were used. Schedule A was designed for group enumeration such that the members of each household were grouped by tribe, sex and whether adults or children; it was used for the enumeration of the African population in rural areas (excluding the Northern Province). Schedule B (English) and C (Swahili) was designed for individual enumeration of all households in urban areas, non-Africans in rural areas, and for a 10% sample re-enumeration of sub-locations, forest stations and farms in rural areas, using a systematic probability sample. Schedule D was used only in the Northern Province, where the census was conducted through local headmen or *sagalles* who acted as the respondents on behalf of the families who fell within their aegis; the questions were restricted to relationship, tribe, sex, age and whether present in the district at the time of the census.

The B/C schedule included a question on birthplace, and three fertility questions for adult women:

- total children born alive;
- number of children still living;
- births in the 12 months preceding the census.

The numbers dead were obtained by subtracting the number still living from the total ever born.

The results of the census were published in four volumes between July 1964 and October 1966. Volume III contained an analysis of the fertility and mortality data and population projections up to the end of the century. The total population enumerated in the 1962 census was 8,636,263, which included 270,321 non-Africans. The projections made then for the year 2000 gave a total of 30,271,000 (Africans only), which agrees closely with the current estimate for 2000, based on the corrected and updated 1999 census, of 30,208,365. This good agreement, however, was largely the result of compensating errors. The 1962 projections were based on the assumptions of constant fertility and steadily declining mortality; in fact fertility first rose and then declined, and mortality, after substantial falls, started to rise again in the 1990s. Although some data were collected on migration, they were only used estimating migration in a separate volume. However, the data were extensively used in a study of the relationship between internal migration and land potentiality in Kenya (Ominde, 1968).

The 1969 Census

The third census of Kenya, held in 1969, again used a short and a long form. The short form was used in 9 out of ten rural areas, the long form in all urban areas and every 10th rural

area. Thus, the census proper was confined to one field enumeration: the sample was "built-in" to the main census rather than taking the form of a post-enumeration survey as had been done in 1948 and 1962. Furthermore, each individual was enumerated on a separate line of the census schedule, rather than as a group enumeration with one line per household. A post-enumeration survey designed to measure the coverage of the census was conducted, but no full report on this survey was published. However, a document known as the *Compendium* (see below), which appeared after the 1979 census, noted that the 1969 Post-Enumeration Survey (PES) did reveal clear evidence of undercounting in some areas, particularly Nairobi and Mombasa. In addition, appreciable numbers of records were known to have been lost, in one way or another, during the data processing. An attempt was made to correct these errors by replicating a systematic sample of cards equivalent to the estimated undercount.

The short form was restricted to questions on name, relationship, tribe, sex and age. The long form added questions on birthplace, marital status, education, orphanhood ("Is father alive?" and "Is mother alive?") and fertility questions for females aged 12 and over: Of the children ever born alive;

- How many children are living with you?
- How many are living elsewhere?
- How many have died?

From these questions the total number of children born alive by the woman was obtained by summing the answers to these three questions in the computer. In addition, the question on births in the last 12 months, which had been asked in the 1962 census, was replaced by one on the date of the woman's most recent live birth; women who had borne children during the 12 months before the census were then identified in the processing and tabulation. These changes undoubtedly yielded improvements in the quality of the data on both lifetime and current fertility. It may also be noted that Kenya was among the first countries in Africa to include the orphanhood questions in their censuses in order to obtain indirect estimates of adult mortality.

The total population shown by the 1969 census was 10,956,501, which included 13,796 persons in the area known as Karapokot which, though officially part of Kenya, was at that time administered by Uganda and had been enumerated in the 1969 census of Uganda. Non-Africans numbered 207,516 - a decline of 23% on the 1962 census. Presumably emigration of non-Africans in the first few years after Kenya's independence in 1963, due to uncertainty occasioned by the new political development, accounted for this decline.

The 1979 Census

The fourth census, held in 1979, used a single uniform schedule throughout the country.

There was no post-enumeration survey, or any attempt to compensate for an undercount by replicating a sample of cards. The questions asked were similar to those of the long form of 1969, with the addition of one question on place of residence in August 1978 - i.e. 12 months before the census. In so far as it was intended to give data on annual migration rates, this question was clearly a failure, and the *Analytical Report, Volume VI: Migration and Urbanisation* concluded that it cannot be recommended for inclusion in future censuses in Kenya (Kenya, 1996:59). Nevertheless, the question was still included in both the 1989 and 1999 censuses. The fertility questions on the numbers of children living at home, elsewhere and dead were further elaborated by asking for the sex breakdown of the children in each category; and the questions on the woman's last live birth asked both for the date of the birth and for the sex of the child.

The total population shown by the 1979 census was 15,327,061, which was rather less than had been projected after the 1969 census. The causes of the discrepancy between the projected and enumerated totals were examined in the document entitled *Compendium to Volume 1 1979 Population Census* (CBS, July 1981). A small part of the discrepancy was accounted for by the continued decline in the number of non-Africans, who were down to 157,637, but the major part was attributed to under-enumeration, mostly of young children. It was also suspected that some 300,000 persons had been missed out in Nyanza Province.

The 1989 Census of Population and Housing

The fifth census of 1989 again used a single uniform schedule throughout the country. All the questions asked in 1979 were repeated, together with several additional ones: literacy for all persons aged 6 years and over; economic activity, occupation and work status for those aged 10 and over; and for females 12 and over the questions on the last live birth asked not only for the date of the birth and the sex of the child, but also whether the child was still alive, and, if dead, the date of death. Housing questions were also included on whether the building was owner-occupied or rented; the materials of the roof, walls and floor; the source of water, type of sewage disposal; and cooking fuel and type of lighting.

The census was followed by a sample post-enumeration survey, conducted in September/October 1990, but no report on this exercise was ever published. The total population shown by the census was 21,448,774[1], which was generally recognized as being an under-count, though the extent of the under-count has been a matter of controversy. The *Analytical Report Volume III* of that census concluded that probably a round figure of 23 millions for the population of Kenya in August 1989 is as good an estimate as any, giving an overall under-enumeration of 7%. But recent re-working of the calculations in the light of the results of 1999 census has suggested that this figure may have been exaggerated (see

[1] The figure published in Volume I of the census report was 21,443,636, but this was subsequently amended in the *Analytical Report Volume III*.

monograph on *Population Projections).*

One of the most significant findings of the 1989 census was the confirmation of the dramatic fall in fertility, first shown by the 1989 Kenya Demographic and Health Survey (KDHS), which had occurred during the preceding decade. The tracking of this fertility decline through the census and survey data is one of the principal objectives of this monograph (see Chapter 2).

The 1999 Census of Population and Housing

The 1999 census, which is the subject of these analytical monographs, was thus the sixth census of Kenya, and the fourth to be held at regular 10-year intervals since Independence. A uniform schedule was used for the whole population, and was double-sided to accommodate additional questions and the extra space required by the optical character reader, which was used for the data capture. All the questions asked in 1989 were repeated, except for those on literacy, occupation and work status, and the date of death of last-born children. But new questions on duration of residence, highest level of education reached, and total children ever born (previously obtained by summing those at home, elsewhere and dead) were added. The housing questions were also expanded to include questions on the number of dwelling units and the number of rooms occupied by the household. In the event, the check question on total children ever born proved highly valuable for the editing of the errors introduced by the optical character reader, which is further discussed below.

The 1999 census was again followed by a sample post-enumeration survey in 2000. This survey has provided valuable additional information on fertility and mortality, but was conducted too long after the census to provide a check on coverage. The total population of Kenya shown by the 1999 census, as published in Volume I of the census report, was 28,686,607. The accuracy of this figure will be discussed below.

Other Data Sources on Population Dynamics

In addition to the population censuses, various sample surveys have collected data on fertility, mortality and migration in Kenya. The National Demographic Surveys (NDS) of 1977 and 1983, and the Contraceptive Prevalence Survey of 1984 asked questions on lifetime and current fertility, which were similar to those that were included in the 1989 and 1999 censuses. Due to financial difficulties, the fieldwork for the 1983 NDS was never fully completed, and some of the selected sample areas were omitted; it was therefore suspected that the results had been statistically biased.

A hitherto unexploited source of data on fertility and child mortality is the Post-Enumeration Survey conducted in February 2000 in a probability sample of 530 enumeration areas. This survey included questions to adult women on total children ever

born, the number who had died, and the date of the last live birth by sex of the children, from which estimates of fertility and child mortality can be derived.

More detailed investigations involving the compilation of *birth histories* were carried out as part of the Kenya Fertility Survey of 1977-78, and the KDHS of 1989, 1993 and 1998. The eligible women respondents in these surveys were asked to list all the children they had borne alive, giving the sex and the date of birth of each one, whether or not the child was still alive and, if dead, the age at death. From these data fertility and child mortality rates can be reconstructed, not just for the period immediately preceding the survey, but also for different times up to twenty years before the survey.

The 1998 Demographic and Health Survey also included questions designed to obtain information on adult mortality through the compilation of sibling histories. All eligible women were asked to list their brothers and sisters (by the same mother), whether or not the siblings were still alive; if alive their current age, and if dead their date of death and age at death. From these data the numbers of deaths by sex and age, the person-years of exposure, and hence the age-sex specific mortality rates were calculated for the period 0-6 years prior to the survey.

Reliability of the Census and Survey Data

All census and survey data are subject to errors, both of coverage and content. Coverage errors take the form of the omission or faulty inclusion of whole households, or of selected persons within households. Omissions are more common than faulty inclusions, so that censuses are more often under-counts rather than over-counts (except where there has been a political motive to inflate the numbers). However, faulty inclusions can occur because of misunderstanding, e.g. the inclusion of absent household members when the census is being conducted on a *de facto* basis, as are Kenya censuses. Content errors affect the information on the characteristics of the people enumerated. They may be divided into two main categories: those that originate when the information is being recorded in the field; and those that arise in the course of the data processing.

Response Errors in Censuses

Errors in the field may sometimes be the fault of the respondent who, because of ignorance, misunderstanding, or even deliberate falsification, provides the enumerator with the wrong answer. More often the errors are the fault of the enumerator, who may not put the question at all and tries to infer the answer from other information; the enumerator may word the question badly or differently, resulting in the question being misunderstood; or through sheer carelessness may record the wrong answer; some enumerators may not themselves understand how the answers should be recorded. Some enumerators have even been known to have never visited the households in their areas, and simply completed the census forms with fictitious information.

In this monograph we are particularly concerned with the reliability of the data on fertility, mortality and migration. It has long been recognized that the data on lifetime fertility - children ever born - have been vulnerable to a variety of errors of both omissions and faulty inclusions. The former include children who have died in infancy and children who have grown up and left the home; the changes in the nature of the questions, which were made between the 1962 and 1969 censuses, were designed to minimize these omissions. Faulty inclusions may comprise stillbirths, adopted children, children born to the husband by another wife, and grandchildren.

A common error is for all the data on children ever born to be entered against the father rather than the mother. In the 1999 census a new source of misunderstanding, not encountered in earlier censuses, arose from the instruction printed at the head of the columns for each category of children ever born: Mark X in the box and fill single digit only for 10 and above. The Enumerators' Instructions Manual provides a fuller explanation: If the woman has borne any child alive, write the number of boys in the bigger box in P40 and the number of girls in P41 if it is a single digit. However, mark an X in the smaller box and then fill in the last digit for 10-19. Nevertheless from the frequency with which X's were placed in the leading box when it was clear that there were in fact fewer than 10 children in the relevant category, these instructions were widely misunderstood. It is hoped that in the course of the computer editing these errors were largely eliminated, but they add another dimension of uncertainty to the 1999 parity data.

The particulars of women's last live births have also been vulnerable to response errors. In the 1969 census, when the only such question was on the date of the birth, there was reason to believe that many enumerators never asked the question: they would look for the youngest child in the household, estimate the age and enter the corresponding date of birth. The possibility that there might have been a subsequent child who had either died or was living elsewhere was never investigated. Largely for this reason the additional question on whether or not the child was still alive was included in the 1989 and 1999 censuses. In the latter case the information has been of value in its own right as an additional source of data on infant mortality, and particularly, given the extra question on the sex of the last-born child, on the sex differentials in infant mortality. Further corruption of the parity data by scanning errors (see below) largely invalidated our usual source on the variable.

One of the principal uses of the data on the last-born child has been to obtain current age-specific fertility rates from the births recorded as occurring during the 12 months before the census. Since many people in Kenya do not know their exact dates of birth, or those of their children, such rates are vulnerable both to dating errors and to non-response. In the 1969 and 1979 censuses, no provision was made for recording multiple births, so that their omission will have constituted another factor in the under-reporting of the current fertility rates. Yet, as only 1 or 2 percent of pregnancies normally result in multiple births, the error thus introduced will have been minimal. In 1989 and 1999 provision was made for

recording such multiple births.

The orphanhood questions – Is your father alive? In addition, is your mother alive? - is our principal source of data on adult mortality. They are subject to various response errors, most important of which is adoption effect: the substitution of foster parents, who are living, for the true biological parents, who may be dead. Young children are particularly vulnerable to this type of error: the census question on relationship shows them as being the sons or daughters of the household head, and the enumerators assume the parent to be alive without asking the probing questions. For this reason the data for children under 10 years of age are generally excluded from the analysis, but it is possible that the data for adults will also have been affected.

The questions on district or country of birth constitute our major source of information on migration, but the question sometimes requires careful definition, which may not always be properly implemented in the field. The Enumerators' Instructions Manual define birthplace as "the usual place of residence of mother at the time of the respondent's birth". Thus, if the respondent's mother went to a maternity hospital in another district or to her own parents' home for the delivery, these should not have been regarded as the birthplace for the purpose of the census. Further complications arise from the extensive changes in district boundaries that were made between the 1989 and 1999 censuses. The provincial and district boundaries which were demarcated at the time of Kenya's Independence remained unchanged for the 1969, 1979 and 1989 censuses; but between 1989 and 1999 the number of districts increased from 41 to 69, with the new boundaries sometimes cutting across locations or even sub-locations. Should a person give his/her district of birth as it was at the time he/she was born, or at the time of the census? The Enumerators' Instructions Manual reads: Relate the person's birthplace to the present district frontiers as far as possible. District boundaries have been changed over the years and we want to relate a person's place of birth to the district, as it is constituted now. For districts, which have been split, probe to find the actual district of birth and code the name by which it is currently known. However, the extent to which enumerators were able to implement this instruction remains problematical.

Similar problems affect the question on previous residence - Where was this person living in August 1998? Many persons living and working in urban areas may be in temporary lodgings which they do not regard as home; they have another place of residence in a rural area where their families remain, and which they visit at intervals. Thus when asked where they were living in August 1998 they may give their rural home when they had in fact already moved to the town. Such errors will inflate the annual migration rates derived from this question. The question on duration of residence, asked for the first time in the 1999 census, should provide a check, but when a person has been moving to and fro several times, which of these moves should be regarded as the beginning of the duration of residence? That several questions were likely to elicit ambiguous answers

implies the complexity of errors on the part of respondents on the one hand and enumerators on the other.

Response and Sampling Errors in Sample Surveys

There is reason to believe that the standard of fieldwork achieved in sample surveys is generally higher than that of censuses. The smaller numbers of field staff employed facilitate more thorough training and supervision, and in the birth history surveys (KFS 1977-78; KDHS 1989, 1993 and 1998) female enumerators were used who interviewed the eligible women themselves rather than obtaining the information from their husbands.

When the birth histories have been used to reconstruct fertility trends, the results have sometimes been vulnerable to errors in the dating of the births. A common tendency is for the dates of the more recent births to be pushed back in time, depleting the numbers in the last five years and inflating those between 5 and 15 years before the survey, thus simulating a spurious decline in fertility. This bias can be aggravated if some births that had occurred more than 15 years before are brought forward into the 5-9 or 10-14 year periods. Such double squeezing has been termed the "accordion effect". Methods of detecting and correcting such errors have been devised and will be described below.

Sample surveys are also subject to sampling errors: births and deaths are rare events and large numbers of person-years of exposure are needed to obtain meaningful fertility and mortality rates. As a result, the sample designs often represent compromises between efficient management of the fieldwork and sampling precision. The reports on the Demographic and Health Surveys normally contain an appendix on the sampling errors attached to the estimates of selected variables. The 1998 KDHS report shows that the 95% confidence limits of the estimated total fertility rate (last 3 years) ranged from 4.48 to 4.92 births per woman, and those for the under-5 mortality rate (last 10 years) from 93.7 to 116.8 per thousand live births (NCPD and Macro International 1999, p.189).

Data Processing Errors

These errors will of course have varied with the methods of data processing, which have changed from census to census. In the general censuses of 1948 and 1962, which used "group enumeration" such that the number of persons in each household were typically entered on one line only of the census form[2], the figures were added by hand, transcribed on to a summary sheet, and then further compiled with adding machines. This procedure clearly ran the risk of errors of addition and transcription. The data from the Sample Censuses in these years were coded on to separate coding sheets and then punched on to 80-column punch cards. Tabulations were then produced using Hollerith punch-card machinery for the 1948 census, but by the time of the1962 census, electronic computers

[2] If the household was composed of persons from more than one tribe, additional lines were used.

had become available, and the rating up and tabulation of the sample was done on an ICT 1500 computer. Although the punch cards were theoretically subjected to 100% verification, many punching errors got through. Particularly dangerous forms of such errors were cards punched one column to the left or right. When this happened, a woman who had had, say, 2 children might be tabulated as having had 20.

With the 1969 census, the information was coded on the census schedules themselves, punched on to punch cards with 100% verification, and then transferred on to magnetic tape for processing on an ICL 1902 computer. The use of computers for the editing and correction of errors was by then becoming more sophisticated, and limited use was made of hot deck procedures. Where the parity data were concerned, checks were made of the compatibility of the woman's age and the number of children she was shown as having borne; if the stated parity was too large for her age, it was changed to not stated. Unfortunately the rules of compatibility have tended to change from census to census, thereby affecting the comparability of the results.

The 1979 census was coded on the schedules, as in 1969, and then keyed manually on to diskettes, with 100% verification for the first 3 months, which was later reduced to 50% and then to 10%. In 1989 most of the coding was done in the field, the answers to the questions being recorded in the form of numeric codes rather than in words or other symbols; only the question on occupation was coded in the census office. This procedure has both advantages and drawbacks. It obviates the necessity for a separate coding operation in the office; but it also means that the enumerators are being required to do two jobs - to act both as an enumerator and as a coding clerk; in such a case, if they mis-code the answers they have been given there is less chance that the errors will ever be detected. Thus the net result will almost certainly have been an increase in the incidence of errors. The 1989 schedules were again keyed manually on to diskettes; verification was reduced to 2% as a quality control. The development of computerized techniques for the detection and correction of errors enabled greater reliance to be placed in such checks as means of monitoring the operators' outputs.

For the 1999 census the forms were again pre-coded in the field, but a major change was made in the methods of data capture: in place of manual keying, the census forms were scanned by Kodak optical character readers. Unfortunately these machines frequently mis-read the characters written on the forms, resulting in a serious deterioration in the reliability of the data. The incidence of these errors varied considerably between different parts of the census form, and in general they were more frequent on the back of the two-sided form than on the front; but *no field was immune to these errors,* including the geographical and enumeration area identification. In an examination of the records for Nairobi Province, Dr. David Beckles, the DFID consultant on data processing, found 54,437 (2.5% of the population) age records (on the front of the form), which were in error. He concluded: Closer investigation of some of these errors...has shown that many, if not all,

have been caused by an intermittent malfunction of the archiving software.

The worst affected area of the form was the column for dead female children (P47). The numbers shown in this column seemed seriously inflated, but editing of the data helped to minimize the effect of these errors. The editing process was rendered feasible by the presence on the form of the check question on total children ever born, so that when the sums of the children at home, elsewhere and dead did not agree with the total ever born, an error was indicated. It would appear that in the country as a whole, the records for some 837,000 women aged 15-49, or 12% of the total, were corrupted in this way.

Errors such as these must of necessity enlarge the area of uncertainty attached to the census results. The primary purpose of this monograph is to present the results of the census questions on fertility, mortality and migration, the ultimate aim being to make the best possible estimates of the principal indices for the country which will serve as a basis for the population projections needed by the planners. It therefore becomes doubly important that the census results are seen in the context both of the earlier censuses and of the sample surveys, which have enabled us to track Kenya's progress through the demographic transition over the last half-century.

Nonetheless, the nature and extent of the errors mentioned should not lead readers to the conclusion that Kenya's census data are grossly flawed. If anything, analysts of the country's census as well as survey data have identified specific errors that in no way mar the quality of the data upon which estimates and projections are based. This kind of transparency goes to confirm the seriousness with which demographic accounting is treated in Kenya.

Chapter 2

Fertility

This chapter highlights the first vital event, namely fertility, from which both mortality and migration derive meaning. It provides cumulative and current fertility estimates, which relate to children ever born and children born 12 months before the census respectively. The estimates from the 1999 census are compared with those based on the Post-Enumeration Survey 2000 to establish similarities and differences. Finally, adjustments and extrapolation of fertility estimates are made from fertility history and the Demographic and Health Surveys already carried out in the country.

2.1 Fertility Estimates from the 1999 Census

The census provides three sources of data from which estimates of fertility can be derived:

- the questions on children ever born alive (columns P-40 to P-47) by all females aged 12 and over, sub-divided by the sex of the children, and into those still living with the mother, those living elsewhere, and those who had died;
- the particulars of the woman's last live birth (columns P-48 to P-51): the date of the birth, the sex of the child, and whether the child was still alive; and
- the age and sex distribution of the population (column P-11 and P-12).

Children Ever Born

The data on children ever born recorded in a single census cannot, in isolation, give estimates of the current level of fertility, particularly in populations where fertility is changing rapidly, as was the case in Kenya in the 1990s. But if they are used in conjunction with corresponding data compiled in an earlier census, estimates for the inter-censal period can be obtained. Thus, the women who were aged 15-19 in the 1989 census are the same women (mortality and migration apart) as those aged 25-29 in the 1999 census; those aged 20-24 in 1989 are the same as those aged 30-34 in 1999. If we know the number of children they had borne both in 1989 and in 1999, then the number born during the 1989-99 decade must be the difference between the two. If these differences are cumulated across the age groups, an estimate can be obtained of the total fertility of a hypothetical cohort of women who go through life having children at the rates current during the decade (United Nations 1983).

Before making these calculations, however, it is important to ensure the data from the two censuses are comparable, and that any adjustments that might influence the results have been similarly effected. There are two areas in which such adjustments are commonly made: childless women, and women whose stated parity is considered incompatible with their age. As regards the childless, the enumerators are normally instructed to complete the columns with zeros; but some fail to do so, particularly when the

women are young and unmarried, and the columns are left blank; such women are then classified as not stated. However, there may also be other women who have borne children but who the enumerators had been unable or unwilling to record the information, and who would also be shown as "not stated". How many of the not stated women are in fact childless? There are two procedures usually adopted to this problem.

The classic procedure is that developed by El Badry (1961), who proposed that the percentage not stated should be plotted against the percentage shown as childless for each age group of women. If the points of the graph lie approximately on a straight line, then the intercept of a fitted line will represent a fixed proportion, constant for all age groups, who are not stated for reasons other than childlessness. This proportion should therefore be subtracted from the total proportions not stated in each age group, and the balance will be those who are childless.

The second procedure is imputation: on finding a woman whose parity is not stated, the computer searches for a previous woman with the same age (and perhaps other characteristics), and attributes her parity data to the not stated woman.

The El Badry method was applied successfully to the 1969, 1979 and 1989 censuses; but with that of 1962 it gave clearly misleading results. With the 1999 census both procedures were tried. The results are shown in Table 2.1. It will be seen that they give encouragingly similar results, which make little difference to the final fertility estimates. But it should be remembered that the data had already been subjected to heavy editing to minimize the effect of the scanning errors described in the preceding chapter. Because of the trivial differences, we have opted to use the imputed figures both in this monograph and in the more detailed analyses in the monographs on fertility, mortality and projections, on account of their greater convenience.

Table 2.1 Census 1999: Average Parities adjusted by Different Procedures

Age Group	*El Badry Correction and by Imputation*		
	Unadjusted	El Badry	Imputed
15-19	0.2535	0.2632	0.2830
20-24	1.2702	1.3188	1.3520
25-29	2.4836	2.5787	2.6114
30-34	3.9698	4.1218	4.1471
35-39	5.1645	5.3622	5.3862
40-44	6.1359	6.3708	6.3840
45-49	6.6870	6.9430	6.9471

Women whose numbers of children appear to be incompatible with their ages pose a problem for which there is no standardized solution. Because they are at the upper end of the parity distributions, the inclusion or exclusion of even a small number of women can have an appreciable effect on the average parities, which are a crucial ingredient of the

fertility estimates. Nor is there any standardized procedure for the treatment of the excluded women: should they be classified as not stated, or allocated the maximum allowable parity for their age? Possible biases arising from these adjustments should be borne in mind when assessing the validity of the estimates.

Table 2.2 shows the mean numbers of children ever born alive by women in Kenya, or average parities as they are frequently termed, from the 1969, 1979, 1989 and 1999 censuses. They have all been adjusted by the El Badry correction except in 1999, which were imputed. It will be seen that there was little consistent change between 1969 and 1979, thereafter there was a general decline, reflecting the beginning of the fertility transition in Kenya.

Table 2.2: Adjusted Average Parities from 1969, 1979, 1989 and 1999 Censuses

Age Group	1969	1979	1989	1999
15-19	0.366	0.321	0.273	0.283
20-24	1.939	1.899	1.610	1.352
25-29	3.764	3.743	3.357	2.611
30-34	5.267	5.523	5.049	4.147
35-39	6.186	6.632	6.247	5.386
40-44	6.637	7.197	7.093	6.384
45-49	6.891	7.353	7.440	6.947

Table 2.3 shows the hypothetical cohorts calculated for the three inter-censal decades. An additional refinement of this procedure consists in fitting a fertility model to the average parities of the hypothetical cohorts, which has the advantage of smoothing irregularities, particularly at the older age groups that are generally thought to be the most vulnerable to reporting errors. Brass's relational Gompertz fertility model has been used for this purpose (Brass 1981).

Table 2.3: Hypothetical Cohorts and Model Fertility Rates for Inter-Censal Periods

Age Group	Hypothetical Cohort Average Parities		
	1969-79	1979-89	1989-99
15-19	0.321	0.273	0.283
20-24	1.899	1.610	1.352
25-29	3.698	3.309	2.621
30-34	5.483	4.760	3.899
35-39	6.566	5.813	4.651
40-44	7.413	6.331	5.224
45-49	7.733	6.622	5.351

Table 2.3 cont.

Age Group	Fitted Models Age-Specific Fertility Rates		
	1969-79	1979-89	1989-99
10-14	0.0033	0.0019	0.0026
15-19	0.1883	0.1583	0.1362
20-24	0.3745	0.3344	0.2619
25-29	0.3688	0.3231	0.2543
30-34	0.3006	0.2522	0.206
35-39	0.2132	0.1685	0.1458
40-44	0.0963	0.0697	0.0658
45-49	0.0122	0.0077	0.0084
Total (x5)	7.7858	6.5789	5.4050

These figures indicate that total fertility in Kenya fell from a high point of just under 8 births per woman in 1969-79 to 6.6 in 1979-89 and 5.4 in 1989-99. The last figure is somewhat higher than the TFR of 4.7 given by the 1998 Demographic and Health Survey for the period 1995-98 (NCPD, CBS and Macro International Inc., 1999). Part of this discrepancy may be explained by the fact that they refer to different time intervals during a period when fertility was falling rapidly; but the possibility that fertility was over-estimated by the census and/or under-estimated by the DHS will be examined below.

Current Fertility

In columns P48 and P49 of the census schedule all women who had ever had a live-born child were asked for the month and year of their most recent birth, and in column P50 for the sex of the child and whether it was a single, twin or multiple birth. From these data the numbers of children born during the twelve months before the census were tabulated by the mother's age group, and age-specific fertility rates calculated. In general, fertility rates derived from such data have tended to under-estimate the true level of fertility, partly on account of non-response and partly because of misdating of the births.

The standard test for such under-reporting is to cumulate the fertility rates by age in such a way as to make them comparable, age group by age group, with the average parities derived from the questions on children ever born (Brass et al., 1968; Brass 1975; United Nations 1983). The trend and pattern of the resulting P/F ratios - where the P's are the average parities and the F's the cumulated current fertility - provide a powerful diagnostic tool for interpreting both the trends in fertility and the patterns of error. If the P/F ratios rise with age, it is a strong indication that fertility has been falling; conversely falling P/F ratios suggest rising fertility, though the same trend can be produced by progressive under-reporting of parity by older women. P/F ratios which are appreciably greater than unity for

the younger age groups (under 25 or under 30), suggest under-reporting of current births; over-reporting will give ratios of less than 1, but this situation is much more rare.

An additional and worth-while refinement of the technique consists in fitting a fertility model to the current fertility rates, thus smoothing irregularities and correcting distortions in the rates for older women which are a common feature of such data. Again Brass's relational Gompertz model is suitable for this purpose. Thus the fitted model provides the relative shape of the age-specific fertility distribution, and the level of fertility is determined by the average parities of younger women, most of whose children have been born during the relatively recent past. However, when fertility is declining rapidly, the adjusted rates can no longer be taken as representing those for the 12 months before the census, but rather for an indeterminate period which varies with the age groups used to make the correction. The results of these procedures are shown in Table 2.4.

Table 2.4: Census 1999: Average Parities and Current Age-Specific Fertility Rates

Age Group	Average Parities	Current Fertility	Fitted Model
15-19	0.283	0.1169	0.1418
20-24	1.352	0.2507	0.2540
25-29	2.611	0.2270	0.2356
30-34	4.147	0.1830	0.1846
35-39	5.386	0.1299	0.1269
40-44	6.384	0.0611	0.0555
45-49	6.947	0.0218	0.0068
Total (x5)		4.9520	5.0260

The rise in the P/F ratios with age reflect the decline in fertility in Kenya which began some twenty years earlier, and the fact that the ratios for the 20-24 and 25-29 age group were very close to unity suggests that the reporting of current births was virtually complete[3]. Therefore, the implied adjustment gives a total fertility rate for the twelve months before the census of just over 5 births per woman, as does the use of the relational Gompertz model[4].

[3] It must be pointed out that the current fertility rates were calculated from imputed data. Women who were "not stated "as to the date of their last birth, had a value imputed based on the previous woman with the same age. Rates calculated from the edited rather than imputed data set gave a TFR of 4.28, and that calculated from the raw data, which neither had been edited nor imputed, was 3.70.

[4] Similar calculations using the edited and raw data sets in conjunction with average parities adjusted with the El Badry correction, gave estimated TFRs of 5.007 and 5.228 respectively.

2.2 Estimates from the Age-Sex Distribution

The children aged under-5 years at the time of the census should be the survivors of those born during the 5 years before the census. Thus if allowance can be made for mortality, the numbers of births during this period can be reconstructed. If these births are divided by the numbers of females of child-bearing age, the child-woman ratios so obtained will be a close approximation to the general fertility rate for the last five years, which, by using suitable models, can be converted into estimates of the gross reproduction rate and total fertility rate. Similarly, child-woman ratios using the 5 - 9 age group will give fertility estimates for the period between 5 and 10 years before the census.

A simple method of making the conversions, using stable population models, has been devised by Rele (1967), and incorporated in a spreadsheet constructed by the U.S. Bureau of the Census (Arriaga 1994). Fertility estimates for Kenya have been made using this spreadsheet, and are shown in Table 2.5. They are clearly vulnerable to a number of biases. The method is based on the assumption that the population is stable, or at least quasi-stable, whereas fertility in Kenya had been declining for some 20 years prior to the census. As a result the total fertility rates so derived will have been over-estimated, but the bias is unlikely to have been very large - possibly of the order of 3 or 4%. More important are the possible effects of the under-enumeration and age-misreporting of young children, which generally will lead to under-estimates if the child-woman ratios use the 0-4 age group in the numerators, but may give over-estimates if the 5-9 age group is used. Table 2.5 shows the Rele estimates for Kenya from the 1999 census, which suggests Total Fertility Rates (TFRs) of 4.5 for the 5 years before the census and 5.6 for the preceding 5 years. This difference may be attributed to the continuous decline in fertility, but some may also be due to the afore-mentioned errors in the age distribution.

Table 2.5: Census 1999: Fertility Estimates from the Age-Sex Distribution by Rele's Method

Child-Woman Ratio	Estimated TFR
0-4/15-44	4.45
0-4/15-49	4.61
5-9/20-49	5.51
5-9/20-54	5.63

2.3 Estimates from Survey Data

Post-Enumeration Survey 2000

Although part of the 1999 census operation, the PES was not processed using the optical character readers; the data were keyed in manually and were not subjected to further editing and imputation. Table 2.6 shows the average parities and current age-specific fertility rates based on women who had borne a child during the 12 months before the survey.

Table 2.6: Post-Enumeration Survey 2000: Average Parities and Current Age-Specific Fertility Rates

Age Group	Average Parities	Current Fertility	Fitted Model
15-19	0.215	0.0714	0.0935
20-24	1.092	0.2193	0.2269
25-29	2.181	0.2282	0.2440
30-34	3.423	0.1853	0.2075
35-39	4.581	0.1427	0.1502
40-44	5.610	0.0801	0.0681
45-49	6.168	0.0412	0.0085
Total (x5)		4.8409	4.9941

The average parities are consistently lower than those derived from the census (see Table 2.2). At least part of the difference may be attributed to the time lag between the census and the PES during a period when fertility in Kenya was falling rapidly. But it should be observed that the numbers of women in the PES who were classified as not stated were negligible, which did not allow for the application of the El Badry correction. Yet the proportions classified as childless were consistently higher, in all age groups, than those obtained from the census. On the other hand no attempt has been made to exclude women in the younger age groups whose stated parities appeared to be incompatible with their ages. Thus the data may well have been subject to both upward and downward biases.

The current births give a total fertility rate of 4.84 births per woman. The application of the P/F ratio and the relational Gompertz model suggest that this figure may have been slightly too low. Adjustments based on the Gompertz (last column of Table 2.6) and the average parities for the 25-29 and 30-34 age groups indicate that a round figure of 5 births per woman for the mid-1990s is as good an estimate from this data set as any.

Birth History Surveys, 1977/78- 1998

There have been twenty years of birth history surveys in Kenya. Between 1977-78 and 1998, Kenya witnessed four national surveys in which birth history data were collected.

These were the Kenya Fertility Survey (KFS) 1977-78 and three Kenya Demographic Surveys (KDHS) held in 1989, 1993 and 1998. As has been mentioned above, these surveys enable fertility estimates to be made, not just for the last few years, but also for different periods up to 20 years before the surveys. Since the surveys were restricted to women under the age of 50, the fertility rates for the older women become increasingly truncated as they are taken further back in time, and have to be extrapolated up to the end of childbearing by "borrowing" the rates from the nearest subsequent time periods. When fertility is falling rapidly, this procedure introduces a progressive downward bias in the estimates. The results from the four Kenya surveys are shown in Table 2.7.

Table 2.7: Recorded and Extrapolated Estimates of Total Fertility from Birth History Surveys

Period	KFS 1977-78	Period	KDHS 1989
1958-62	8.41	1969-73	8.00
1963-67	9.01	1974-78	8.19
1968-72	8.70	1979-83	7.64
1973-77	8.26	1984-88	6.70
Period	KDHS 1993	Period	KDHS 1998
1973-77	7.88	1978-82	6.87
1978-82	8.02	1983-87	6.89
1983-87	7.35	1988-92	5.71
1988-92	5.53	1993-97	4.65

The consistency of these estimates can be readily assessed by comparing the estimates for the same time periods from different surveys: e.g. the estimates for the three 5-year periods between 1978 and 1992 from the 1993 KDHS can be compared with the estimates for the same periods from the 1998 KDHS. The discrepancies are in some cases quite large: for example, those for the period 1978-82 were 8.02 from the 1993 KDHS and 6.87 from that of 1998. They can be largely attributed to the misdating of the births and the "accordion effect" described above. All four surveys show lower fertility rates for the periods 15-19 years than for those 10-14 years before the surveys.

These biases can be reduced by redistributing the births in time using a fertility model. Once again Brass's relational Gompertz model is a suitable tool for this purpose (Brass 1981). Brass himself fitted the model to the 1977-78 KFS and the 1989 KDHS (Brass and Jolly 1993); the adjustments to the 1993 KDHS and the 1998 KDHS were made in two separate works (Macrae, Bauni and Blacker, 2001; Blacker forthcoming). The results are shown in Table 2.8.

Table 2.8: Adjusted and Extrapolated Estimates of Total Fertility from Birth History Surveys

Period	KFS 1977-78	Period	KDHS 1989
1958-62	7.84	1969-73	7.89
1963-67	8.12	1974-78	7.72
1968-72	8.05	1979-83	7.27
1973-77	7.91	1984-88	6.71
Period	KDHS 1993	Period	KDHS 1998
1973-77	7.24	1978-82	6.62
1978-82	6.89	1983-87	6.15
1983-87	6.45	1988-92	5.54
1988-92	5.79	1993-97	4.89

Although the methods are to some extent dependent on the subjective judgement of the analyst, the general coherence of the estimates has undoubtedly been improved. Furthermore they have brought the estimates from the birth history surveys into better agreement with those from the censuses, as will be described below.

The projected trends in the age-specific fertility rates, which make up the total fertility are based on a model fitted to the current fertility rates from the 1999 census. It was then assumed that as fertility continued to fall the spread of the age-specific fertility distribution would get progressively narrower. The results are shown in Table 2.9.

Table 2.9: Model Total and Age-Specific Fertility Rates for Kenya, 1990-2020

Age Group	1990-95	1995-2000	2000-05	2005-10	2010-15	2015-20
10-14	0.0039	0.0030	0.0024	0.0019	0.0016	0.0014
15-19	0.1533	0.1273	0.1113	0.0987	0.0907	0.0856
20-24	0.2659	0.2252	0.2008	0.1816	0.1703	0.1638
25-29	0.2472	0.2094	0.1868	0.1690	0.1585	0.1526
30-34	0.1962	0.1652	0.1465	0.1318	0.1229	0.1176
35-39	0.1375	0.1147	0.1007	0.0897	0.0828	0.0785
40-44	0.0620	0.0509	0.0441	0.0386	0.0351	0.0328
45-49	0.0079	0.0064	0.0054	0.0046	0.0041	0.0037
Total (x5)	5.37	4.51	3.99	3.58	3.33	3.18

Chapter 3

Mortality

Mortality represents subtraction of population from that already born. As mortality occurs at all ages, its estimation entails distinguishing infant and child mortality from adult mortality whose probability is best explained by constructed or model life tables based on existing data.

3.1 Infant and Child Mortality

Estimates from the 1999 Census

Two sources of information on infant and child mortality are available from the 1999 census:

- in columns P46 and P47 all females aged 12 and over were asked how many of the children they had ever borne had died by the time of the census; the dead male children were entered in column P46 and the dead females in column P47; when divided by the total ever borne in columns P40 and P41, the proportions dead, tabulated by age group of mothers, are obtained, and may be converted into mortality rates by specific ages of childhood, q(x) ;
- in columns P48 and P49 all mothers were asked for the date (month and year) when their last child had been born; P50 asked for the sex of the child and P51 whether the child was still alive; the proportions dead among those borne during the last two years before the census provides a close approximation to the infant mortality rate.

Estimates from Children Ever Born

Table 3.1 shows the proportions of children dead by age group of mother from the 1999 census, together with the corresponding proportions from the other Kenya censuses since 1962. Table 3.2 shows the proportions dead among male and female children compared with those from the 1979 and 1989 censuses (prior to 1979 information on the sex of the children was not collected).

Table 3.1: Proportions of Children Dead by Age Group of Mother Kenya Censuses 1962 - 1999

Age Group	1962	1969	1979	1989	1999
15-19	0.146	0.128	0.116	0.111	0.117
20-24	0.170	0.147	0.125	0.104	0.108
25-29	0.205	0.174	0.141	0.108	0.099
30-34	0.238	0.202	0.166	0.126	0.110
35-39	0.269	0.231	0.185	0.139	0.118
40-44	0.308	0.263	0.217	0.165	0.139
45-49	0.338	0.304	0.253	0.186	0.156

Table 3.2: Proportions of Male and Female Children Dead 1979, 1989 and 1999 Censuses

	Males			Females		
Age Group	1979	1989	1999	1979	1989	1999
15-19	0.123	0.113	0.117	0.109	0.109	0.117
20-24	0.129	0.107	0.106	0.120	0.100	0.110
25-29	0.148	0.112	0.099	0.134	0.104	0.100
30-34	0.173	0.135	0.106	0.159	0.123	0.115
35-39	0.192	0.144	0.115	0.177	0.133	0.122
40-44	0.225	0.171	0.137	0.210	0.158	0.141
45-49	0.263	0.194	0.155	0.243	0.178	0.157

The relationship between the proportion dying to each age group of mothers and the life-table probabilities of dying between birth and specified ages of childhood was first established by Brass (1968) as follows:

Age group of mothers:	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Probability of dying, q(x), by age (x):	1	2	3	5	10	15	20

This relationship needs to be refined in the light of information on the shape of the age curve of fertility: if the mothers started their child-bearing when young, their children will, on average, be older at the time of the census, and vice versa. Similarly the older the children the further back in the past will be the average time location of the mortality estimate. Methods of estimating the time locations were first developed by Feeney (1976), and modified by Coale and Trussell (1977) whose method has been used here. If the various estimates of q(x) are matched against a model life table system, equivalent values of infant mortality, q(1), and under-5 mortality, q(5), can be obtained, and hence the time trends in infant and under-5 mortality. The effects of using different model life table systems are examined in the monograph on *Mortality*, and it is concluded that the Princeton North models are the most suitable for Kenya.

In the case of the 1999 Kenya census, the conversion of the proportions dead into life-table probabilities of survival involved complications not previously encountered with the earlier censuses, and which arose both from the corruption of the data set by the scanner described above, and from the AIDS element in the recent data. As noted above the field which was most affected by the scanning errors was P47, the dead female children, and it will be seen from Table 3.2 that the proportions dead among female children were higher than those of males, implying higher female than male mortality. This feature was not apparent in the 1979 or 1989 censuses, nor has it been shown by any of the sample surveys described below. It is undoubtedly spurious. Thus, if the female rates have been over-estimated in relation to the male, those for both sexes combined will have been biased upwards.

The possible biases, which the AIDS epidemic may have introduced in the indirect mortality estimates, are discussed in the monograph on *Mortality*. Briefly they have undermined the assumptions underlying the methods on three counts:

- the mortality of children borne by mothers living at the time of the census cannot be regarded as representative of all child mortality, as children born by mothers who have died of AIDS will themselves have suffered abnormally high mortality;
- since HIV prevalence varies with the age of the mothers, so will the mortality of the children attributable to vertical transmission, so that the assumption that the level of child mortality is independent of mother's age is no longer valid;
- the underlying shape of the age-specific mortality curve will no longer correspond with those of any of the standard model life tables on which the conversion factors are based.

It may be noted that of these biases the first will also affect the direct mortality estimates obtained from birth histories.

No fully satisfactory solution to these problems has yet been found, but a first step in that direction has been taken by Zaba and Ward (forthcoming) who have developed a correction procedure for populations where the epidemic has stabilized. The use of this correction with populations such as that of Kenya where the epidemic is still increasing will lead to a small over-estimate of mortality. Thus, the corrected and uncorrected estimates can reasonably be seen as upper and lower bounds. They are shown in Table 3.3.

Table 3.3: Estimated Proportions Dying by Specified Ages with Equivalent Infant and Under-5 Mortality 1999 Census: North Models

No AIDS Adjustment				
Age (x)	q(x)	Q(1)	q(5)	t
1	0.108	0.108	0.166	1998.4
2	0.103	0.085	0.132	1997.1
3	0.093	0.068	0.107	1995.3
5	0.109	0.069	0.109	1993.2
10	0.124	0.068	0.107	1990.9
15	0.144	0.074	0.116	1988.4
20	0.159	0.075	0.117	1985.6
With AIDS Adjustment				
Age (x)	q(x)	Q(1)	q(5)	t
1	0.114	0.114	0.175	1998.4
2	0.105	0.087	0.135	1997.1
3	0.102	0.075	0.117	1995.3
5	0.123	0.079	0.123	1993.2
10	0.135	0.075	0.117	1990.9
15	0.144	0.074	0.116	1988.4
20	0.159	0.075	0.117	1985.6

The estimates based on the 15-19 age-group of mothers, and, to a lesser extent, those from the 20-24 age group, have been biased upwards by the high mortality rates of children borne by young mothers; they should therefore be discarded as representative of mortality in the mid-1990s. For this purpose the most reliable estimates are those derived from the 25-29 and 30-34 age groups, which suggest an infant mortality of about 69 per thousand live births and an under-5 mortality of 108 per thousand without the AIDS correction, which are increased to 77 and 120 respectively with the correction.

The estimates derived from the older age groups refer to time periods further back in the past. However, it may be noted that they agree very satisfactorily with the indirect estimates obtained from previous censuses, as will be shown below in Figure 3.2.

Hypothetical Cohorts 1989-1999

Another way of using the data on proportions of children dying by age group of mothers is the use of hypothetical cohorts from the changes in the mean number of dead children per mother between two consecutive censuses or surveys. This procedure has the advantage of giving estimates that are representative of a time period which is closer to the time of second census or survey than would be the case using one data set only. The results for Kenya using the 1989 and 1999 censuses, with and without the AIDS correction, are shown in Table 3.4.

Table 3.4 Estimates of Infant and Child Mortality from a Hypothetical Cohort for 1989-99

No AIDS Adjustment					
Age Group	Proportion Dead	Age (x)	q(x)	q(1)	q(5)
15-19	0.117	1	0.108	0.108	0.166
20-24	0.108	2	0.103	0.085	0.132
25-29	0.100	3	0.094	0.069	0.108
30-34	0.112	5	0.110	0.070	0.110
35-39	0.115	10	0.121	0.066	0.105
40-44	0.131	15	0.136	0.069	0.109
45-49	0.139	20	0.142	0.066	0.104
With AIDS Adjustment					
Age Group	Proportion Dead	Age (x)	q(x)	q(1)	q(5)
15-19	0.117	1	0.112	0.112	0.172
20-24	0.108	2	0.106	0.087	0.136
25-29	0.100	3	0.101	0.074	0.116
30-34	0.112	5	0.125	0.080	0.125
35-39	0.115	10	0.137	0.076	0.119
40-44	0.131	15	0.157	0.081	0.127
45-49	0.139	20	0.190	0.091	0.142

Since all the estimates refer to the same time period, they may be averaged after discarding those based on the two youngest age groups. They suggest infant and under-5 mortality rates of 69 and 108 without the AIDS correction and 81 and 125 with the correction.

Survival of Last-Born Children

The estimates of infant mortality, and the equivalent values of under-5 mortality, derived from the proportions dying among the children born during the 24 months before the census, are shown in Table 3.5. The infant mortality rates were calculated by dividing the proportions dead by the "default" factor of 0.9 (Brass and Blacker, 1999); the equivalent values of under-5 mortality were based on the age patterns of infant and child mortality shown by the 1998 KDHS, according to which deaths in the first year of life constituted two-thirds of those in the first 5 years.

Table 3.5: Estimates of Infant and Under-5 Mortality from Proportions Dying among Last-Born Children Born in the last 24 Months

	Proportion Dying	Estimated Infant Mortality(1)	Equivalent Under-5 Mortality(2)
Total	0.0717	79.7	119.5
Males	0.0734	81.6	122.4
Females	0.0699	77.7	116.5

(1) Estimated by dividing the proportion dying by 0.9
(2) Estimated from the 1998 KDHS ratio of q(5)/q(1) = 1.5

These estimates are less vulnerable to the biases affecting those based on children ever born. Scanning errors were fewer in this part of the census form, and the sex differentials are of the expected pattern. Of the AIDS-related biases, the selectivity implied by the fact that the only reports are from living mothers is still pertinent, but the numbers of children born by mothers who have died of AIDS during the 24 months before the census will have been small. Since mother's age is not a variable in the calculations, the other potential biases can be disregarded. But data on recent births and deaths are generally susceptible to dating and response errors. It will be seen that the method gives an infant mortality of 80 per thousand, implying an under-5 mortality of 120, for the late 1990s.

Estimates from Sample Surveys

(a) Post-Enumeration Survey 2000

The PES conducted in February 2000 repeated the census questions on children ever born and how many of these had died, but not that on the survival of the last-born child. Table 3.6 shows the proportions dead by sex of the children, and Table 3.7 the mortality estimates derived from them, with and without the AIDS correction.

Table 3.6: Proportions of Children Dead by Age Group of Mother Post-Enumeration Survey 2000

Age Group	Total	Males	Females
15-19	0.1075	0.1011	0.1141
20-24	0.0964	0.0985	0.0941
25-29	0.1011	0.1042	0.0980
30-34	0.1053	0.1105	0.1000
35-39	0.1147	0.1163	0.1132
40-44	0.1429	0.1438	0.1419
45-49	0.1614	0.1673	0.1555

Table 3.7: Estimated Proportions Dying by Specified Ages with Equivalent Infant and Under-5 Mortality Post-Enumeration Survey 2000: North Models

No AIDS Adjustment									
Age	Total			Males			Females		
(x)	t	q(x)	q(1)	q(5)	q(x)	q(1)	q(5)	q(x)	q(1)
1	1999.5	0.1033	0.1033	0.1592	0.0971	0.0971	0.1503	0.1096	0.1096
2	1998.2	0.0932	0.0763	0.1196	0.0952	0.0780	0.1222	0.0910	0.0745
3	1996.3	0.0949	0.0693	0.1090	0.0978	0.0715	0.1123	0.0920	0.0671
5	1994.2	0.1033	0.0655	0.1033	0.1084	0.0689	0.1084	0.0981	0.0621
10	1991.8	0.1201	0.0658	0.1038	0.1217	0.0667	0.1052	0.1185	0.0648
15	1989.3	0.1478	0.0759	0.1189	0.1487	0.0764	0.1197	0.1467	0.0753
20	1986.4	0.1637	0.0772	0.1209	0.1697	0.0803	0.1255	0.1577	0.0741
With AIDS Adjustment									
Age	Total			Males			Females		
(x)	t	q(x)	q(1)	q(5)	q(x)	q(1)	q(5)	q(x)	q(1)
1	1999.5	0.1085	0.1085	0.1667	0.1023	0.1023	0.1579	0.1148	0.1148
2	1998.2	0.0956	0.0784	0.1227	0.0976	0.0801	0.1252	0.0934	0.0765
3	1996.3	0.1035	0.0758	0.1188	0.1065	0.0780	0.1221	0.1006	0.0736
5	1994.2	0.1213	0.0774	0.1213	0.1264	0.0809	0.1264	0.1160	0.0739
10	1991.8	0.1395	0.0772	0.1209	0.1411	0.0782	0.1223	0.1379	0.0762
15	1989.3	0.1729	0.0900	0.1399	0.1738	0.0906	0.1407	0.1718	0.0894
20	1986.4	0.2216	0.1084	0.1666	0.2275	0.1118	0.1714	0.2155	0.1051

The estimates derived from the 25-29 and 30-34 age groups indicate infant and under-5 mortality rates of 67 and 106 without the AIDS correction, and 76 and 119 with the correction. The data were not processed by scanners, and show higher male than female mortality for all age groups of mother over 20.

(b) Birth History Surveys: KDHS 1989, 1993 and 1998

These surveys collected information on the dates of birth of all children borne by the eligible women, the sex of each child, whether or not he/she was still alive at the time of the survey, and, if dead, the age at death. These data have enabled the infant and child mortality rates to be calculated directly, without resort to indirect estimation and model life tables. The published reports have all contained estimates of infant and under-5 mortality for the three 5-year periods preceding the surveys, which are shown in Table 3.8. But it is also possible to compute mortality rates for single calendar years, though the numbers are small, so that sampling errors and random fluctuations are large. Marston (2001) has made the single-year calculations for the three Demographic and Health Surveys, and to smooth the fluctuations we have fitted three-year moving averages to her figures. They are shown in Table 3.9 and are illustrated in Figure 3.1.

Table 3.8: Kenya Demographic and Health Surveys Direct Estimates of Infant and Under-5 Mortality Per 1000 live births

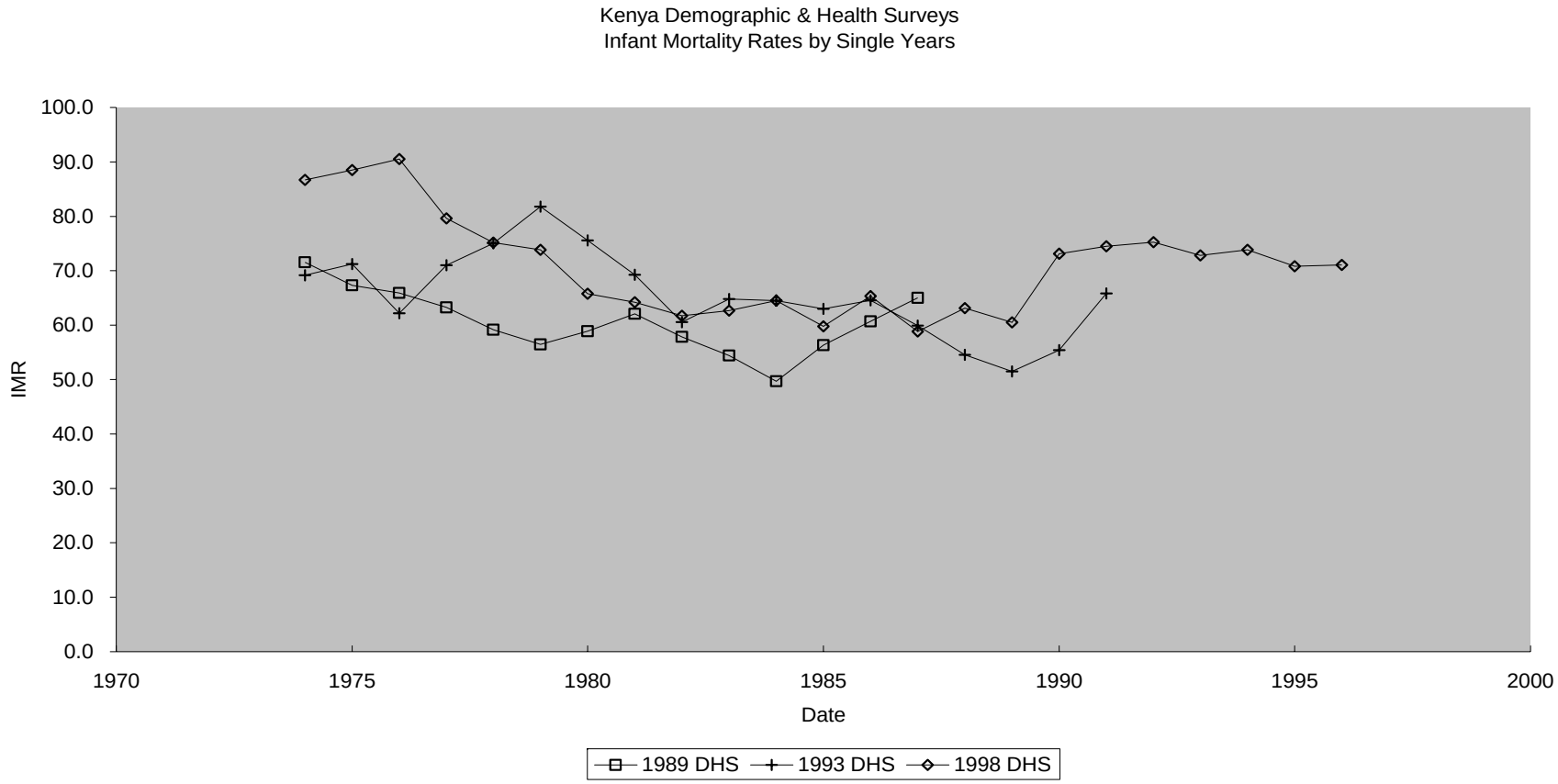
Both Sexes	Period	Infant Mortality	Under-5 Mortality
KDHS 1989	1974-78	64.1	105.5
	1979-83	57.6	93.1
	1984-89	59.6	89.2
KDHS 1993	1978-82	68.9	101.8
	1983-87	63.4	87.9
	1988-93	61.7	96.1
KDHS 1998	1983-88	61.9	89.6
	1988-93	67.7	98.9
	1993-98	73.7	111.5
KDHS 1989	Males	63.0	96.1
1979-89	Females	54.3	85.7
KDHS 1993	Males	66.6	97.1
1983-93	Females	58.6	89.3
KDHS 1998	Males	74.5	107.8
1988-98	Females	66.8	102.6

Source: Kenya Demographic and Health Survey Reports

Table 3.9: Kenya Demographic and Health Surveys, 1989, 1993 and 1998 Direct Estimates of Infant and Under-5 Mortality for Single Calendar Years

3-Year Moving Averages						
Rates per Thousand Live Births						
Year	Infant Mortality			Under-5 Mortality		
	1989	1993	1998	1989	1993	1998
1974	71.6	69.2	86.7	133.5	134.6	146.4
1975	67.3	71.2	88.5	124.1	135.5	140.4
1976	65.9	62.2	90.5	114.1	123.8	138.2
1977	63.3	71.0	79.6	107.8	124.0	114.4
1978	59.1	75.0	75.2	100.6	121.6	114.4
1979	56.5	81.8	73.9	101.9	122.4	115.7
1980	58.9	75.6	65.8	109.4	113.5	110.5
1981	62.1	69.3	64.2	102.7	103.1	104.3
1982	57.9	60.5	61.7	93.8	92.6	94.6
1983	54.4	64.8	62.7	81.3	95.4	95.1
1984	49.7	64.5	64.5	78.1	96.3	97.4
1985	56.3	63.0	59.8	84.4	93.9	91.2
1986	60.7	64.6	65.3	87.7	95.1	98.6
1987	65.0	59.9	58.8	97.4	89.9	92.9
1988		54.5	63.1		86.0	101.3
1989		51.5	60.5		85.7	97.4
1990		55.4	73.1		90.6	106.2
1991		65.8	74.5		101.4	106.9
1992			75.2			109.6
1993			72.8			114.0
1994			73.9			114.8
1995			70.8			110.7
1996			71.0			108.8

Source: Marston 2001


Kenya Demographic & Health Surveys
Infant Mortality Rates by Single Years
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
IMR
1970
1975
1980
1985
1990
1995
2000
Date
1989 DHS
1993 DHS
1998 DHS

The 1999 census provides three different sets of estimates of infant and under-5 mortality during the middle or late 1990s which may be compared with those obtained both from the Post-Enumeration Survey of February 2000 and from the 1998 Demographic and Health Survey. They are summarized in Table 3.10.

Table 3.10: Summary of Recent Estimates of Infant and Under-5 Mortality Rates per thousand live births

Source	Approximate Date	Infant Mortality	Under-5 Mortality
Census 1999			
CD/CEB(1) – unadjusted	1994	69	108
CD/CEB(1) - AIDS-adjusted		77	120
HC(2) - unadjusted	1994	69	109
HC(2) - AIDS-adjusted		77	121
Deaths in last 24 months	1997	80	120
Post-Enumeration Survey 2000			
CD/CEB(1) - unadjusted	1995	67	106
CD/CEB(1) - AIDS-adjusted		77	120
KDHS 1998			
Direct estimates for 1993-98	1995	74	111

(1) CD/CEB = Children dead/Children ever born. Estimates based on an average of 25-29 and 30-34 age groups.

(2) HC = Hypothetical cohort. Estimates based on an average of all age groups except 15-19 and 20-24.

The estimates cover a wide range, and much of the uncertainty arises from the differences between the unadjusted estimates and those adjusted for AIDS-related bias. The truth probably lies somewhere between the two, and figures of 77 per thousand for infant mortality and 116 per thousand for under-5 mortality for 1995 have been adopted as the starting points for the national population projections, but the margins of error must be at least plus or minus 5 per mill points. Corresponding estimates by sex are: infant mortality - males = 79, females = 75; under-5 mortality – males = 119, females = 113.

The census data have also confirmed the conclusions on mortality trends drawn from the Demographic and Health Surveys. The long-term decline in mortality, which has been apparent from the 1940s, petered out in the late 1980s whence it started rising again. The vertical transmission of HIV/AIDS accounts for much of, if not this entire rise in under-5 mortality.

The rates from the 1989 KDHS are for the most part lower than those shown by the 1993 and 1998 surveys, which supports the conclusion previously reached by Brass (Brass and Jolly 1993, pp. 30-34) that infant and child deaths had been under-reported

in the 1989 survey. The comparison of the 1998 and 1993 rates shows that the latter were generally lower for the years 1986 to 1991. All three surveys show a general decline in mortality from the mid 1970s until the mid 80s, followed by a rise, most clearly apparent from the 1998 KDHS.

3.2 Adult Mortality

Estimates from the 1999 Census

In columns P-20 and P-21 of the 1999 census schedule, all persons were asked to state whether their fathers and mothers were still alive. These questions constitute the only source of data on adult mortality from the census. (Inter-censal survival, which has sometimes been used for this purpose in developing countries, tends to be vitiated by varying coverage in the censuses.) The 1999 census was the fourth Kenya census in which the orphanhood questions have been asked. Various methods have been developed for converting the proportions of persons with mothers and fathers alive into probabilities of survival. We have used the regression equations of Timaeus (1992), which have the advantage of being based on more sophisticated models of the age patterns of male fertility that are needed for the estimation of male survival probabilities.

It has long been recognized that the mortality estimates derived from data on orphanhood have been vulnerable to a variety of potential biases, which include "adoption effect" (i.e. the substitution of foster parents for true parents), the multiple reporting by more than one offspring-respondent on the same parents, the selective survival of respondents and their parents, the effects of age mis-reporting of respondents, and of errors in the estimation of the mean ages of mothers and fathers at the birth of their children (needed for converting the proportions orphaned into life-table survival probabilities), and of using inappropriate model life tables in the estimation procedures (Blacker and Mukiza-Gapere, 1988). These potential biases have been aggravated by the emergence of the HIV/AIDS epidemic, particularly as regards the selectivity of respondents and the distortion of the age patterns of mortality. As with the AIDS-related biases in the estimates of child mortality, no fully satisfactory solutions have yet been devised, but Timaeus and Nunn (1997), using data from the Masaka longitudinal study in Uganda, have developed a correction procedure for selectivity, and revised regression coefficients for females which take account of the changed age patterns of mortality; but corresponding coefficients for males have not yet been calculated. As with the Ward-Zaba adjustments to child mortality, the Timaeus-Nunn formulae are based on the assumption that the epidemic has stabilized, and will tend to over-estimate mortality if used in situations where it is still increasing.

The census questions on whether fathers/mothers were alive made provision for three answers: "Yes", "No", and "Don't know"; persons for whom no answers were recorded were classified in the first instance as "Don't know". In total only 1.4% of persons were categorised as "Don't know" in respect of their fathers and 0.8% in respect of their mothers. In past censuses, such persons were subtracted from the

denominators when calculating the proportions with parent alive. This procedure was also tried with the 1999 census and compared with those obtained by imputation. The differences were entirely trivial, so that the imputed figures can confidently be used in conjunction with those from earlier censuses.

The proportions of persons with fathers and mothers alive, by sex of the respondents, are shown in the monograph on *Mortality*. As with earlier censuses, the proportions shown by male respondents were consistently higher than those shown by females in the same age group. This phenomenon has been explained in terms of differentials in the mis-reporting of ages of male and female respondents. The mortality estimates have therefore been based on the data from female respondents only. They have also been restricted to females aged 10 and over, since the adoption effect apparently has injected biases on data for children under 10 years.

Table 3.11 shows the proportions of females with mothers and fathers alive as recorded by the census and with the Timaeus-Nunn adjustments for selectivity, which consist simply of multiplying the proportion with parent alive by 1-0.5P, where P is the proportion of women of childbearing age who are HIV-positive. The values of P used are obtained at the time location of the mortality estimates (see below). Since HIV prevalence before 1990 was negligible, the only age groups of respondents deemed affected are those under the age of 25.

Table 3.11: Proportions of Females with Father and Mother Alive with Adjustments for AIDS-Related Selectivity

Age Group	Father Alive		Mother Alive	
	Unadjusted	Adjusted	Unadjusted	Adjusted
0-4	0.9547	0.9547	0.9896	0.9896
5-9	0.9234	0.9234	0.9749	0.9456
10-14	0.8873	0.8474	0.9582	0.9127
15-19	0.8412	0.8130	0.9374	0.9042
20-24	0.7784	0.7722	0.9096	0.8927
25-29	0.7032	0.7032	0.8773	0.8773
30-34	0.6123	0.6123	0.8287	0.8287
35-39	0.5200	0.5200	0.7713	0.7713
40-44	0.3976	0.3976	0.6689	0.6689
45-49			0.5691	0.5691
50-54			0.4266	0.4266
				0.3400

Table 3.12 shows the conversion of proportions with parent alive, both adjusted and unadjusted, into life-table probabilities of survival, together with the time location of the estimates. For the data on mothers, the conversions have been made using both Timaeus's original regression coefficients, and the revised coefficients which take account of the altered shape of the mortality curve resulting from AIDS. The latter only affect the survival probabilities to ages under 50. As noted above, revised coefficients for the data on fathers have not yet been calculated. It may be noted that the correction for selectivity has a much larger effect than the use of the revised coefficients.

Table 3.12: Proportions Surviving to Specified Ages from Age 35 for Males and Age 25 for Females

	Males		Females	
Age	Unadjusted	Adjusted	Unadjusted	Adjusted
40			0.9529	0.9092
45			0.9338	0.9121
50	0.8712	0.8147	0.9083	0.9101
55	0.8232	0.7949	0.8799	0.8801
60	0.7499	0.7374	0.8369	0.8369
65	0.6545	0.6396	0.7870	0.7870
70	0.5448	0.5270	0.6949	0.6949
75	0.3990	0.3801	0.5803	0.5803

It is tempting to convert these survival probabilities to different ages into standard indices of mortality and hence to examine time trends. Unfortunately this step in the calculations is highly sensitive to the assumed model life table; by manipulating the underlying pattern of mortality it is possible to twist the apparent time trends so as to give widely different results. Furthermore, the time locations shown in Table 3.12 show that only the estimates based on the youngest age groups are relevant to the more recent period in which we are primarily interested. Such up-to-date estimates are better obtained from the changes between the 1989 and 1999 censuses.

Hypothetical Cohorts 1989-1999

The procedure used is similar to that used for the estimation of fertility and child mortality from the inter-censal changes and may be illustrated by the following example: in 1989 88.55% of females aged 25-29 reported that their mothers were still alive; in 1999 these women were aged 35-39 and the proportion with mothers alive had fallen to 77.13%; thus the proportionate reduction in the percentage with mothers alive was 77.13/88.55 = 0.871. By chaining these relative reductions together from the youngest ages to the oldest, a hypothetical cohort of women who go through life losing their mothers at the rates shown by the changes between the censuses may be constructed. In this case the changes effected at the youngest age groups by the selectivity adjustment get carried through to the older ages by the process of chaining. The results are shown in Table 3.13.

Table 3.13 Proportions with Father and Mother Alive for a Hypothetical Cohort 1989-99

Age Group	Father Alive		Mother Alive	
	Unadjusted	Adjusted	Unadjusted	Adjusted
0-4	0.9547	0.9547	0.9896	0.9896
5-9	0.9234	0.9234	0.9749	0.9456
10-14	0.8746	0.8353	0.9539	0.9085
15-19	0.8205	0.7930	0.9267	0.8671
20-24	0.7436	0.7044	0.8886	0.8307
25-29	0.6664	0.6440	0.8496	0.7949
30-34	0.5706	0.5406	0.7959	0.7440
35-39	0.4849	0.4686	0.7401	0.6925
40-44	0.3726	0.3530	0.6462	0.6041
45-49			0.5602	0.5242
50-54			0.4354	0.4070

The probabilities of survival implied by the proportions orphaned can then be calculated in the same way as before. They are shown in Table 3.14.

Table 3.14: Proportions Surviving to Specified Ages in a Hypothetical Cohort 1989-99

Age	Males		Females	
	Unadjusted	Adjusted	Unadjusted	Adjusted
40			0.9681	0.8989
45			0.9480	0.9034
50	0.8529	0.8012	0.9226	0.8700
55	0.7872	0.7555	0.8868	0.8410
60	0.6977	0.6716	0.8516	0.7959
65	0.5886	0.5569	0.8028	0.7489
70	0.4751	0.4506	0.7534	0.7022
75	0.3370	0.3139	0.6693	0.6218

Estimates from Surveys

(a) The 1998 Kenya Demographic and Health Survey

The only other source of information on adult mortality in Kenya is that from the 1998 KDHS, in which all eligible women were asked about the survival of their siblings: their sex; whether or not they were still alive; if alive, their current age; if dead, their age at death and date of death (in terms of years before the survey). Comparable questions had not been included in the KDHS 1989 or 1993. From the data obtained from these questions, sex- and age-specific mortality rates have been calculated for the 5-year age groups between the ages of 15 and 50 for the period covering the last 6 years before the survey (NCPD/CBS/Macro International 1999, p.163). In order to make these rates comparable with those derived from the census, and to minimize the effects of sampling errors, the age-specific mortality rates have been converted into life-table probabilities of dying and surviving, and chained together so as give the overall probability of surviving from age 15 to age 50 (or ${}_{35}p_{15}$ in life table notation), as shown in Table 3.15.

Table 3.15: Kenya Demographic and Health Survey 1998: Adult Mortality Rates. Calculation of Life Table Survivors from Age 15

	Age-Specific Mortality Rate	Probability of Dying	Probability of Surviving	Probability of Surviving from Age 15	Age
Males	5m(x)	5q(x)	5p(x)	l(x)/l(15)	x
15-19	0.00229	0.0114	0.9886	1.0000	15
20-24	0.00313	0.0155	0.9845	0.9886	20
25-29	0.00372	0.0184	0.9816	0.9733	25
30-34	0.00525	0.0259	0.9741	0.9553	30
35-39	0.00634	0.0312	0.9688	0.9306	35
40-44	0.01007	0.0491	0.9509	0.9015	40
45-49	0.00977	0.0477	0.9523	0.8573	45
				0.8164	50
Females	5m(x)	5q(x)	5p(x)	l(x)/l(15)	x
15-19	0.00213	0.0106	0.9894	1.0000	15
20-24	0.00426	0.0211	0.9789	0.9894	20
25-29	0.00485	0.0240	0.9760	0.9686	25
30-34	0.00647	0.0318	0.9682	0.9453	30
35-39	0.00489	0.0242	0.9758	0.9153	35
40-44	0.00721	0.0354	0.9646	0.8931	40
45-49	0.00728	0.0357	0.9643	0.8615	45
				0.8307	50

These results are not immediately comparable with the orphanhood estimates, which give probabilities of survival from age 35 for males and 25 for females. But survival probabilities from age 15 may be calculated from the model life tables fitted to the orphanhood data for the 1989-99 decade, described in the next section. Out of 1000 males reaching the age of 15, the KDHS shows 816 surviving to age 50, compared with 752 from the census; for females the KDHS shows 831 survivors at 50, compared with 780 from the census. Thus for both sexes the KDHS shows higher survival, and hence lower mortality, than the census. Since it is generally thought that the orphanhood data are more likely to give under-estimates than over-estimates of mortality, we feel it would be dangerous to accept the KDHS results in preference to those from the census. However, when faced with a range of estimates from the census, the KDHS results lend weight to the belief that those nearer the lower end of the range may be more realistic.

3.3 Model Life Tables for Kenya 1989-99

The 1999 census has therefore provided estimates of infant and under-5 mortality for male and female children, and a series of probabilities of surviving from age 25 for women and from age 35 for men to various older ages up to 75. It links these estimates of child and adult mortality together with a model life table that will cover the whole life span.

Brass's logit life table system is ideally suited for this purpose (Brass et al., 1968; Brass 1971). The system consists essentially of a standard life table, which it is possible to twist and mathematically until it fits the data in hand. The bending and twisting is done with two parameters of which the first, alpha, determines the general level of mortality, and the second, beta, the steepness with which the mortality rates increase with age. Brass originally developed an "African Standard" life table, which he applied to the data from the three previous Kenya censuses. In the present case, however, we have sought to modify the shape of the mortality curve to take account of AIDS. Deaths from AIDS tend to be concentrated among younger adults, so that the epidemic introduces a "hump" into the mortality curve. We have developed standard sets of AIDS-related mortality rates, peaking around age 40 for males and age 30 for females, and a third parameter (AIDS) provides a factor for increasing or decreasing these standard rates. They were then combined with the Brass African Standard by cross-multiplying the probabilities of survival. The modified standard was then fitted to the observed values of child and adult mortality: alpha was locked on to the under-5 mortality, beta and AIDS were determined by minimizing the sums of the squared differences between the observed values of adult survival and those of the models. The results are shown in Table 3.17.

Table 3.17 Model Life Tables for Kenya Males and Females, 1989-99

Age (x)	MALES				FEMALES			
	Life Table Survivors l(x)	Probability of Dying q(x)	Life Table Population L(x)	Expectation of Life l_0	Life Table Survivors *l(x)*	Probability of Dying *q(x)*	Life Table Population *L(x)*	Expectation of Life l_0
0	1.0000	0.0793	0.9132	52.8	1.0000	0.0753	0.9759	60.4
1	0.9207	0.0431	3.5883	56.4	0.9247	0.0407	3.5857	64.3
5	0.8810	0.0239	4.3523	54.8	0.8870	0.0160	4.3996	63.0
10	0.8599	0.0096	4.2788	51.1	0.8728	0.0062	4.3506	59.0
15	0.8516	0.0165	4.2230	46.6	0.8674	0.0112	4.3127	54.3
20	0.8376	0.0231	4.1396	42.3	0.8577	0.0215	4.2423	49.9
25	0.8183	0.0319	4.0260	38.3	0.8392	0.0291	4.1352	45.9
30	0.7921	0.0457	3.8703	34.5	0.8148	0.0321	4.0088	42.2
35	0.7560	0.0557	3.6745	31.0	0.7887	0.0334	3.8774	38.6
40	0.7139	0.0629	3.4569	27.7	0.7623	0.0344	3.7460	34.8
45	0.6689	0.0714	3.2253	24.4	0.7361	0.0367	3.6130	30.9
50	0.6212	0.0842	2.9751	21.0	0.7091	0.0421	3.4708	27.0
55	0.5689	0.1058	2.6939	17.7	0.6792	0.0532	3.3059	23.1
60	0.5087	0.1433	2.3611	14.5	0.6431	0.0739	3.0969	19.3
65	0.4358	0.2059	1.9545	11.6	0.5956	0.1099	2.8145	15.6
70	0.3460	0.3026	1.4684	8.9	0.5302	0.1705	2.4250	12.2
75	0.2413	0.4395	0.9415	6.7	0.4398	0.2713	1.9007	9.2
80	0.1353	0.6043	0.4720	5.0	0.3205	0.4236	1.2630	6.7
85	0.0535	0.7684	0.1648	3.8	0.1847	0.6154	0.6394	4.8
90	0.0124	0.8906	0.0344	3.0	0.0711	0.7870	0.2155	3.6
95	0.0014	1.0000	0.0034	2.5	0.0151	1.0000	0.0378	2.5

It will be seen that the life tables give an expectation of life of 52.8 years for males and 60.4 years for females. These figures show appreciable declines on the life expectancies derived from the 1979-89 life tables of 57.9 for males and 65.9 for females. The life expectancies at age 15, which summarize adult mortality, show an even greater decline: 46.6 for males and 54.3 for females for 1989-99 compared with 52.3 and 60.1 for 1979-89 respectively.

When age-specific mortality rates are constructed from the life tables and multiplied by the graduated age distribution to give the annual number of deaths, a crude death rate of 13.3 per 1,000 is obtained. The corresponding crude death rate for the period 1979-89 was 9.1 per 1,000.

To what extent can this rise in mortality be attributed to the HIV/AIDS epidemic? In an attempt to answer this question we used the computer package *Spectrum* developed by the Futures Group International to generate a series of AIDS-only mortality rates based on the year-by-year estimates of HIV prevalence. Mortality rates from causes other than AIDS were then calculated by dividing the probabilities of survival from the life tables in Table 3.17 by those from the AIDS-only life tables. This decomposition into AIDS and other-cause mortality is shown in Table 3.18. The rates attributable to causes other than AIDS may be compared with those from the 1979-89 life table, when AIDS was negligible, also shown Table 3.18. The comparison suggests that while the increase in under-5 mortality could be entirely explained by the vertical transmission of HIV, the increases in adult mortality were also partly due to rises in non-AIDS mortality. A fuller description of the methodology of this exercise will be found in the monograph on *Population Projections.*

Table 3.18: Life Table Probabilities of Dying [5q(x)] from AIDS and from Other Causes 1989-99 and from All Causes 1979-89

	MALES			FEMALES		
	1989-99		1979-89	1989-99		1979-89
	AIDS only	Other Causes	All Causes	AIDS only	Other Causes	All Causes
0	0.0119	0.1084	0.1170	0.0119	0.1023	0.1080
5	0.0018	0.0222	0.0222	0.0018	0.0142	0.0222
10	0.0000	0.0096	0.0090	0.0000	0.0062	0.0090
15	0.0003	0.0162	0.0152	0.0005	0.0107	0.0152
20	0.0034	0.0197	0.0207	0.0071	0.0145	0.0207
25	0.0060	0.0260	0.0215	0.0162	0.0131	0.0215
30	0.0177	0.0284	0.0228	0.0167	0.0157	0.0228
35	0.0250	0.0315	0.0260	0.0163	0.0174	0.0260
40	0.0235	0.0404	0.0311	0.0118	0.0228	0.0311
45	0.0173	0.0550	0.0398	0.0102	0.0268	0.0398
50	0.0157	0.0696	0.0534	0.0115	0.0309	0.0534
55	0.0148	0.0924	0.0749	0.0092	0.0444	0.0749
60	0.0106	0.1342	0.1090	0.0055	0.0688	0.1090
65	0.0080	0.1996	0.1637	0.0047	0.1056	0.1637
70	0.0035	0.3001	0.2496	0.0025	0.1684	0.2496
75	0.0012	0.4388	0.3787	0.0006	0.2709	0.3787
80	0.0000	1.0000	1.0000	0.0000	1.0000	1.0000

Chapter 4

Migration and Urbanisation

4.1 Overview

This chapter highlights spatial dynamics of Kenya's population, namely migration and urbanisation and shows how the population moves and is distributed between urban and rural areas. It begins with an explanation of the methodology employed in analysing migration and urbanisation data, which, for consistency, is similar to that used in previous censuses. Direct methods of measuring internal and international migration are applied, and statistics on refugees reported to provide information on both voluntary and forced immigration. Unfortunately, Kenyan censuses contain no data on emigration to permit estimation of net international migration in the country. Internal migration measurement is made at both provincial and district levels, which linked to demographic and socio-economic characteristics of migrants, provide levels, trends and patterns in successive censuses. The decade 1989-1999 saw the urbanisation process continue unabated due to both rural-urban migration and natural increase and because of reclassification of formerly rural territory, with urban populations markedly different from those in rural areas. This chapter proposes some policies that need to guide future migration and urbanization, including taking a critical look at data collection and analysis.

4.2 Methodology

Estimation of Internal Migration

Estimation of internal migration is based on two kinds of information:

- Information collected specifically for the measurement of migration, such as place of birth and place of previous residence. Generally, direct measurement of migration involves the cross-classification of place of birth/ previous residence with place of enumeration thus permitting distinction between migration and non-migration.
- Information not collected specifically for the purpose of measurement of migration such as the age structure of a population. It has been noted that migration peaks at certain ages and ebbs at other ages.

The census questionnaire, P-16 through P-18 sought information on migration. P-16, on birthplace asked: "where was … born?". Enumerators were to indicate a district code in Kenya or a country code if the birthplace was outside Kenya. P-16, on previous residence, asked about where was …living in August 1998? Both P-18 and P-19, on duration of residence (which was asked for the first time in a Kenya census), asked: "when did … move to this district"?. Code" 00" applied where the person's district of enumeration was the same as of birth, and code "99" where the duration was unknown. Although analysis of P-16 and P-17 appear in the monograph on migration and Urbanisation, the results of P-18 and P-19 do not, rendering the monograph a

continuation of the status quo.

Cross-classification of information generated by P-16 and P-17 constitutes the direct method of measuring internal migration. It is a conventional method pioneered by Ominde (1968) using the 1962 census data and subsequently adopted by others using the 1969 census data (Rempel, 1974) and the 1979 census data (Beskok, 1981; Oucho, 1988). It measures lifetime migration that does not specify when migration took place. The inclusion of P-17 remedies that deficiency, though one year is clearly too short to provide useful facts on previous residence of the migrants.

A more sophisticated technique is indirect method of measuring internal migration. Indirect measurement of internal migration involves application of indirect techniques: which measure inter-censal migration: the vital statistics method, which relies on the "balancing equation" variables; the more advanced version of this, known as the birth-residence statistics method; survival ratio methods (based on either census data or lifetime estimation); the age-specific growth rate method; and the national growth rate technique. (For a fuller discussion of these techniques and their applicability or otherwise in Kenya, see Oucho and Odipo, 2000). Note that the data requirements of most of these methods are beyond the scope of the Kenya census coverage; for instance, lack of vital statistics data for the first two techniques renders the methods inapplicable in Kenya. The methods would also apply in the estimation of net international migration, though there are other techniques that are applicable to data on siblings and surviving mothers of migrants. Regrettably, estimates of migration based on all censuses have never been published in the analytical volumes on migration, but have been in articles based on 1969, 1979 and 1989 censuses (Oucho and Omogi, 1991; Oucho and Odipo, 2000).

For consistency, analysis of the 1999 census data is limited to direct estimation of migration. The method permits comparison of migration as of the 1999 census with that in previous censuses, with the exception of the 1962 census, which used different enumeration areas.

4.3 Internal Migration

This section summarises results on analysis of lifetime and recent migration. The former is derived from cross-classification of data on district of birth with district of enumeration, while the latter relates to district of residence one year preceding the census night and district of enumeration on the material night. From these, estimates are made of the volume and patterns of migration with respect to the two separate measures. The section comprises four sub-sections on recent in-migrants and out-migrants; lifetime in-migrants and out-migrants; net migration levels; and lifetime net migration trends, patterns and differentials.

Recent Migration

Analysis of recent migration denotes migration that took place exactly a year (i.e. in August 1998) before the census, those identified as migrants being encountered in the

place of enumeration. At issue are in-migration and out-migration, from which recent net migration is estimated. Details of recent migration appear in the monograph on *Migration and Urbanisation*.

In-migration to urban areas was markedly higher than that to rural areas, implying both rural–urban and inter-urban migration. This explains why in-migration to Nairobi and Mombasa accounted for 17% and 16%, respectively, of the total population of the two. About 6% of each of the population of Coast and Rift Valley consisted of in-migrants. Not surprisingly, the traditional out-migration provinces such as Eastern, North-Eastern, Nyanza and Western had small percentages of in-migrants.

Analysis of census results suggests that a number of districts had between 8 and 10 percent of the population comprising recent in-migrants. The districts, with the provinces in which they are located (indicated in brackets), include: Nairobi (a district-cum-province), Thika (Central), Mombasa (Coast), Kisumu, Bondo, Rachuonyo, Suba and Nyando (Nyanza), Laikipia, Kajiado, Nakuru and Narok. Other notable in-migration districts were Lamu (Coast), Mbeere (Eastern), Siaya (Nyanza), Trans Nzoia and Uasin Gishu (Rift Valley) and Lugari (Western).

Out-migration took place at the same level in both urban and rural areas, involving 4.8% is of the population. In the one year under discussion, the two neighbouring provinces of Nyanza and Western produced the highest percentage of out-migrants; only Nairobi exceeded the two presumably as urban residents returned to their rural home areas. Only two districts, Murang'a (Central province) and Kisumu (Nyanza) reported more than 10% of out-migrants, with Siaya and Homa Bay (Nyanza) as well as Kakamega (Western) closely in their heels.

In general, recent migration did not involve a substantial number. Indeed the time frame is too short to permit a meaningful volume of migration pattern in the country.

Lifetime Migration

Lifetime migration denotes movement detected by identifying those whose places of birth are different from their places of enumeration at the time of a census. The exact date of movement cannot be determined as migration that occurred some years earlier places migrants in the same category as those who moved a week or day before the census. The difference between in-migration and out-migration yields net lifetime migration.

Information pertaining to origin of lifetime in-migrants and out-migrants for each district depicts the pattern of migration. That more than one-half of lifetime in-migrants were encountered in urban areas underlines the importance of rural-urban migration, and to some extent inter-urban migration.

Three provinces – Nairobi, Coast and Rift Valley – unlike all other provinces, continued to be destinations of migration. The trend and pattern of migration for the years 1979-1999 remained consistent, suggesting that the reasons for in-migration for the individual provinces had not changed substantially. Both Nairobi and Coast are in a class of their own as by far the most important destinations in the country, with 69.3% and 56.6% of their population reported as in-migrants. At district level, between one-fifth

and one-third of the population of Kiambu, Nyandarua, Lamu, Isiolo, Kisumu, Migori, Bondo, Nyando, Kericho, Narok, Trans-Nzoia and Buret consisted of lifetime in-migrants. Districts with lifetime migrants exceeding one-third of the population were Laikipia, Nakuru, Uasin Gishu (in Rift Valley province) and Lugari (in Western province).

Countering in-migration is out-migration. In 1999, Nyanza and Western provinces had about one-fifth of their population made up of lifetime out-migrants. All other provinces, with the exception of North-Eastern (with an extremely low proportion), generated between 14 and 22% of out-migrants. This pattern of out-migration is similar to that for the period 1979-1989, reinforcing the hypothesis that the reasons for out-migration from the very provinces had remained the same over the time period in consideration. The most significant sources of migration included Murang'a, Nyeri, Machakos, Homa Bay, Kisumu, Rachuonyo, Kakamega and Vihiga. This trend has persisted throughout Kenya's census enumeration.

Net Migration at the District Level

The impact of migration levels and differentials, trends and patterns on the population growth of various districts can easily be established by net migration. A detailed analysis in the monograph on *Migration and Urbanisation* shows that most of the districts had negative net migration, which implies that most of the districts were experiencing more out-migration than in-migration. The most affected districts were in Nyanza, Western, Eastern and Central provinces. Just to amplify, out of 69 districts in the country, only 26 experienced net in-migration, the rest experiencing net out-migration.

The following provinces, with districts in brackets, were areas of net in-migration: Nairobi; Central (Nyandarua and Thika); Coast (Lamu, Mombasa, Tana River and Malindi); Eastern (Isiolo, Mbeere and Meru North); Nyanza (Kuria, Migori, Suba, Bondo and Nyando); Rift Valley (Kajiado, Laikipia, Nakuru, Nandi, Narok, Trans Mara, Trans Nzoia, Uasin Gishu and Buret); and Western (Lugari and Teso). However, the following were the areas of net out-migration: Kiambu, Kirinyaga, Murang'a, Nyeri and Maragua in Central province; Kilifi, Kwale and Taita Taveta in Coast; Embu, Kitui, Makueni, Machakos, Marsabit, Meru Central, Moyale, Mwingi, Tharaka and Nithi) in Eastern; Garissa, Mandera and Wajir in North-Eastern; Gucha (S. Kisii), Homa Bay, Kisii Central, Kisumu, North Kisii (Nyamira), Rachuonyo and Siaya in Nyanza; Baringo, Bomet, Keiyo, Kericho, Koibatek, Marakwet, Samburu, Turkana and West Pokot in Rift Valley; and Bungoma, Busia, Mt. Elgon, Kakamega, Vihiga and Butere-` Mumias in Western province.

To sum up, in the period 1979-1999 net in-migration provinces were Nairobi, Coast and Rift Valley. Conversely, the provinces of net out-migration were Central, Eastern, Nyanza and Western. For all the provinces, the trends and patterns of net migration remained the same for the period 1979-1999. For details, see the monograph on *Migration and Urbanisation*.

The size of lifetime in-migrants, out-migrants and net migrants in the census years 1979, 1989 and 1999 have had a similar trend and pattern at both district and

provincial levels. For example, at the district level, Kwale, Marsabit, Garissa and West Pokot had been areas of net in-migration in the years 1979 and 1989, but in 1999 changed to be areas of net out-migration.

4.4 International Migration: Immigrants and Refugees

This section considers four issues in international migration, namely: the size of refugee population; its distribution by rural/urban residence; net refugee stock in the country; and foreign population enumerated in the 1999 census.

Refugee Population in Kenya

Data on refugee population have been assembled from sources other than the 1999 census. The United Nations refugee agency, the United Nations High Commissioner for Refugees (UNHCR), has a good record of refugees by country of origin and place of residence in Kenya. Although the information in this sub-section does not come from the census, it is extremely useful for understanding and appreciating forced immigration in a country that has enjoyed peace and tranquillity since independence nearly four decades ago.

Kenya has played host to refugees from the neighbouring countries for several decades. For the year 1997/98, apart from the refugees from Somalia and Ethiopia, those from the other countries were on the increase. Unlike the refugees from the other countries, the trends show that in 1998/99 the influx of Sudanese refugees into Kenya constituted slightly over one-third contrasted with the outflow of whom Burundians accounted for slightly over two-thirds of the entire refugee population.

In 1997/98, the proportions of refugees from Somalia and Ethiopia declined by about 7% and 6.2% respectively. However, a heavier refugee influx originated from other countries – for example, from Democratic Republic of Congo (DRC), Burundi, Sudan and Rwanda. UNHCR sources suggest that ethnic conflicts and political turmoil (including genocide in the last country) in these countries during the period 1994-1998 might have triggered the flight of refugees from these war-torn countries.

At the same time, some refugees left Kenya in 1999, resulting in emigration of refugees from countries other than Ethiopia (with 1.1%) and Sudan (33.4%) of the total refugee stock. Countries with notably high refugee outflow were DRC (-35.3%), Burundi (-63.1%) and Rwanda (-67.0%). This phenomenon could also be explained by the relative calm in these countries that necessitated repatriation of refugees.

Temporary settlement of refugee population in rural Kenya is best illustrated by two camps, Kakuma and Dadaab, which hold large numbers of refugees. By 1999 the rural sections of the two camps held refugees from Somalia, Sudan, Demographic Republic of Congo, Burundi, Eritrea and Liberia while the urban sections had Ugandan and Rwandan refugees; and those who settled in both rural and urban sections were Ethiopian refugees (Table 4.1).

Table 4.1: Distribution of Refugees by Rural/Urban Settlement by Country of Origin, 1999

Origin	Rural Population			Urban Population	Total	Refugee Population	
	Kakuma	Dadaab	Total			%Rural	% Urban
Somalia	19,405	121,481	140,886	202	141,088	99.85	0.14
Sudan	62,764	1,342	64,106	148	64,254	99.76	0.23
Ethiopia	2,967	1,660	4,627	3,564	8,191	56.48	43.51
Rwanda	339	0	339	2,519	2,858	11.86	88.14
Uganda	403	52	455	5,492	5,947	7.65	92.35
Congo (DRC)	219	2	221	30	251	88.04	11.95
Burundi	157	0	157	48	205	76.58	23.41
Eritrea	33	57	90	0	90	100	0
Liberia	8	0	8	0	8	100	0
STR	295	0	295	0	295	100	0

Source: Data from UNHCR reports

Net Refugees Stock in Kenya, 1999

The net refugees stock is the difference between refugee outflow and influx in Kenya. In 1999, majority of departing refugees comprised nationals of Somalia, Rwanda, Uganda and Democratic Republic of Congo. However, there was a heavier influx of refugees from Sudan, Ethiopia, Eritrea and STR. The aggregate situation was one of more departing refugees in 1999, with a net outflow of -14, 491 refugees. Earlier in 1998, there were more incoming refugees, resulting in a net figure of 3, 118. Thus, there was a dramatic increase in the net stock of refugees from 1998 to 1999 when a large number of refugees actually left Kenya (Table 4.2). This could have been necessitated by relatively more calm experienced in the countries of origin in 1999 than was the case between 1994 and 1998.

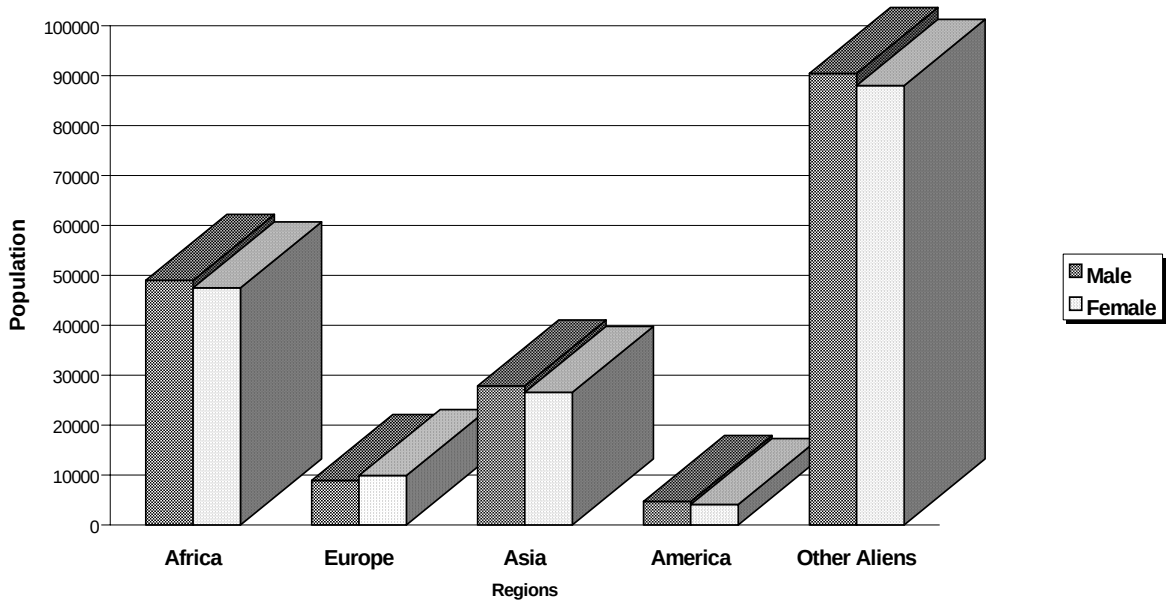
Table 4.2 Refugee inflow and outflow and net stock in Kenya by country of origin, 1998-1999

Origin	1998			1999		
	Influx	Out flow	Net Figure	Influx	Out flow	Net Figure
Somalia	7,643	19,802	-12,159	22,607	46,176	-23,569
Sudan	12,985	2,174	10,811	16,547	455	16,092
Ethiopia	2,989	3,524	-535	3,427	3,335	92
Rwanda	3,090	187	2,903	158	5,965	-5,807
Uganda	1,027	334	693	199	255	-56
Congo (DRC)	314	65	249	135	272	-137
Burundi	482	41	441	70	421	-351
Eritrea			0	80	9	71
STR	293	0	293	2		2
Liberia			0			0
VAR	448	26	422		831	-831
TOTAL	29,271	26,153	3,118	43,228	57,719	-14,491

Foreign Population in Kenya: Voluntary Immigration

Analysis of the 1999 census data by age groups 0-4 through 75+ years suggests that the foreign population constituted a small percentage of the total population of respective age groups. For instance, in the age brackets 30-59, the share of foreign population was a mere 2%. Overall, the foreign population comprised the following: 1.3% of the total male population; 1.2% of the total female population; and 1.3% of the total Kenya population in 1999. The composition of foreigners is dominated by "other aliens" (immigrants of different unspecified nationalities), followed by Africans, Asians Europeans and Americans. Interestingly, there was relative parity of male and female foreigners, implying immigration of married couples, for instance (Figure 5).

Figure 5
Immigrants by Regions of Origin, 1999



4.5 Characteristics of Voluntary Migrants

Voluntary migrants, unlike refugees, are those who chose to move on their own volition. Both their demographic and socio-economic characteristics or migrants' differentials distinguish them from the general population. Demographic characteristics include sex, age and marital status, while socio-economic states relate to educational attainment, economic activity and relationship to head of household. Cross-tabulation of demographic with socio-economic characteristics provides useful insights into how these attributes play an important part in migration. This analysis is limited to internal migrants within different districts and provinces.

Migrants' Educational Attainment

The pattern of migrants' distribution by the level of education attained at the district level was found to be generally similar to that at the provincial level. Not surprisingly, the proportion of those who never attained any formal education is highest in North Eastern province (54.0%) and lowest in Nairobi (5.3%), followed by Central Province (9.42%). The proportion of migrants with completed primary level of education (Standards 5-8) was highest in Nyanza and Central provinces – at above 35%, and lowest in North Eastern (12.7%). Completion rate at Forms 1-4 was highest (above 27%) in Nairobi, Central and Coast and lowest (less than 20%) in Nyanza and North Eastern provinces. Forms 5-6 level of education was highest in Nairobi (2.9%), with the other provinces recording less than 2%. Apparently, relatively low numbers of secondary school-leavers and tertiary-level graduates in Nyanza province were more likely to be in Nairobi and other larger urban centres in the country. Indeed, estimation of internal migration from previous census data has confirmed a heavy Nyanza migration stream to Nairobi and Mombasa (Ominde, 1968; Oucho, 1988). The figure for Coast province at this level of education might have been inflated by in-migration due to the influence of Mombasa and the effect of the hotel employment in the tourism industry, which is more dominant in Coast province than in any other province in Kenya.

The districts with migrants whose highest (40% and above) educational grade was Standard 5-8 were all in Nyanza province, namely, Homa Bay, Migori, Rachuonyo and Suba. In contrast, districts with below 10% of migrants at this level of education were all in North-Eastern province. At Forms 1-4, Nairobi had migrants with the highest completion level; and, of course, Moyale and Mandera in Eastern and North-Eastern provinces respectively had the lowest completion levels, much below 10%. Thus, migration tends to redistribute population with varying educational attainment, giving the false picture of the actual levels of education in certain provinces, in particular heavy out-migration and in-migration whose figures are inflated and deflated respectively.

Migrants' Marital Status

Kenya's censuses classify marital status into four categories: single, married, widowed and separated and/or divorced. In all the districts, majority of the migrants were either single or married. And in all of them, with the exception of Nairobi, majority of the single migrants were males. Apart from Turkana, Meru Central and Mackakos districts that had exceptionally high proportions (40% or more) of single migrants, the rest of the districts reported lower proportions.

In Nairobi, Thika, Isiolo and Turkana, married migrants were mainly male, while married females were actually encountered in all other districts. The proportions of married migrants were highest in Nyanza province (66.1%), followed closely by Western province (65.6%) and Rift Valley (63.8%). Proportions for other provinces ranged between 54% and 60%. These statistics suggest that marriage is universal among migrants, as indeed among non-migrants in the country.

The widowed migrants consisted of more females than males in all the districts. The hardest hit province is Nyanza with widows comprising between 7% and 10% of the migrants as exemplified by district figures in brackets: Rachuonyo (10.0%), Siaya (8.5%), Homa Bay (8.5%), Nyando (8.0%), Bondo (8.0%), Migori (7.5%) and Suba (7.4%). In contrast, the lowest rates were recorded in Buret (1.2%), Nairobi (1.3%) and Turkana (1.3%).

More female than male migrants were separated and/or divorced in all districts of Kenya. Generally, the districts in Coast and North Eastern provinces had the highest rates of separated and/or divorced migrants. In Coast province, the highest rates were recorded in Lamu (4.8%) and Kwale (94.1%), while Taita Taveta, Tana River, Kilifi and Malindi, recorded levels of more than 2.5%. This disparity could be due to religious influence, specifically Islamic teachings, which among other things permit separation and/or divorce initiated by husbands. On the contrary, the lowest rates of divorce and/or separation are experienced among the migrants in Nyanza province, particularly in Homa Bay, Rachuonyo, Kisii Central, Gucha, Migori, and Nyamira, which recorded less than 1.0%. This feature could be explained by socio-cultural factors in the communities in the region – for example, the Luo and Kisii who do not believe in divorce, but who accept separation pending reconciliation of couples in dispute.

Migrants' Relationship to Heads of Household

Analysis of the distribution of migrants by relationship to household head by sex and district shows the predominance of heads of household in all the districts of Kenya. This could be the result of data collection bias given that census questions were generally administered to heads of household. Relationship to heads of household consists of three categories: spouse, children and other relatives. Analysis of age-sex net migration rates are almost identical in almost all the districts of the country. It confirms an important recent finding: that female and male migration rates are largely similar principally in their search for employment opportunities, education, and to join either spouses or other relatives.

In all the districts and provinces as well, the migrant heads of the households were mainly males. The distribution of male vis-à-vis female headship rates across the provinces was as follows: Nairobi (25.2% and 9.6%), Central (23.0% and 10.5%), Coast (24.0% and 9.3%), Eastern (16.6% and 8.8%), North Eastern (14.1% and 6.28%), Nyanza (17.9% and 10.0%), Rift Valley (20.2% and 9.7%), and Western (15.2% and 8.4%). The observed male headship in net in-migration provinces contrasts with the female headship in net out-migration provinces.

In most of the districts and provinces (with the exception of North-Eastern), children born to the migrant heads of the household were mainly males. To verify this, male vis-à-vis female percentage variations at the provincial level were as follows: Nairobi (32.9% and 29.5%), Central (42.0% and 40.9%), Coast (38.8% and 39.4%), Eastern (49.9% and 49.8%), North Eastern (67.5% and 72.4%), Nyanza (47.6% and 41.2%), Rift Valley (46.8% and 47.1%), and Western (56.1% and 50.6%).

Again in all the provinces, with the exception of North Eastern, female relatives were dominant in the households headed by migrants. Provincial-level distribution shows the following male-female contrasts: Nairobi (21.2%, 22.8%), Central (20.7%, 23.5%), Coast (23.3%, 25.1%), Eastern (21.4%, 24.6%), North Eastern (9.4%, 9.0%), Nyanza (25.6%, 31.5%), Rift Valley (18.4%, 20.8%), and Western (21.4%, 25.5%).

Migrants' Economic Activity

A particular economic activity that dominates varies from one province or district to another. In general, the districts with the main urban centres had the following representation for male vis-à-vis female distribution: Nairobi (44.4% and 26.7%), Mombasa (40.3% and 29.5%), Kisumu (26.6% and 35.9%) and Uasin Gishu (29.3% and 34.0%), with the predominant economic activity being paid work. The compatible migration of both males and females could possibly represent migration for employment, followed by migration of either their relatives joining them either as wives, pupils/students, or children yet to be in the employment bracket. It is noted also that migrants in the farming category are more likely to be found in the rural cash-crop growing districts such as Kirinyaga, Narok, Trans-Nzoia, Uasin Gishu, Nyandarua, Kiambu and Kericho, as well as those with settlement schemes such as Laikipia, Lamu, Tana River, Kwale and Kilifi. Migrants reporting business as their main economic activity resided in major urban centres such as Nairobi, Mombasa, Malindi, Eldoret, Kisumu, and Nakuru.

4.6 Urbanisation: Levels, Trends and Patterns

Throughout all its censuses, Kenya has adopted the United Nations criterion of classifying as urban all settlements with a population of at least 2,000. This has provided easy comparison of urbanisation levels, pattern and trends in the country.

The proportion of urban population is still small compared to the rural population in Kenya. The trend in the proportion of urban population has been 8.0% in 1970, 15% in 1980, 18.0% in 1990 and 19.0% in 1999. Generally, inter-censal growth rate of urbanization for the period 1979-89 was 5.2%, declining to 3.2% in 1989-99. However, demographic, social, economic and political factors have greatly spurred the urbanization process, resulting in varied urbanization levels, trends and patterns at both provincial and district levels.

Urbanisation Levels

Apart from Tharaka and Marakwet districts whose populations were completely rural, all other districts had their populations distributed between rural and urban areas in the 1999 census. Both Nairobi and Mombasa are metropolitan districts. Of all the other provinces, Coast province had the largest share (36.6%) of urban population, followed by North Eastern (15.2%), Rift Valley (13.7%), Central (9.6%), Nyanza (9.7%), Western (8.1%), and Eastern (5.8%).

At the district level, the phenomenon was similar, with only a few districts having 20% or more of urban population. These districts include Mombasa (50.0%), Kisumu (39.0%), Nakuru (29.7%), Uasin Gishu (29.0%), Thika (26.0%), Garissa (22.1%), Lamu (20.8%) and Samburu (20.8%). However, in Western and Eastern provinces, district urbanisation levels were almost equitably distributed.

Table 4.3 shows both distribution and trends of urban population in Kenya by province in the period 1962-1999. It suggests that the percentage of total urban population has been highest in Nairobi, Coast and Rift Valley provinces in descending order. For the period 1989-1999, the trend in urbanisation for the provinces fluctuated, with Nairobi and urban centres in Coast, Rift Valley, and Western experiencing an upturn while the rest had a downturn save for North Eastern province, which maintained the same share in the national urbanisation process of 2.3%. In the two years, while Eastern had the greatest share loss of all the provinces, Nairobi had the greatest share gain.

The period 1989-99 saw Nairobi register the highest urbanization growth rate, followed by Coast and Western. Nonetheless, although Western province registered the third highest inter-censal growth rate during the period 1989-99, it had a downturn from that (5.6%) recorded in 1979-89. In conclusion, a comparative analysis of the tempo of urbanization by province shows that Coast province had the highest rate of 4.2 % in 1989-99 up from 3.7% in 1979-89.

Table 4.3: Trends and Patterns of Urbanisation by Province, 1962 – 1999

Province	Urban Population					Share % of Urban Population		Inter-censal Growth Rate (%)	
	1962	1969	1979	1989	1999	1989	1999	1979-89	1989-99
Nairobi	343,500	506,286	827,775	132,4570	2,087,668	34.14	38.94	4.7	4.5
Central	35,047	45,955	128,932	309,821	354,017	7.99	6.6	8.8	1.3
Coast	195,834	283,652	406,991	588,470	894,311	15.17	16.68	3.7	4.2
Eastern	28,746	37,965	233,316	354,359	265,280	9.13	4.95	4.2	2.9
Nyanza	28,068	43,829	207,757	352,527	423,183	9.09	7.89	5.3	1.8
Rift Valley	112,517	148,576	341,696	672,177	940,311	17.33	17.54	6.8	3.4
Western	3,939	10,645	105,743	186,049	270,503	4.81	5.05	5.6	3.7
N. Eastern	-	63,486	-	90,724	125,644	2.34	2.34	3.6	3.3
Total	747,651	1,079,908	2,315,696	3,878,697	5,360,916	100	100	5.2	3.2

Distribution of Urban Centres by Population Size

Table 4.4 shows the number and distribution of urban centres by population size in 1962-1999. The 1999 data are analysed by core urban and local authority boundaries. Yet it should be noted that many administrative and municipal boundary changes after 1989 distort the actual picture. It has therefore been necessary to make adjustments to eliminate inherent errors and to distinguish between two urban components – "core urban" and "local authority" that have different boundaries. Generally, the local authority boundary, which encompasses some rural territory, is much larger than the core urban

boundary.

The pure (core) urban category shows that the urban centres with a population of 2,000-4,999 were the majority (with a share of 41.3%), followed by urban centres with a population of 10,000-19,999 (19%). Urban centres with a population of 5,000-9,999 and 20,000-99,999 tied at 33 each, having a share of 18.4% a piece. The lowest share was that of the centres with a population of 100,000+ that had a share of only 2.8% of all urban centres.

Similarly, the local authority category showed that the urban centres with a population of 20,000 - 99,999 were the majority, commanding 41.8% of the total. This was followed by the urban centres with a population of 2,000-4,999 at 25.4%. The centres with a population of 10,000-19,999 had the least share in the local authority category.

Table 4.4: Distribution of Urban Centres by Population Size, 1962-1999

Size of Centre	1962		1969		1979		1989		1999			
									Core Urban Boundary		Local Authority Boundary	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
100000+	2	5.9	2	4.3	3	3.3	6	4.3	5	2.8	19	9.6
20000-99999	2	5.9	2	4.3	13	14.3	21	15.1	33	18.4	84	41.8
10000-19999	3	8.8	7	14.9	11	12.1	19	13.7	34	19	17	8.5
5000-9999	11	32.4	11	23.4	22	24.2	32	23	33	18.4	30	14.9
2000-4999	16	47	25	53.1	42	46.1	61	43.9	74	41.3	51	25.4
Total	34	100	47	100	91	100	139	100	179	100	201	100

Urban primacy

Table 4.5 shows the index of primacy at the provincial levels for seven provinces, excluding Nairobi, an urban centre that doubles as a province and district. The indices of each province gives the ratio between the population in the largest urban centre to that in the next largest centre in the province. The indices in Table 4.5 are labelled as “four-city index” and “eleven-city index” respectively. The classification of primacy indices have been applied by the United Nations (UNECA, 1989), whereby: less than 1 = low; 1-2.9 = medium; 3 and above = high.

In 1999, according to both the Four-cities and Eleven-cities index, Coast and Nyanza provinces had the highest primacy index. Provincial differences are as follows: Central (0.58; 0.1), Coast (5.17; 6.0), Eastern (0.5; 0.4), Nyanza (2.2; 2.3), North Eastern (0.8; -), Rift Valley (0.8; 1.0), and Western (0.5; 0.6). Thus, Coast province, with the highest increase in urban population concentration, falls in the medium category. At the national level, the data suggest that Kenya falls in the medium category.

Table 4.5: Urban Primacy Index by Province, 1999

Province	Population of City 1999 (Core Urban Centre Boundary)				Primacy Index		
	Largest	Second	Third	Fourth	Four Cities		11 Cities
					1989	1999	1999
Central	83,094	79,935	47,180	15,101	0.8	0.58	0.11
Coast	663,842	54,124	43,943	30,435	7.5	5.17	6
Eastern	52,618	46,875	33,545	31,230	0.8	0.47	0.41
Nyanza	196,147	32,242	31,687	26,032	2.3	2.18	2.32
N. Eastern	51,350	30,663	20,515	11,136	0.6	0.82	-
R. Valley	221,753	167,326	60,201	35,865	0.8	0.84	0.98
Western	57,554	44,323	36,260	30,888	0.8	0.52	0.61
National							
1999	2,111,633	660,080	219,366	194,390	1.97	-	2.6
1989	1,324,570	461,753	192,733	163,927	1.6	-	-
1979	828,000	341,000	153,000	93,000	1.4	-	-

Indices of City Population by Province, 1999

Table 4.6 gives different indices of city population by province and the national level. Four provinces – Coast, North Eastern, Rift Valley and Nyanza – recorded 10% and above of urban population. The urban/rural ratio index shows that at the national level and also for all the provinces, no province had equal urban and rural indices. A value of 1 for the urban/rural ratio implies parity in urban-rural index.

The city concentration ratio shows that Coast province leads all the other provinces, followed by Nyanza. The same applies for the index of city distribution. For the index of mean city population size, Coast still led the other provinces, followed by Rift Valley; the former also led in the index of city concentration, followed by North-Eastern province. In general, the level and growth rate of urbanization were highest in the Coast province, followed by Rift Valley, Nyanza and North-Eastern provinces.

Table 4.6: Indices of City Population by Province, 1999

Index	Value for Province							
	Central	Coast	Eastern	N. Eastern	Nyanza	R. Valley	Western	KENYA
Total Population	3666860	2443947	4593317	828900	4347743	6850379	3342744	28686605
Urban Population	365551	923515	422755	130136	436701	968811	279667	5573295
Rural Population	3301309	1520432	4170562	698764	3911042	5881568	3063077	23113310
Percent Urban	9.97	37.79	9.2	15.7	10.04	14.14	8.37	19.43
Urban/Rural Ratio	0.11	0.61	0.1	0.19	0.11	0.16	0.09	0.24
City Population	302697	885081	380360	121100	385272	853773	250776	4940765
Non-city Population	3364163	1558866	4212957	707800	3962471	5996606	3091968	23745840
Number of Cities*	12	11	19	5	14	27	12	68
Primacy Indices	Value for Province							
	Central	Coast	Eastern	N. Eastern	Nyanza	R. Valley	Western	KENYA
First 4 Cities	0.582	5.166	0.471	0.824	2.18	0.842	0.516	1.97
First 11 Cities	0.776	6.001	0.409	-	2.322	0.984	0.612	2.59
Index of City Distribution	1.036	1.968	0.603	1.064	1.385	1.047	0.857	1.32
City Concentration Ratio	0.51	0.735	0.363	0.355	0.581	0.559	0.431	0.73
Index of Mean City Population Size	4,523	183,211	2,421	5,039	9,719	13,087	2,581	176,577
Index of City Concentration	0.001	0.075	0.001	0.006	0.002	0.002	0.001	0.006

*Note: * Limited to pure urban population only*

4.6 Characteristics of Urban Population

This section presents demographic and socio-economic characteristics of the urban population. The characteristics include age profile of the urban population, its sex structure, educational status and its economic activity.

Age Structure

The distribution of urban population by age is considered in terms of three broad age categories: 0-14, 15-64 and 65+ years, comprising children, economically active and old age population respectively. Data for all the urban centres show the domination of the age bracket 15-64 years. This implies that majority of the economically active population (labour force) has migrated into the urban centres to work or seek employment, higher education, or business transactions. The national outlook shows the domination of Kenya's urban centres by this category, followed by children (0-14 years); and the least represented are the old age population of 65 years and above. This distribution conforms to the pattern during colonial and post-colonial periods in Kenya, corroborating results of previous censuses.

Sex Structure

The development of urban centres in Kenya can be traced back to the history of the long-distance trade, both at the coast with the Arabs in the Gulf States and the early European explorers and traders as well as among various ethnic groups as they met at the central meeting points to transact their business. During the colonial period, the administration established administrative centres in different localities for easier administration of, and to serve as growth centres in, the country. Emergence of urban centres encouraged recruitment of the local labour force, which was dominated by men migrating from rural to urban areas as their wives, who were not allowed to accompany them, remained in the rural areas. This phenomenon explains why high sex ratio remains a characteristic feature of Kenya's urban areas.

Male dominance in rural-urban migration streams resulted in a sex ratio in excess of 100 for all urban centres, implying a high sex ratio. For example, urban centres that have been the focal points of the sugar industry, namely Chemelil (122), Muhoroni (119) and Awendo (111) in Nyanza province, as well as Mumias (104) in Western province, registered high sex ratios largely because the sugar industry, specifically cane cutting and transportation of cane to factories, relies heavily on male labour. All provincial headquarters and large urban centres also exhibit high sex ratios. These are Nairobi (116), Nyeri (101), Mombasa (119), Nakuru (106), Eldoret (110), Garissa (107), Kisumu (103) and Kakamega (100). Only Embu had a low sex ratio of 88 for the core urban and 90 for the local authority, which suggest its ruralised nature. The pattern of sex ratio in the 1999 census is consistent with the sex ratios in 1979 and 1989 censuses, though those for Embu during the two years were high – 115 and 106 respectively. Thus, although the pattern of sex ratio for urban centres has consistently remained the same, the levels have been consistently dropping from high to low values, i.e. below 100. This trend suggests that the size of female rural-urban migration has been on the increase, a result that corroborates earlier findings that attributed it to increasing female education, women's desire to seek urban employment and their tendency to stay with their relatives or to join their husbands.

Educational Status of Urban Population

Educational attainment is a good indicator of socio-economic development and the capacity of a population to participate in development activities. Ideally, it is an index that reflects the stock of highly educated and skilled labour force in a country. The norm in Kenya has been heavy rural-urban migration of this category of population.

At the national level, a higher proportion of females (7.4%) compared to males (3.7%) had no education as of the 1999 census. The trend changed for Standards 1-4 through 5-8, with more females reporting having attained those levels than males. All the higher levels of educational attainment – from Forms 1-4 up to the University – had more males than females given the high dropout rate of the latter. For example, at

Forms 1-4 males accounted for 47.9% compared with 41.8% for females; at Forms 5-6, the proportions were 1.4% and 1.2% respectively; and at the university level, they were 4.7% and 2.8% respectively.

Economic Activity of the Urban Population

The distribution of urban population by economic activity suggests that majority of the population worked in paid employment. The national figures indicate that 40.4% of males and 21.4 of females were on "work for pay", that more males (5.6%) than females (0.6%) were seeking employment; 15.1 % of females and no male were homemakers; and 6.1 % of males had no work compared with 10.1 % of females in a similar situation. The plausible explanation is that women, particularly the unemployed, migrate as "associational migrants" to accompany their husbands who have migrated as workers or who seek employment opportunities.

Both employment and unemployment rates provide partial explanation of the human poverty index. Socio-economic development levels of the districts and provinces in Kenya can thus be inferred from unemployment rates. The existing reality on the ground, varying from province to province, gives this disparity in development as amplified by the following statistics: the national unemployment rate is reported to be 8.0%, going by those who reported having no work; at the provincial level, unemployment rates vary: 8.5% in Nairobi, 5.7% in Central, 9.5% in Coast, 6.0% in Eastern, 10.4% in North-Eastern, 6.7% in Nyanza, 7.1% in Rift Valley and in 6.05 in Western.

Chapter 5

Population Growth in Kenya

Kenya's population growth has for long been a source of great concern to the Government of Kenya and its development partners, including the international community. From the onset of independence in 1963, the country singled out rapid population growth as a major threat to its development hence the formulation of a population policy in 1967 whose main thrust was family planning to reduce high fertility. Kenya goes on record as the first country in mainland Sub-Sahara to adopt a population policy. Nonetheless, rapid population growth continued in the country until the late eighties when it registered a fertility transition, with population growth abating a few years later.

This chapter examines population growth since 1948 and makes projections up to 2050. Previous inter-censal projections are presented to provide insights of demographic trends in the light of changes in fertility and mortality, and on the assumption that the country's population is closed or relatively closed.

5.1 Inter-Censal Population Growth, 1948-1999

Kenya's population has increased nearly six-fold in the fifty years, 1948-1999. Table 5.1 shows the total population figures obtained from the seven censuses of Kenya, with the inter-censal rates of growth declining only slightly. Population growth rate has been calculated using the exponential increase formula:

$$r = [\log_e (P_2/P_1)]/n$$

where r is the rate of growth, n is the number of years between the censuses, and P_1 and P_2 are the populations shown by the first and second censuses respectively. At the respective inter-censal periods, the country's population registered a doubling time of more than twenty years: 22 years in 1948-1962, 21 years between 1962 and 1989 and 24 years in 1989-199. Thus, rapid population growth has been Kenya's best known and most disturbing demographic trait.

Table 5.1: Kenya Population Census Totals 1948-1999

Census	Population	Percentage Increase	Rate of Growth
1948	5,497,599		
		57.1	3.2
1962	8,636,263		
		26.9	3.4
1969	10,956,501		
		39.9	3.4
1979	15,327,061		
		39.9	3.4
1989	21,448,774		
		33.6	2.9
1999	28,660,534		

5.2 Some Shortcomings of Kenyan Censuses

Rates of growth calculated in this way suffer from two principal drawbacks: they may be biased by differences in the completeness of the censuses, and they are composites of both natural increase and net migration. Any meaningful analysis should seek to quantify these elements, but unfortunately the data for doing so are incomplete. There are no direct measures of census coverage, and no data on emigration. All we can do therefore is to project the population from one census to the next using the fertility and mortality models which have been constructed for the relevant periods and to draw what inferences we can from the discrepancies between the enumerated and projected populations. In so doing it is important to consider separately the population aged 10 and over, who should be the survivors of those enumerated 10 years earlier, and that under 10 which is calculated from the assumed fertility rates between the censuses, with allowance for infant and child mortality.

The basic assumption has been that Kenya's population is "closed" or "relatively closed', that is, not affected by emigration and immigration. Yet, the assumption is untenable given large-scale immigration of population from neighbouring countries and recent (since the 1980s) emigration. The problem is that no proper records of emigration are kept and immigration data are not well analysed to provide volumes and patterns of the two movements.

In the past such projections have assumed that net migration in and out of Kenya is negligible, so the discrepancies have been attributed primarily to variations in coverage. But this method is clearly also heavily dependent on the validity of the estimates and models of fertility and mortality, and on the estimated under-coverage of the first census.

Analysts of Kenya's census data acknowledge the fact that of all the censuses in the country before 1999, that of 1969 achieved the most complete coverage. A sample post-enumeration survey conducted shortly after the 1969 census revealed some evidence of under-enumeration in Nairobi and Mombasa and appreciable numbers of records were lost during the data processing. However, a sample of records was used to

compensate for these deficits. A back-projection to 1969 of the population aged 10 and over in 1979 suggested that there had been an under-count of children under 10, but the result was sensitive to way the in which the 1979 age distribution was smoothed (CBS 1981).

In contrast, the 1979 census gave a total population, which fell short of the projected figure by about 5%. The estimate had been obtained by projection of the 1969 population using fertility and mortality rates derived from the 1977 National Demographic Survey. Some of the discrepancy was because of the emigration of non-Africans, which reduces the projected population by slightly less than 4%. When broken down by age and sex the major discrepancies were found to be for children aged under 10 years: the number of children 0-9 enumerated in 1979 fell short by some 10% of those calculated on the basis of the fertility and mortality rates thought to have been current during the 1969-79 decade. A compendium to the 1979 census confessed that there had been an under-count of adults in Nyanza Province, where the rate of growth between 1969 and 1979 was well below the national average and could not be accounted for adequately in terms of differentials in fertility, mortality or migration. This apparent under-count in Nyanza remains unexplained. The inter-censal rates of growth for the province in 1979-89 and 1989-99 remained below the national average, though now more readily explainable in terms of mortality and out-migration. However, it would appear that the population missed by the 1979 census never re-appeared in subsequent censuses.

The deficit of children under 10 in 1979 might now be partially explained by the onset of the fertility decline, which cannot be pinpointed precisely but may have begun before the 1979 census. Yet at that time there was no evidence that fertility in Kenya had started to fall, either from the fertility data in the census, or from the 1977-78 Kenya Fertility Survey, or from the 1977 National Demographic Survey. The level of total fertility of 7.89 assumed for the 1969-79 projections was regarded as conservative, and even now, with our benefit of hindsight, does not appear unreasonable.

The corrections made to the 1979 census, based largely on projections from 1969, gave an adjusted population of 16,141,359, implying an under-count of 5% (CBS and, pp.115-122). The projections were re-worked after the 1989 census (CBS 1996), but with much the same result: they gave a projected population of 16,182,468. They have now been re-worked again after the 1999 census, using a projection package provided by the U.S. Census Bureau, which has given a somewhat lower figure of 15,763,495, implying an under-count of 2.8% (see the monograph on *Population Projections*).

The 1989 census showed an even larger discrepancy between the projected and enumerated populations. The projections made after the 1989 census, based on the *adjusted* 1979 population, gave a total of 23,091,946 which, compared with the enumerated figure of 21,448,774, implied an under-count of 7.1%. The shortfall for children under 10 was again greater than that for the population 10 and over: 8.6% as against 6.5%, implying either a selective under-count of children within households, or that fertility had been over-estimated for the 1979-89 decade. In the light of the new

information on fertility, which has since become available, the latter explanation appears unlikely.

However, the recent re-working of the projections using the U.S. Census Bureau package again gave lower figures: the projection from the adjusted 1979 base gave a 1989 population of 22,824,890, implying an overall under-count of 6%.

In summary, therefore, it may be concluded that the estimates of the degree of under-counting in the 1979 and 1989 censuses were subject to substantial margins of uncertainty. The projection procedure involved a variety of unhappy assumptions, most notably the absence of migration; the results varied with the projection methodology, and involved a long chain of calculations.

5.3 Population Projections

The instability of population dynamics alluded to in previous sections of this chapter imply that population projections are also unstable. No sooner than fertility showed signs of ebbing than mortality began to exhibit an upsurge and international migration, which in the past had been negligible, assumed growing importance.

Inter-censal Projections1989-1999

Table 5.2 compares the 1999 projected population (from 1989) with the population enumerated in 1999. The projections, by sex and age, were made in two 5-year steps, using survival ratios by age and sex from the life tables given above in Table 3.17. Total fertility was assumed to be 5.39 for 1989-94 and 4.56 for 1994-99; these rates were based on the logistic curve fitted to the available data since 1969, described in Chapter 2.

Table 5.2: Comparison of Projected and Enumerated Populations, 1999

		Projected from 1989	Enumerated 1999	Percentage Discrepancy
Males	0-9	4,385,037	4,217,834	3.96
	10+	9,627,501	9,955,421	-3.29
	Total	14,012,538	14,173,255	-1.13
Females	0-9	4,330,067	4,145,049	4.46
	10+	10,079,866	10,342,230	-2.54
	Total	14,409,933	14,487,279	-0.53
Both Sexes	0-9	8,715,104	8,362,883	4.21
	10+	19,707,367	20,297,651	-2.91
	Total	28,422,470	28,660,534	-0.83

The overall agreement is remarkably good: the projected population fell short of the enumerated by less than 1%. Whether this small discrepancy should be attributed to net immigration or to improved coverage in the 1999 census is debatable. What is clear is that the inter-censal increase was broadly compatible with the estimates of fertility and mortality. No adjustments were made to the 1989 base population either for under-

enumeration or for age mis-statement, so that any such adjustment for the under-count in 1989 will result in a corresponding increase in the projected figure for 1999.

Thus an alternative set of projections, based on the census of 1969 and using the U.S. Census Bureau's packages for smoothing and projection, gave a 1999 population of 29,453,024, implying an undercount of 2.7% (see the monograph on *Population Projections*, Table 1.8).

It is easy, when concentrating on these discrepancies, to become preoccupied with the negative aspects of the results. However, perhaps the most remarkable feature is the general agreement between the projected and enumerated figures. On the one hand, there are manifold difficulties of effecting an accurate population count in a country such as Kenya, and on the other the projections were spread over a 30-year period (so that the survivors of the 1969 population constituted little more than a quarter of the total in 1999), using fertility and mortality rates based on fragmentary and inaccurate data. However, the general agreement boosts our confidence both in the validity of the census counts and in the techniques of estimation and the modelling of the components of Kenya's population dynamics.

Population Projections up to 2050

The future growth of Kenya's population, at least in the short term, will continue to be dominated by natural increase, the excess of births over deaths; migration is unlikely to become a major factor. The number of persons reported as having been born outside Kenya increased from 133,970 in the 1989 census to 356,846 in the 1999 census. Although these figures may not represent the full extent of immigration during the decade, they will have been counterbalanced, at least partially, by an unknown volume of emigration, and the difference constitutes a trivial proportion of the overall inter-censal increase of over 7 million. Unfortunately, Kenya's population living outside the country is unknown, though emigration has become an important feature since the 1980s.

The construction of population projections is a hazardous and uncertain operation, since the future trends in fertility and mortality cannot be predicted with confidence. In the past, fertility was the major area of uncertainty: It was not clear whether it would decline, and if so how fast. By the time of the 1989 census the fertility transition was clearly established, and three sets of projections – on the assumptions of slow, medium and fast declines – were calculated. In the event the continued fall in fertility has come closest to the fast decline assumptions, but there is also evidence that the rate of decline is slowing up. For reasons given above in chapter 3, we believe that total fertility is unlikely to fall below 3 births per woman, at least in the near future.

At the same time, the major area of uncertainty has shifted from fertility to mortality. Although the post-1989 projections envisaged an overall increase in mortality because of the HIV/AIDS epidemic, the rise in HIV prevalence was in fact greater than had then been predicted, and there is evidence that mortality from causes other than AIDS also increased, as described in Chapter 3. Thus, the mortality projections depend

both on the assumed future course of the epidemic, and on what is going to happen to non-AIDS mortality, both of which are far from clear. Our assumptions may be seen as optimistic. HIV prevalence is thought to have peaked at 13.3% in 2000; it is then projected to plateau at 13.0% until 2010 and thereafter decline slowly, reaching 8% by 2020. Because of the long period of incubation, AIDS mortality would not be expected to peak before 2006, and would then decline slowly. Non-AIDS mortality is assumed to have continued to rise until the turn of the century, but then is projected to resume its long-term decline, albeit at a modest rate.

On the basis of these assumptions on fertility and mortality, detailed projections up to 2020 by sex and age, with the school-age population and labour force, and up to 2010 for provinces and districts, are shown in the monograph on *Population Projections*.

The assumption that total fertility will not go below 3 births per woman, combined with the resumed decline in mortality, implies that Kenya's population will continue to grow, albeit at a much reduced rate. Thus with the TFR of 3 and mortality stabilized at the level reached in 2020, the population would ultimately settle into a steady rate of growth of rather less than 1% per annum.

Although we believe that the assumptions regarding fertility and mortality, which underlie these detailed short-term projections, are the most plausible, it is nevertheless instructive to see the effects of alternative scenarios and to take the projections further into the future. Let us consider first the effects of a more drastic decline in fertility. The assumption that total fertility will not fall below 3 births per woman, at least in the short-term, is supported by the fact that this is what has happened in some other countries going through the fertility transition, notably Bangladesh and Malaysia. But it is rare. A more common phenomenon is for the decline to continue until fertility reaches replacement level, or even below it. We have therefore made an alternative set of projections, extended up to 2050, with the lower asymptote of the logistic curve set at 2 births per woman, as shown in Table 5.3. A TFR of 2 is of course below replacement level: with mortality as estimated for 2000-2005, a TFR of nearly 2.5 would be needed to ensure replacement in the next generation. Thus, following the scheme in Table 5.3, the net reproduction rate (the index of replacement) will not fall below unity until the period 2015-2020. Even then the population does not immediately decline; there is a delayed action effect due to the population momentum: the mothers of the next generation are already born, and since they are more numerous than their mothers were, the numbers of births remain higher than the numbers of deaths, despite the fact that women individually are having fewer children. Only when the depleted birth cohorts have themselves moved up into the child-bearing ages will the full impact of the fertility decline make itself felt. Thus, as will be seen below in Table 5.5, the population would continue to grow until the middle of the century when it would reach a total of about 44 millions. Thereafter it would start to decline slowly.

Table 5.3 Projected Total Fertility Rates for Kenya Assuming Lower Limits of 3 and 2 Births per Woman

Time Period	Lower Limit	
	3	2
2000-2005	3.838	3.562
2005-2010	3.456	2.966
2010-2015	3.238	2.568
2015-2020	3.122	2.323
2020-2025	3.061	2.181
2025-2030	3.031	2.100
2030-2035	3.015	2.055
2035-2040	3.008	2.030
2040-2045	3.004	2.016
2045-2050	3.002	2.009

These projections are based on the assumption that mortality will fall during the first half of the 21st century: that the AIDS epidemic gradually comes under control, and that mortality from other causes will resume the long-term decline observed prior to the 1990s. But we also need to consider the possible effects of a continued rise rather than a decline in mortality. The alternative scenarios are summarized by the selected mortality indices shown in Table 5.4: the expectations of life at birth and at age 15 [$e(_0)$ and $e(_{15})$], the infant and under-5 mortality rates [q(1) and q(5)], and the probability of dying between age 15 and age 60 [45q15]. The assumed rates of change, both rising and falling, are modest. They have been combined with the two fertility assumptions to give four sets of projections, the results of which are summarized in Table 5.5, and illustrated in Figure 5.1.

Table 5.4 Projected Mortality Indices for Kenya assuming Rising and Falling Mortality

RISING MORTALITY

		2000-05	2005-10	2010-15	2015-20	2020-25	2025-30	2030-35	2035-40	2040-45	2045-50
Males											
	e(0)	46.07	45.78	45.49	45.21	44.92	44.63	44.34	44.05	43.76	43.47
	e(15)	39.23	39.06	38.88	38.71	38.53	38.36	38.18	38.01	37.84	37.67
	q(1)	75.1	76.5	77.9	79.4	80.8	82.3	83.9	85.4	87.0	88.6
	q(5)	122.8	125.0	127.2	129.4	131.7	134.0	136.3	138.7	141.1	143.5
	45q15	0.596	0.600	0.604	0.608	0.612	0.616	0.619	0.623	0.627	0.631
Females											
	e(0)	52.83	52.51	52.19	51.87	51.54	51.22	50.89	50.56	50.24	49.91
	e(15)	45.65	45.44	45.22	45.01	44.80	44.58	44.37	44.16	43.95	43.73
	q(1)	72.5	73.8	75.2	76.6	78.1	79.5	81.0	82.5	84.0	85.6
	q(5)	109.7	111.7	113.7	115.8	117.8	119.9	122.0	124.2	126.4	128.6
	45q15	0.450	0.454	0.459	0.463	0.467	0.471	0.476	0.480	0.484	0.488

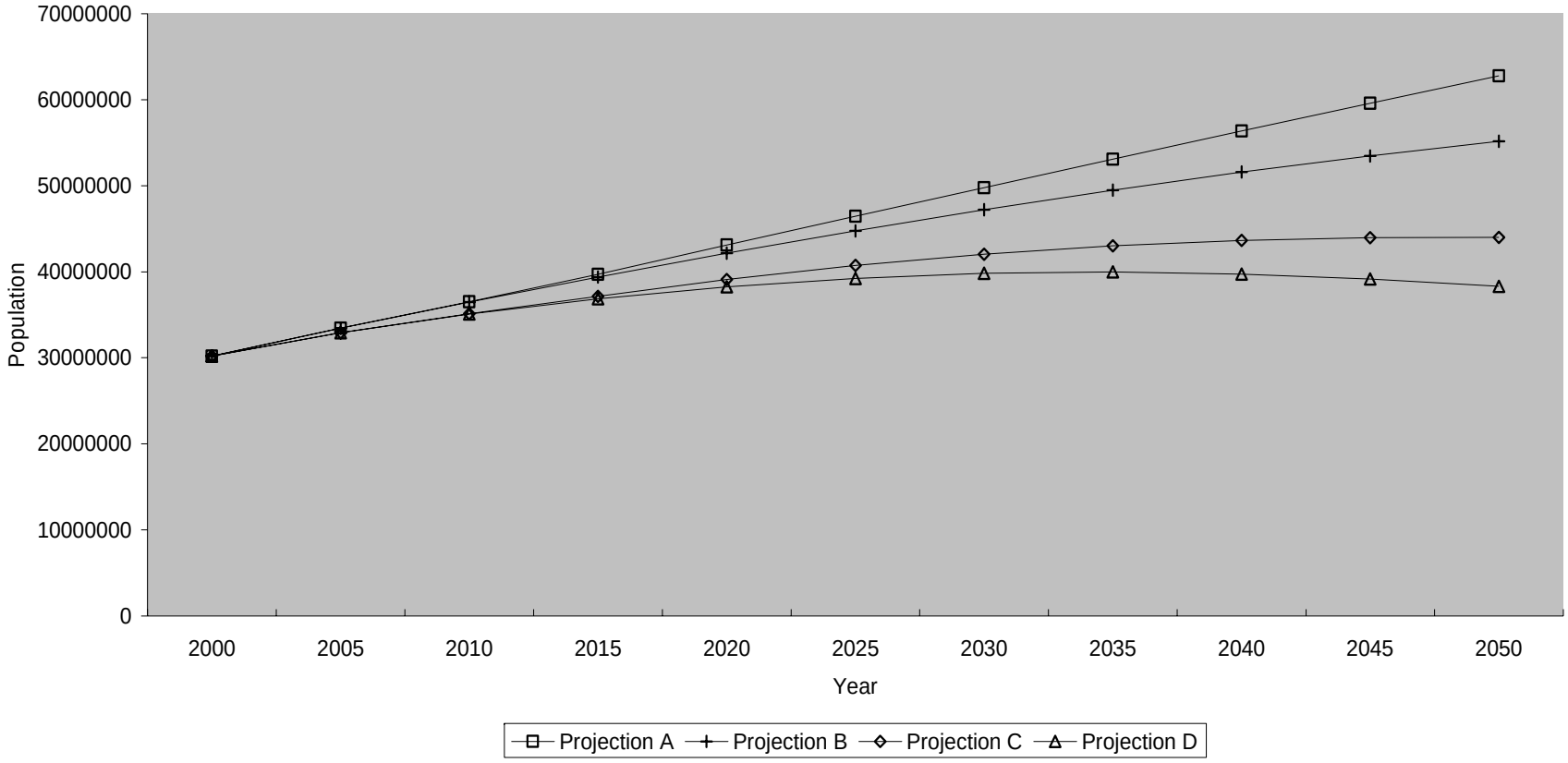
FALLING MORTALITY

		2000-05	2005-10	2010-15	2015-20	2020-25	2025-30	2030-35	2035-40	2040-45	2045-50
Males											
	e(0)	46.07	46.54	48.63	50.86	51.15	51.44	51.72	52.01	52.29	52.58
	e(15)	39.23	39.26	41.06	42.78	42.97	43.16	43.36	43.55	43.74	43.93
	q(1)	75.1	77.6	71.8	64.2	63.0	61.9	60.7	59.6	58.5	57.4
	q(5)	122.8	115.8	107.2	96.0	94.3	92.6	90.9	89.3	87.6	86.1
	45q15	0.596	0.591	0.539	0.495	0.490	0.486	0.482	0.477	0.473	0.468
Females											
	e(0)	52.83	52.48	54.90	56.98	57.30	57.62	57.93	58.24	58.55	58.86
	e(15)	45.65	45.18	47.30	48.83	49.05	49.27	49.49	49.71	49.93	50.14
	q(1)	72.5	71.6	65.9	59.1	58.0	56.9	55.8	54.8	53.8	52.8
	q(5)	109.7	108.5	100.0	89.6	88.0	86.4	84.8	83.3	81.8	80.3
	45q15	0.450	0.461	0.415	0.382	0.378	0.374	0.370	0.365	0.361	0.357

Table 5.5: Projected Population Totals for Kenya (thousands) on Alternative Assumptions of Fertility and Mortality

Year	Projection A TFR 3 Mortality Falling	Projection B TFR 3 Mortality Rising	Projection C TFR 2 Mortality Falling	Projection D TFR 2 Mortality Rising
2000	30,208	30,208	30,208	30,208
2005	33,445	33,445	32,903	32,903
2010	36,508	36,474	35,115	35,084
2015	39,715	39,379	37,162	36,853
2020	43,113	42,164	39,105	38,244
2025	46,442	44,755	40,744	39,240
2030	49,778	47,215	42,047	39,815
2035	53,091	49,500	43,010	39,972
2040	56,366	51,588	43,645	39,742
2045	59,595	53,474	43,970	39,170
2050	62,778	55,167	43,995	38,299

Figure 5.1
Projected Population Totals for Kenya



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2025	46,442	44,755	40,744	39,240
2030	49,778	47,215	42,047	39,815
2035	53,091	49,500	43,010	39,972
2040	56,366	51,588	43,645	39,742
2045	59,595	53,474	43,970	39,170
2050	62,778	55,167	43,995	38,299

The combination of the ultimate TFR of 3 with rising mortality still gives above-replacement fertility: female life expectancy at birth would need to be reduced to about 42 years before the NRR drops below 1. But the increased mortality reduces the projected population for 2020 by nearly a million, and that for 2050 by some 7 or 8 millions. The projection combining lower fertility with rising mortality shows the population peaking at nearly 40 million in 2035.

It must be emphasised, however, that these projections should not be regarded as realistic forecasts. They are based on assumptions, which become more and more implausible the further they are extrapolated into the future. Even our preferred set, incorporating fertility levelling at 3 births per woman and declining mortality, appears increasingly dubious when extended beyond 2020, showing as it does a further doubling of the population by the middle of the century. No population can continue to grow indefinitely, and fertility and mortality rates rarely follow regular and predictable trends. If the fertility decline does stall at 3 births per woman, it may well prove a temporary phenomenon, and could be resumed at some unknown date in the future. Yet one conclusion from these projections would seem to be justified: Kenya should be prepared to accommodate a population of at least 40 millions which will be reached eventually during the next fifty years. Moreover, international migration should continue to be ignored in population projections given recent emigration from and increasing immigration into Kenya.

Chapter 6

Summary, Conclusions and Recommendations

This chapter summarises, draws conclusions on and make recommendations against the background of the information presented in the previous chapters. The sections are devoted to fertility, mortality, migration and urbanisation, and population growth and its development implications.

6.1 Summary and Conclusions

Fertility

The 1999 census has provided four different estimates of total fertility in Kenya:

- the hypothetical cohort constructed from the average parities from the 1989 and 1999 censuses gave a TFR of 5.5 for the 1989-99 inter-censal period;
- current fertility rates calculated from births reported as occurring during the 12 months prior to the census, after imputation for non-response, gave a TFR of 4.95 , and the application of the P/F ratio and relational Gompertz model suggested a trivial upward adjustment of less than 2%, but would also displace the time location of the estimate to the mid-1990s;
- Rele's method using child-woman ratios from the age-sex distribution, adjusted for mortality, gave TFRs of 4.5 using the 0-4 age group and 5.6 with the 5-9, estimates that should therefore be seen as representing fertility during the periods 1994-99 and 1989-94 respectively.

In view of the margins of uncertainty (associated with both the response and the data processing errors described above) which are attached to these estimates, we are led to the conclusion that a round figure of 5 births per woman for the mid-1990s is as good an estimate as any, but with a margin of error of plus or minus 0.5 births per woman. Analysis of the Post-Enumeration Survey of February 2000 gave a similar figure. It is marginally higher than that derived from the 1998 KDHS, which gave a TFR of 4.7 for the 3 years prior to the survey, but the correction of the KDHS for dating errors using the Gompertz model resulted in a small upward adjustment, suggesting a TFR of about 4.9 for the 5 years before the survey (1993-97).

These estimates reflect the fertility transition, which probably began in the late 1970s. Prior to the onset of the decline total fertility in Kenya had been of the order of at least 8 births per woman and had almost certainly been rising steadily since the 1950s or even earlier[5]. The course of the recent decline is evident both from the birth histories of the KFS and KDHS's and from the 1969, 1979 and 1989 censuses. A comparison has

[5] The evidence for this rise comes largely from the cohort parity progression ratios calculated from the census data and are shown in the fertility monograph.

been made of the observed and adjusted TFRs from the birth histories based on several surveys and the censuses. The census-based estimates for the 1969-79 and 1979-89 decades were for hypothetical cohorts calculated from the cohort changes in average parities.

The unadjusted survey estimates tend to be rather higher than those from the censuses, but the process of adjustment has brought them better into line, as well as narrowing the gaps between the different surveys. Despite residual discrepancies the general downward curve is clearly apparent. Since there are few objective criteria for preferring one data set to another, we have fitted a parabola by least squares to the adjusted estimates, giving TFRs of 6.6 and 4.9 for 1985 and 1995 respectively.

However, the parabola clearly cannot be used to extrapolate the estimates beyond the time span of the data because it would simply plunge with increasing steepness giving negative values by the year 2014. To portray the course of the fertility transition, a reverse-S-shaped curve is required. We have therefore fitted a logistic curve to the points of 6.6 and 4.9 for 1985 and 1995, and with upper and lower asymptotes of 8.1 and 3.0 (Arriaga 1994, pp.351-355). The latter figure therefore implies the assumption that total fertility in Kenya will not go lower than 3 births per woman in the foreseeable future. The justification of this assumption is based on a study of the data from the 1998 KDHS, including projected completed family sizes for women still of child-bearing age, the slackening in the rise of contraceptive use, the trend in total fertility rates in Central Province and for women with secondary education (seen as the forerunners in the fertility transition), the downward trend and then stabilization of the ideal family sizes (Blacker, forthcoming).

Several conclusions are drawn from fertility estimates and extrapolation. First, there is evidence that fertility is declining further and that the trend will remain sustained in the future, Second, fertility decline below a TFR of 3 is not be expected soon and will certainly not reach replacement level before 2020. It is evident that several studies capturing fertility issues have provided a basis for putting confidence on past, current and future fertility trends in the country.

Mortality

The period 1979-1999 saw a higher infant and under-5 (child) among females than males. This anomalous demographic situation is presumably the result of poorer nutrition of female children. In 1989-1999, most infants and children are thought to have died of AIDS through mother-to-.child transmission of HIV, distorting the theoretical mortality model. As the HIV/AIDS epidemic in Kenya has yet to abate, further distortion of the model is expected as more infant and under-5 mortality continues. Unadjusted (without AIDS) and adjusted (with AIDS) figures suggest significant differences in infant and under-5 mortality rates.

It is useful, for comparative purposes, to summarise the probabilities of survival from the hypothetical cohorts shown in Table 3.13 into a single index of adult mortality. The probabilities of survival may be seen as life table survivors from a radix of 35 for

men and of 25 for women, from which the average numbers of person-years lived between the ages 35 and 75 for men, and between 25 and 75 for women, can be calculated. If nobody died between these ages, the numbers of such person-years would be 40 for men and 50 for women. Thus, the extent to which the calculated figures fall short of 40 and 50 respectively provides a summary index of mortality over these age ranges. We have designated the shortfall as the person-years lost. Table 3.16 shows these indices, both with and without the AIDS adjustments, and in comparison with the corresponding figures from the 1969-79 and 1979-89 hypothetical cohorts.

Table 3.16: Summary Measures of Adult Mortality from Orphanhood Hypothetical Cohorts: Person-years lived and lost between 35 and 75 for males and between 25 and 75 for females

	1969-79	1979-89	1989-99	
			Unadjusted	Adjusted
Males 35-75				
Years Lived	31.01	32.49	29.61	28.47
Years Lost	8.99	7.51	10.39	11.53
Females 25-75				
Years Lived	43.41	44.83	42.84	40.75
Years Lost	6.59	5.17	7.16	9.25

Whereas the 1979-89 estimates show an appreciable decline on those of 1969-79, the data for 1989-99 show a sharp increase in mortality to a level higher than that of 1969-79. This upturn in mortality is primarily attributable to the AIDS epidemic, though the AIDS-related mortality is difficult to quantify precisely. However, an attempt has been made to disaggregate the mortality rates into those due to AIDS and those attributable to other causes. The methodology is described in the monograph on *Population Projections*, and it is concluded that AIDS cannot entirely account for the rise in mortality, so that there may also have been an increase in mortality from other causes.

A closer examination of Kenya's primary health and public health system in general might identify other factors accounting for increasing adult mortality. Likely issues include the breakdown of health infrastructure, overworked and underpaid health personnel, a large number of whom have so far emigrated; escalating cost of health due to cost-sharing and expensive hospitals; and lack of a viable health insurance for all. These issues need closer investigation with a view to inform the health policy and influence policy changes as well as programmes emanating from it.

Migration and Urbanisation

Analysis of internal migration in Kenya based on the 1999 census leads to identification of six broad regions where the drama takes place. These are:

(1) Resettlement districts: Laikipia, Trans-Nzoia, Uasin Gishu, West Pokot and Kajiado in Rift Valley province and Lamu and Tana River districts both in Coast province.

(2) Commercial farming (especially cash crop) districts: A number of districts have been found to register net gains in the population of young people aged 10-19 years. The districts include Murang'a, Kiambu, Nyeri, Embu, Kirinyaga, Nyandarua, Kericho, and Nandi districts, which produce crops such as coffee, tea and pyrethrum. The in-migration of population aged 50 or more years represents retirement migration of those with farms in these areas.

(3) Marginal area districts: The pattern is clearly observable in Mandera, Wajir, Garissa, Marsabit, Samburu and Turkana districts. The districts experience losses and gains of population at certain age groups. In North-Eastern province, Garissa, the provincial headquarters by the same name, receives most in-migrants from its counterparts in North-Eastern province.

(4) National border districts: This phenomenon was particularly evident in Busia and West Pokot on the Kenya-Uganda border; Kajiado and Narok on the Kenya-Tanzania border; Garissa and Wajir on the Kenya-Somalia border; and Marsabit on the Kenya-Ethiopia border. Net gains of population in these districts are largely attributable to the turbulent political conditions that prevailed in most of the neighbouring countries (Sudan, Ethiopia and Somalia) during the inter-censal period 1989-1999. However, much of the in-migration into Kajiado and Narok districts presumably involved those who moved in because of land pressure in their districts of origin.

(5) Western and Eastern Kenya regions: A total of 10 out of 13 districts in Nyanza, Western and Eastern provinces registered net gains in the population of children aged 0-9 years. Incidentally, these same districts contribute a considerable portion of migrants to the metropolitan districts of Nairobi, Mombasa, Kisumu and Nakuru. The districts receiving children in the age group 0-9 years include the major sources of rural-urban migration, such as Kitui, Machakos, Kakamega, Busia, Siaya, Karachuonyo, Homa Bay, Migori, Suba, Nyando, Migori, Vihiga, Lugari and Kuria.

(6) Urban districts (Nairobi and Mombasa). Characteristics of each of the six are highlighted in order to provide some insights. The two metropolitan districts of Nairobi and Mombasa experienced out-migration of children aged 0-9 years and women in the 20-29 years age bracket. Out-migration of these two age brackets may be attributed to the acute shortage of Standard one places in the major urban centres of Kenya, forcing the children just about to enter nursery and primary education to move with their mothers to their rural districts. The migration pattern in Kenya's third and fourth largest urban centres, Kisumu and Nakuru respectively, is similar to that in Nairobi and Mombasa – the first and second largest urban centres. Net gains of population in these four urban districts were in the age groups 10-29 years for females and 10-39 years for

males. These may have been mainly school dropouts, school leavers, unemployed job seekers, and those seeking further education and training that expected availability of opportune and better socio-economic conditions in these urban centres. Nairobi and Mombasa experienced net losses in the age brackets 30-69 years for males and 20-69 years for females. These were most likely returning unsuccessful job-seekers in the towns; entrepreneurs who had accumulated enough money and were moving out to invest in land and/or business elsewhere; people who had completed their education and/or training; those on job transfers; and people who had attained retirement age.

Kenya's past rapid population growth so much dominated demographic and economic literature that it naturally excited policy-makers and donor agencies. That fertility reduction became the thrust of the country's population policy way back in 1967 underlines the deliberate efforts made to contain fertility as mortality declined on its own and international migration was virtually non-existent.

Population growth, explained by population size and rate of growth, has been viewed against national development objectives, trends and problems thus effecting a demographically conscious planning. As no component of population dynamics has stabilised in Kenya, the country has to make a continuous search for appropriate strategies for development challenges posed by demographic trends and solutions to put the country on the path of sustainable development. Indeed, the country's latest population policy emphasizes the relationship between population and sustainable development, broadening the scope of the issues involved. The impact of HIV/AIDS on population and development need no overemphasis given that all organs of governmental and non-governmental sectors are waging a spirited war to contain the scourge.

6.2 Recommendations

The recommendations made relate to the census exercise and each of the components of population dynamics. While some of them are instructive for policymakers, others could to improve the coverage and quality of future censuses, thus improving the quality of both estimates and projections from the available data.

On Future Censuses

Future censuses should administer better conceived questions, such as: migration five years rather than one year preceding a census; individual, family, economic and social factors that influence migration from particular places to others; and the consequences of migration at both origins and destinations of migration. To avoid overloading census questionnaires, it may be necessary to carry out detailed investigation of migration in periodic national migration surveys.

Lack of adequate statistics on immigration and emigration, presents special analytical and logical problems, even when it is evident that Kenya's population is not as "closed" or "relatively closed" as previous censuses had found out. Research on international migration in developed countries and media reports in Kenya have confirmed heavy emigration and "stay-ons" (those who stayed on at the destinations instead of returning home) of Kenyans overseas and in other African countries as well. Unlike the two vital events – mortality and fertility – migration may occur repeatedly to the same person or may never occur to an individual in his/her lifetime. Thus, there is a need to differentiate migration (volume of flow) from migrants (number of persons who have moved) and to specify precisely the period for which migration status (migrant vis-à-vis non-migrant) is defined. A carefully chosen time-period is necessary to permit accurate estimation of migration rates.

Analysis of international migration streams calls for data on country of permanent residence of immigrants and emigrants' countries of next residence. The country of birth or citizenship may serve as a substitute for previous permanent residence or as a supplement to it. For both administrative and demographic uses, it is important to have data on citizenship, type of migration (for example, permanent, temporary, and 'commuters' or 'border crossers'), and the legal basis of entry of aliens. A major shortcoming is lack of data on emigration of Kenyans or from Kenya to other countries, to balance the immigration data that censuses do collect – which implies the inability of the Central Bureau of Statistics (CBS) to estimate net international migration in Kenya.

On Population Dynamics

Regional variations do persist in fertility in the country. Therefore, there is a need for formulating region-specific policies upon which to develop specific programmes, and not just blanket national ones that fail to capture such variations. This recommendation is necessary because a uniform level and trend of fertility is unrealistic in a country with significant, cultural differences and socio-economic characteristics. In future, it should dawn on the CBS that asking similar questions in successive censuses is imperative for making comparable estimates and extrapolation. Other birth history surveys could ask more detailed fertility questions not only to supplement but also to verify fertility data from the censuses.

The upsurge of infant and child mortality is a worrisome demographic feature of Kenya's population. This is because infant and child mortality provide the best reflection of the quality of health and potential for survival through adulthood to old age. Kenya's population, which aims to reduce infant and under-5 mortality in the light of the HIV/AIDS should be implemented through more vigorous prevention and curative programmes if the quality of population is to be realised. Thus, more child survival and safe motherhood programmes provide promise for improving the heath of infants and children in Kenya.

Previous censuses have provided evidence to the effect that female migration, in particular rural-urban migration, has increased over the last few decades in Kenya. Therefore policy needs to address the implications of increasing female migration and its

significance in areas in both out-migration and in-migration areas. Equally deserving attention is the unravelling of factors that influence female migration patterns and levels. In effect, the needs of female migrants, which in the past were neglected, need to be identified and addressed through carefully designed policies and programmes. The notion that migration is solely a male affair is evidently outdated and needs rectifying in the light of revelations from available data. It is also necessary to establish factors underlying discrepant age-sex migration flows between the two neighbouring provinces of Nyanza and Western and, particularly why Nyanza province is a consistent net out-migration area for both sexes and in almost all age groups. Reasons for substantial oscillatory flows at different ages in North-Eastern province also need to be investigated as should the factors accounting for negligible differences in Nairobi, Coast, Central and Eastern provinces.

The complexity of international migration and the diversity of the movers, causes and consequences of the phenomenon are major challenges for the CBS and its partners. Among the useful sources of data that could be explored are the following:

- Frontier-control data collected at the international borders.
- Passenger statistics obtained from lists of passengers on seas, land or air transport manifests.
- Statistics on tourist traffic that exist but that are seldom fully analysed.
- Statistics on holders of passports, entry visas, work permits, etc.
- Statistics obtained in censuses or periodic national surveys on the previous residence, place of birth or citizenship, duration of residence etc.
- Statistics collected in special or periodic migration surveys relating to previous and present residence, or citizenship, such as registration of aliens or a count of citizens overseas.

The collection of these data depends on their utility in providing insights into particular forms of international migration that could supplement census data. It should be noted that the United Nations considers frontier control data and, where available, population registers data to be extremely useful for measuring international migration. Furthermore, it recommends that national governments collect and tabulate total arrivals (immigrants and other arrivals) and departures (emigrants and other departures) and subdivide these totals into several defined categories of arrivals and departures. Such categories would assist a country and its development partners in the interpretation of migration statistics on a yearly basis, in making valid comparisons between countries and in using the statistics in conjunction with other demographic and socio-economic data for planning purposes.

Data generated from authoritative sources during the 1990s show an increasing inflow of refugees into Kenya. As social and economic problems deepen, refugees have been lumped together with foreigners in general and have been seen as increasingly threatening the job market, the utilisation of the overstretched social services and, in some cases, threatening law and order in the country. There is a need for more detailed

data on refugees to provide more insights of these forced immigrants, including prospects for their permanent stay in the country or return to their countries of origin or third countries.

As the refugee population calls for special attention, future censuses need to collect data on refugees and all foreigners granted asylum in Kenya. Although refugees and asylum seekers constitute an anomalous category, it is extremely important given their influx that the country has had to contend with in recent years.

Like refugees, internally displaced persons (IDPs) constitute a special category of population among whom collection of data may turn out to be a difficult exercise. For a country like Kenya where the number of IDPS exploded at the turn of the 1990s, it will be essential to employ special psycho-social methods in collecting data among them in future censuses or, better still, surveys. As a traumatised lot, the IDPS might not give as accurate response to census questions as expected, especially where the information sought includes places of birth and migration since a certain date preceding a census. Perhaps IDP surveys preceding a census could reveal some useful facts about how best to handle this category of the national population.

On urbanisation, the ambiguity of "core urban" and "local authority" boundaries calls for policy decisions on a clear definition of enumeration areas in censuses. Housing data as well as other socio-economic data can permit the separation of urbanised and rural parts of the settlements designated as urban centres. There are different approaches to determine urban centres in different countries in the world. However, Kenya has consistently used population size (a threshold of 2,000 people in a settlement) as the criterion for determining an urban centre. For some urban areas, there has been reclassification of formerly rural territory, resulting in the expansion of boundaries that include both the "core urban" and "local authority" (e.g. municipal, town council) boundaries. Urbanisation policy should of necessity acknowledge both urbanised and rural parts of urban centres so defined, which clearly have contrasting demographic and socio-economic characteristics. It is erroneous to assume that the urban centres based on demographic criterion alone captures this contradiction, which places urban planning and management in great difficulties. By distinguishing between the two confusing urban boundaries, it is possible, for instance, to estimate the exact contribution of rural-urban migration vis-à-vis that of natural increase (the difference between births and deaths) to urban population change. This is the essence of the "urban component method", which explains the roles of factors determining urbanisation, a methodology once successfully applied to Kenya's 1969 and 1979 census data (Oyugi, 1991). A major shortcoming is the subdivision of districts in 1989-1999, which has constrained comparison of net migration at district level, except in cases where the new boundaries could easily be determined.

Population Growth

Population enumerated in successive censuses has consistently fallen short of projected population. This is partly because of unstable population dynamics and because of errors of omission and commission during census enumeration. However, as the shortfall is not too large to render census figures questionable, the data remain of high quality, permitting credible estimates and projections.

A major shortcoming remains analytical interpretation of the relationship between population variables and housing variables that have been included in the last three censuses on Population and housing. It calls for two possible suggestions. First, there is a need to publishing a monograph on population and development interrelationship in which the variables of the two phenomena would be more thoroughly analysed. Secondly, it is necessary for population and development specialists to prepare occasional population and development policy papers to inform policy and stimulate new programmes on the interplay between population and development.

6.3 Population Dynamics and Development in Kenya

Kenya's censuses provide two perspectives of national statistics. The census exercise between 1948 and 1979 underpinned the collection of purely demographic statistics only. With the realisation that an extricable relationship exists between population and development, the last two censuses, in 1989 and 1999, were conveniently called "Population and Housing Census". The relationship, obliquely touched on at the World Population Conference (in Bucharest, 1974) and more frontally at the International Conference on Population (in Mexico, 1984) and the International Conference on Population and Development (in Cairo, 1994), is not only reciprocal but also as dynamic as the two phenomena. For a household-based exercise such as the population census, housing poses a special challenge to the household composition, welfare, quality of health and so on.

The country's declining fertility and rising mortality results in a relatively slow rate of population growth, which in turn tends toward the small family norm as household sizes shrink, fewer people will require equally smaller housing units with basic amenities. Depending on household incomes, households would have better prospects for improving housing quality and, therefore, environmental sanitation.

Although Kenya has a population momentum that might increase the population size before the country enters a demographic transition (low fertility and low mortality, resulting in a slow population growth rate), its demographic profile will inevitably be conducive to socio-economic development. Fewer children will most likely gain full enrolment in schools and presumably better pupil/student-teacher ratio and improved educational quality. Such a demographic profile would enhance the country's capacity to provide adequate education and health facilities for the population, thus improving human resources for national development. A more slowly growing population is likely to expand the size of working age population, in the process reducing the dependency

burden.

Currently, declining fertility and increasing mortality portend a bleak demographic scenario as the HIV/AIDS epidemic continues unabated. The scourge will adversely affect both the size quality of population; it is already distorting the age structure of population; its selectivity of the population in the prime ages (15-49) and will soon create artificial labour shortages; and the dependency burden is aggravating due to a fast growing number of orphans and the widowed. This epidemic now confounds the plausible effects of population on development and vice versa. Thus, the use of population data for planning may become more meaningless unless other techniques are devised to estimate and project population in the course of and in the wake of HIV/AIDS.

The future of censuses will depend on improved collection, and more importantly, rigorous analysis of the interplay between population and development. To this end, a monograph on population and development would be a welcome addition in future censuses because, it would, among other things, improve our understanding of the interrelations between the two phenomena, and not least fulfil the objectives of the third version of Kenya's population policy: population and sustainable development.

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Appendix 1: Census Questionnaire

Appendix 2: List of Contributors

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