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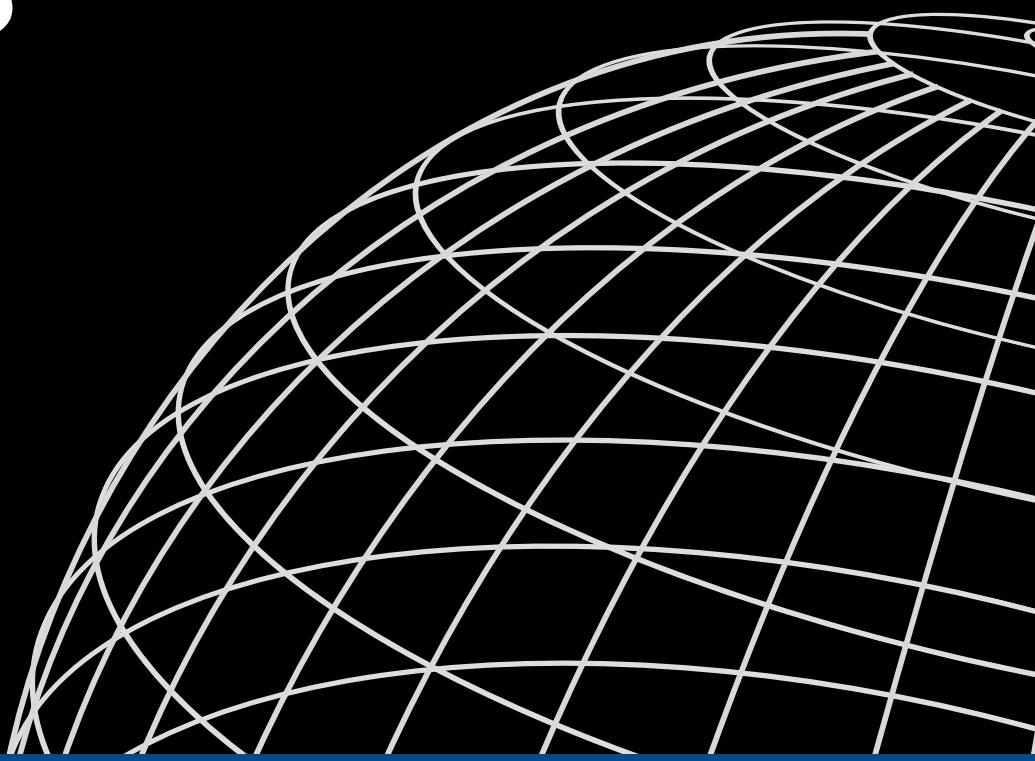
CHANGES IN THE DIRECT AND INDIRECT DETERMINANTS OF FERTILITY IN SUB-SAHARAN AFRICA

DHS ANALYTICAL STUDIES 23



SEPTEMBER 2011

This publication was produced for review by the United States Agency for International Development. It was prepared by Kiersten Johnson, Noureddine Abderrahim, and Shea O. Rutstein of ICF Macro.

MEASURE DHS assists countries worldwide in the collection and use of data to monitor and evaluate population, health, and nutrition programs. Additional information about the MEASURE DHS project can be obtained by contacting MEASURE DHS, ICF Macro, 11785 Beltsville Drive, Suite 300, Calverton, MD 20705 (telephone: 301-572-0200; fax: 301-572-0999; e-mail: reports@measuredhs.com; internet: www.measuredhs.com).

The main objectives of the MEASURE DHS project are:

- to provide decisionmakers in survey countries with information useful for informed policy choices;
- to expand the international population and health database;
- to advance survey methodology; and
- to develop in participating countries the skills and resources necessary to conduct high-quality demographic and health surveys.

DHS Analytical Studies No. 23

Changes in the Direct and Indirect Determinants of Fertility in Sub-Saharan Africa

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September 2011

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Editor: Bryant Robey
Document Production: Yuan Cheng

This study was carried out with support provided by the United States Agency for International Development (USAID) through the MEASURE DHS project (#GPO-C-00-08-00008-00). The views expressed are those of the authors and do not necessarily reflect the views of USAID or the United States Government.

Recommended citation:

Johnson, Kiersten, Noureddine Abderrahim, and Shea O. Rutstein. 2011. *Changes in the Direct and Indirect Determinants of Fertility in Sub-Saharan Africa*. DHS Analytical Studies No. 23. Calverton, Maryland, USA: ICF Macro.

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Preface

One of the most significant contributions of the MEASURE DHS program is the creation of an internationally comparable body of data on the demographic and health characteristics of populations in developing countries.

The *DHS Comparative Reports* series examines these data across countries in a comparative framework. The *DHS Analytical Studies* series focuses on analysis of specific topics. The principal objectives of both series are to provide information for policy formulation at the international level and to examine individual country results in an international context.

While *Comparative Reports* are primarily descriptive, *Analytical Studies* comprise in-depth, focused studies on a variety of substantive topics. The studies are based on a variable number of data sets, depending on the topic being examined. A range of methodologies is used in these studies including multivariate statistical techniques.

The topics covered in *Analytical Studies* are selected by MEASURE DHS staff in conjunction with the U.S. Agency for International Development.

It is anticipated that the *DHS Analytical Studies* will enhance the understanding of analysts and policymakers regarding significant issues in the fields of international population and health.

Ann Way
Project Director

Executive Summary

This report tracks changes in fertility and its determinants in 13 sub-Saharan countries that have had three or more DHS surveys and show at least some evidence of beginning a fertility transition. The countries included are Benin, Burkina Faso, Cameroon, Ghana, Kenya, Madagascar, Malawi, Namibia, Rwanda, Senegal, Tanzania, Zambia, and Zimbabwe. In some of these countries, notably Namibia, there has been a consistent downward trajectory in the total fertility rate (*TFR*). In most countries, however, there was little change from approximately 1995-1999 to approximately 2005-2009, a pattern often described as a "stalled" fertility decline.

The goal of the study is to inform fertility-related population policies, largely from the perspective of women's ability to implement their fertility preferences and to avoid risks associated with births that are too early, too late, or too close. In most of these countries, women have high levels of unplanned births, with less use of contraception than their preferences would imply.

The determinants of fertility are of two types. The "direct" or "proximate" determinants are behavioral mechanisms that act to reduce fertility to less than its theoretical or biological maximum. These are primarily of three types: non-marriage, or reduced exposure to the risk of conception; post-partum amenorrhea, which can be substantially extended by prolonged breastfeeding; and contraceptive use. These three proximate determinants are measured well by DHS surveys. A fourth proximate determinant in the decomposition originally developed by John Bongaarts is induced abortion, which has its effect after conception. Most DHS surveys do not provide estimates of the use of abortion, but there is evidence that it may be significant in some countries.

The "indirect" determinants, sometimes simply labeled "background variables", are socio-economic or contextual characteristics that influence fertility through changes in the proximate determinants, that is, indirectly. In this study, these are assessed nationally at, or near to, the date of each survey. They include the desired number of children, national family planning effort, under-five mortality, level of education, female participation in the workforce, and type of place of residence. Each of these factors has well-established associations with fertility. In addition, this study tracks four indicators of whether women's fertility preferences are being satisfied or whether public health messages related to fertility are being effective, specifically the percentage of births that are wanted; the percentage of births that are to women under 18; the percentage of births that are to women over 34; and the median length of the birth interval.

In most countries, it is found that contraceptive use has been increasing, if only modestly, during the entire series of surveys. Benin and Ghana were the only countries where the fertility-reducing effect of contraception actually reversed between 2000-2004 and 2005-2009. However, fertility decline sometimes stalled, despite an increase in contraception, because of a countervailing trend in non-marriage or post-partum infecundity, predominantly the latter. For example, in all countries observed in 2000-2004 and again in 2005-2009, other than Ghana and Malawi, a reduction in breast-feeding resulted in a shorter period of post-partum amenorrhea and more exposure to the risk of childbearing, tending to neutralize the small increases in contraception.

The analysis is not multivariate, in the sense of statistically articulating the roles of the direct and indirect determinants, and identifying precise pathways that connect them. Moreover, changes in the direct determinants were not consistent or monotonic, either between or across countries. Nevertheless, a description of the patterns within each country helps to clarify how socio-economic development may or may not translate easily into fertility decline.

1. Introduction

1.1 Informing fertility-related population policy priorities through an examination of trends in the determinants of fertility

Current fertility-related population policy and program priorities focus on helping women avoid unintended pregnancy and improve maternal and child health. Millennium Development Goal Number 5, "Improve Maternal Health," incorporates among its key indicators of progress the adolescent birth rate and unmet need for family planning, both of which are fertility-related outcomes. Fertility-related objectives set forth in the 1994 International Conference on Population and Development Programme of Action include helping couples and individuals to meet their reproductive goals in a framework that promotes optimum health, responsibility and family well-being, and respects the dignity of all persons and their right to choose the number, spacing and timing of the birth of their children; and to prevent unintended pregnancies and reduce the incidence of high-risk pregnancies and morbidity and mortality.

Although fertility-related policy priorities are clearly in place at the international level, demographers have only infrequently incorporated insights from classic proximate determinants models of fertility to inform programmatic approaches to these policy objectives. These models can help integrate trend data on total fertility rates, proximate determinants of fertility, and priority fertility-related outcome indicators, and provide a multi-dimensional assessment of change over time to inform programmatic decisionmaking that responds to policy demands.

The purpose of this analysis therefore is to inform fertility-related population policy priorities by examining trends in the proximate determinants of fertility, as derived from models originally developed by John Bongaarts (1978), along with trends in background variables and key outcome indicators reflecting women's reproductive options and maternal and child health policy priorities, with a focus on selected sub-Saharan African countries. This approach can provide insights into fertility dynamics and possible points of programmatic intervention.

For these analyses we use data from the Demographic and Health Surveys (DHS) from 13 sub-Saharan African countries that have implemented three or more surveys and whose fertility rates have begun to decline. We first assess change over time in the contribution to fertility made by each of the three measurable proximate determinants in the Bongaarts model: non-marriage, contraception, and infecundity. The fourth of the original proximate determinants, abortion, is not measured in most DHS. We examine trends in four relevant background factors: level of education, work force participation, urban residence, and per capita income. An additional four fertility-related key outcome indicators reflect policy priorities regarding women's reproductive options: planning status of the most recent birth in the past five years; percentage of births to women under age 18; percentage of births to women over age 34; and the median length of birth intervals.

For each country in the analysis, we provide a summary assessment of the recent trends in fertility and in the proximate determinants of fertility, with a focus on meeting women's needs regarding the prevention of unwanted births and maternal and child health indicators that reflect current fertility-related policy priorities.

1.2 Overview of the theoretical framework used in this analysis

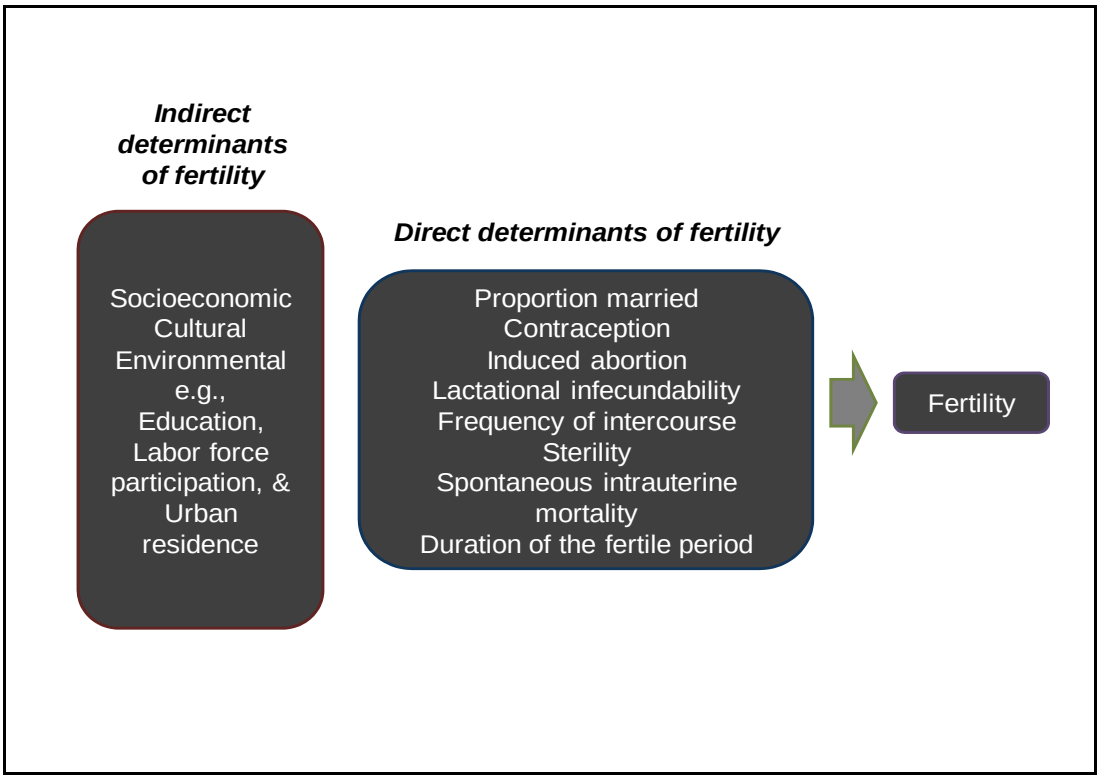
In 1978, John Bongaarts proposed a simple framework to analyze differentials and changes in fertility based on the proximate or direct determinants—that is, those elements which, if changed, would causally

result in a change in overall fertility levels, all else being equal. Background or indirect determinants are those factors that influence the direct determinants and thereby influence fertility.

For this analysis, we follow this framework both theoretically and operationally. In addition to using the proximate determinants conceptual framework (Figure 1) to guide our analytical approach, the analysis uses indices derived from Bongaarts' models to show the relative contribution of each of the three measurable proximate determinants of fertility (non-marriage, contraception, and infecundity) to total fertility rates in the country at the time of each survey.

We examine trends in the indices from the Bongaarts models and, concomitantly, the trends in observed total fertility rates, within the context of selected relevant background variables or indirect determinants of fertility. This approach is expected to provide insight into variations in fertility over time in each of the selected sub-Saharan African countries.

Figure 1. Bongaarts framework for analyzing the proximate determinants of fertility. (Bongaarts, 1978)



2. Data

2.1 Countries included in the analysis

With a focus on examining change in fertility over time in sub-Saharan Africa, the analysis includes 13 sub-Saharan African countries that have implemented three or more DHS Surveys. The countries included are Benin, Burkina Faso, Cameroon, Ghana, Kenya, Madagascar, Malawi, Namibia, Rwanda, Senegal, Tanzania, Zambia, and Zimbabwe. Some of these countries have shown little or no decline in their total fertility rate (*TFR*) across the more recent surveys, a pattern characterized as a "stalled" fertility decline that is of particular interest. Others have shown a continuous decline in fertility.

Schoumaker (2009) suggests that a fertility transition has begun when either the *TFR* or the average number of children ever born among women age 40-49 has declined by at least 10 percent since a previous survey. We have not followed a strict cutoff for inclusion, but all the countries in the analysis have had a period of fertility decline, even if it was not sustained.

Mali, Niger, and Uganda have had at least three DHS surveys but have been excluded on the basis of clearly not having entered a fertility transition. Nigeria has been excluded because of an insufficient number of data points. The 1999 Nigeria survey was not implemented by the DHS program and its data are known to be of poor quality. When that survey is excluded, only two comparable DHS surveys are available for Nigeria.

2.2 Variables included in the analysis and sources of data

This analysis uses data both from DHS individual recode files as well as published data for national-level estimates of the proximate determinants and relevant socioeconomic background characteristics.

For the calculation of the Bongaarts models, including *TFR*s and the Bongaarts indices of the proximate determinants of fertility (index of non-marriage, index of contraceptive use, and index of infecundity), individual data files were analyzed using CSPro software. The *TFR* is calculated from births and exposure during the three years (36 months) prior to each woman's month of interview. The nominal date of a *TFR* is the year of the survey, but it should be understood that the reference period is prior to that. The reference period for the proximate determinants is also prior to the date of interview except for contraception, which is based on current contraceptive use. In terms of synchronization, the link between fertility and contraception is problematic. For individual women, contraception affects subsequent fertility, but in the data, fertility is measured for an earlier date than contraception.

Published data drawn from DHS final reports and STATcompiler provided trend data for national-level estimates of indicators related to the proximate determinants of fertility: median age at marriage, percent of currently married women using a contraceptive method–broken into two types of use, for spacing or for limiting—and the median number of months of postpartum infecundity. We also used STATcompiler and final reports to obtain trend data for estimates of background variables: mean desired number of children, five-year under-five mortality rates, percentage of women with secondary or higher education, percentage of women who report working in the past year (seasonally or year-round), and percentage of the sample who live in areas designated as urban. Note that the designation of a location as urban or rural is not standardized across surveys but rather is determined at the country level by the national statistical office.

Trends in background characteristics include the family planning effort index (FPEI) score, which is meant to provide an indication of the performance of national family planning programs (Ross and Smith

2010). It should be noted that the FPEI has been critiqued for its subjective nature, given that it relies on a limited number of key informants within the national government to provide an assessment of performance (Bertrand and Escudero 2002). The Ross and Smith (2010) report provides scores on a five-year basis that roughly corresponds with the DHS five-year survey cycle. Surveys for which there is no FPEI score provided for the exact year of survey use the FPEI score for the closest available year.

We also include trend data for gross national income (GNI) per capita (Atlas method), which provides a rough indication of national economic performance, measured with per capita income. The World Bank data on GNI per capita were obtained for the year of the survey via the "Quick Query" database available on the World Bank website.

The key indicators that reflect fertility-related international policy and program priorities include planning status for most recent birth in the past five years, percent of children born to mothers under age 18, percent of children born to mothers over age 34, and the median length of the birth interval (in months). Data for these indicators were drawn from STATcompiler and DHS final reports.

2.3 Data quality

Some researchers, notably Schoumaker (2009), have called into question the quality of the fertility data in the DHS, and whether it is sufficient to reliably reflect fertility trends. We accept the evidence that variation in the quality of the fertility data may affect the interpretation of trends, and applaud Schoumaker's careful review of the quality of DHS fertility data.

However, we also note that in most cases Shoumaker's analysis was limited to countries with only two data points, while our study is restricted to countries with three data points, thus providing more of a trend line for analysis–and for spotting anomalous fertility rates that could be the result of data quality problems.

The country with the worst data quality problems in one of its surveys, Nigeria and its 1999 survey, weighs heavily in Schoumaker's assessment of DHS data quality. It has been removed from the analysis altogether, for the reasons noted above.

Finally, the aim of this analysis is not to determine which countries should be considered to have a stalled fertility decline, but rather to understand the relationships among the proximate determinants of fertility over time in each country, and how those relate to key fertility-related population and health outcome indicators. We recognize the importance of data quality concerns but consider that for the purposes of our analysis, the DHS data on fertility, the proximate determinants of fertility, and the fertility-related outcome variables that reflect policy priorities are of sufficient quality.

3. Methods: The Bongaarts Model

The central analysis in this paper consists of an examination of trends in the Bongaarts indices of the proximate determinants of fertility in order to examine the role that each determinant has played in shaping the fertility trajectory in each country.

In the Bongaarts model, the relative importance of each of the proximate determinants of fertility is expressed with an index that can vary from 0 to 1, where 1 indicates no reduction of fertility by the determinant, and values closer to 0 indicate more reduction.

The original Bongaarts (1978) model may be written as $TFR = TF * C_m * C_c * C_i * C_a$,

where *TFR* = total fertility rate
TF = total fecundity
C_m = index of non-marriage
C_c = index of contraception
C_i = index of postpartum infecundability
C_a = index of induced abortion

The *TFR* is interpreted as the average number of children that a woman would have during ages 15-49 if she survived that age range and had children at the current age-specific fertility rates. Total fecundity (*TF*) is a hypothetical or potential value that the *TFR* would take if all four of the *C* indices were exactly 1, that is, if there were no non-marriage (if all women were married from ages 15 to 49), no contraception, no postpartum infecundability (beyond a minimum of 1.5 months) and no induced abortion. *TF* cannot be calculated directly. If all of the *C*'s can be estimated, then *TF* can be estimated as $TF = TFR/(C_m * C_c * C_i * C_a)$, but the main interest is in the *C*'s rather than in *TF*.

With the exception of the index of induced abortion, each of the indices can be estimated from survey data to assess the relative contribution of each proximate determinant to the level of fertility. Because in most countries induced abortion is illegal or legal only if stringent criteria can be met, and because of the high incidence of maternal mortality associated with unsanitary abortions, it is not possible to obtain valid survey data on induced abortion in most countries, with the possible exception of Eastern European countries. Therefore the index of induced abortion must be omitted from our analysis.

A number of modifications to the original proximate determinants model have been proposed. Bongaarts, Frank, and Lesthaege (1984) incorporated an index of pathological sterility to account for the fertility-inhibiting effects of both primary and secondary sterility. Bongaarts and Kirmeyer (1982) gave an age-specific version of the model, motivated by the fact that underlying fecundity varies by age, and the impact of the indices also varies by age. In our analysis, for simplicity, the original form of the model (except for omitting the index of induced abortion) is used.

If unmeasured components of the model are dropped (assumed to be 1), they are implicitly consolidated with *TF*, making it harder to interpret *TF*. Ishida, Stupp, and Oronez Sotomayor (2009) proposed setting a fixed value of *TF*, based on a synthesis of empirical studies, and then using that fixed value, together with the calculated values of the *C*'s, to construct a predicted or implied value of the *TFR* using $\widehat{TFR} = TF * C_m * C_c * C_i * C_a$. This is one possible way to obtain consistency. We find it difficult to interpret $\widehat{TFR}$, because it will be directly proportional to TF, a number whose "true" value is not known but is certainly not a constant, particularly when the index of induced abortion is omitted.

The present analysis modifies the formula in another way to express the fact that the observed *TFR* and the three calculated *C*'s may not be consistent with a fixed *TF*. *TF* is set at an arbitrary but plausible value, 15.3, and the decomposition is re-stated as $TFR = (15.3 * R) * C_m * C_c * C_i$, where the extra factor *R* is an adjustment calculated by $R = TFR/(15.3 * C_m * C_c * C_i)$. *R* is labeled a "residual adjustment" because it combines the unmeasured value of C_a along with other unmeasured components. It can be interpreted as a multiplicative adjustment to $TF = 15.3$ that would be required to achieve internal consistency of the model. *R* varies somewhat from survey to survey and country to country, primarily because of (a) variation in the true value of *TF*; (b) omission of the term for abortion and other proximate determinants in Figure 1; (c) measurement error, including sampling error and fluctuations in data quality; (d) the fact that the decomposition ignores age; and (e) the imperfect synchronization of the measurements. The calculated value of *R* is given for each survey (Table 1). *R* will typically be close to 1, but unlike the *C*'s, it can be larger or smaller than 1. For *R*, as with the *C*'s, the interest here is mainly in change over time within the same country. In the discussion of specific countries, little reference is made to *R*. Any substantial fluctuations in the value of *R* will imply that the model does not fit well for a combination of factors (a) through (e) given earlier in this paragraph.

3.1 Index of non-marriage

The index C_m describes the reduced exposure to the risk of conception because of non-marriage. By definition the index of non-marriage is the ratio of the total fertility rate (*TFR*) to the total marital fertility rate (*TM*). That is, $C_m = TFR/TM$. *TM* is the average number of children that a woman would have during ages 15-49 if she survived that age range and had children at the current age-specific rates for ever-married women. These rates include all births but are limited to ever-married women, and are therefore larger than the usual age-specific fertility rates. Following standard practice, "marriage" is equivalent to "living together as married" and no adjustment is made for interruptions to marriage or co-habitation. If all women marry at age 15, then C_m will be 1; otherwise it will be less than 1.

3.2 Index of contraception

The index of contraception, C_c, varies inversely with the prevalence and use-effectiveness of contraception practiced by couples. The index of contraception is calculated as $C_c = 1 - 1.08 * u * e$, where *u* is the overall proportion of married women currently practicing contraception; *e* is the weighted average of contraceptive use-effectiveness using the proportions of current contraceptive users of each method as weights; 1.08 is a sterility correction factor. If no couples used contraception, or they only used completely ineffective methods, then C_c would be 1; otherwise it will be less than 1.

3.3 Index of infecundability

Normally, following a birth and in the absence of breastfeeding, approximately 1.5 months will elapse before the physiological risk of conception resumes. Postpartum infecundity is extended by breastfeeding. The index of infecundability, C_i, essentially describes the reduced risk of exposure to conception because of extended breastfeeding, although it may include other sources of amenorrhea. Based on empirical evidence, Bongaarts quantified this effect with the formula $C_i = 20/(18.5 + i)$, where *i* is the median number of months of postpartum infecundity. If *i* is 1.5, its minimum possible value, then C_i will be 1; otherwise it will be less than 1.

In the Bongaarts model, for a woman to be infecund, she needs to fall into any of three categories:

- Did not menstruate in the past six weeks;
- Is not currently using a contraceptive method, has no children, has been married for five years or longer, and did not discontinue a method in the past five years; or

- Is not currently using a contraceptive method, has had children but not in the past five years, and did not discontinue a method in the past five years.

Discontinuation of a contraceptive method is available only for countries that have implemented questionnaires that included the calendar, particularly the calendar column on discontinuation. For countries where the DHS did not include the calendar, the question on discontinuation was not included. Since not all surveys included in this study have data on discontinuation, in this analysis, all women were considered as if they *did not* discontinue a method in the five years preceding the survey.

4. Results

In this section, results and discussion of the analysis for each country are presented, with the discussion and graphs presented together. For each country, three graphs are presented. Each describes changes across the three most recent surveys:

Total fertility rate. The observed *TFR* based on all women and births during the three years before the DHS survey. These *TFR*s, also given in Table 1, match those given online by STATcompiler and those in the published country reports (except that a few reports used the most recent five years rather than three years). In country analyses, differences between surveys are taken at face value, without specific comments on sampling error, non-sampling error, data quality, and other sources of uncertainty in the numerical values.

Proximate determinants. The indices of the proximate or direct determinants of fertility from the Bongaarts models: the index of non-marriage; the index of contraception; the index of infecundity; and the product of the three. These numbers also appear in Table 1, along with the residual adjustment *R* described above, which is a consolidation of unmeasured proximate determinants.

Indirect determinants. Selected background characteristics whose influence on fertility is expressed through one or more of the proximate determinants: mean desired number of children; the under-five mortality rate; percent of women with secondary education or above; percent of women in the labor force; percent urban; and per capita income. Table 2 includes the numbers given in these graphs, as well as some measures of the proximate determinants other than the *C* indices. These include the following: mean age at marriage of women age 25-49; mean age at marriage of women age 20-29; percent of currently married women who are using a contraceptive method for spacing purposes; percent of currently married women who are using a contraceptive method for limiting purposes; median number of months of postpartum infecundity.

Table 3 includes four indicators of women's reproductive options and fertility-related international policy and program priorities: planning status of the most recent birth in the past five years; percentage of births to women under age 18; percentage of births to women over age 34; and the median length of birth intervals.

Tables 1-3 follow the country-specific presentations and discussions.

In all figures, surveys are placed at equal intervals on the horizontal axis even if the actual intervals are not equal. Figures showing the *TFR* and the *C*'s may include up to five surveys. Figures showing the indirect determinants are limited to the three most recent surveys, and for those figures, the numbers on the vertical axis apply to all seven variables in the figures.

BENIN

Total fertility rate: The observed *TFR* had an initial slight decline from 5.96 in 1996 to 5.61 in 2006, but has been relatively constant for the 10-year period. The net decline across the three surveys is only about 4 percent.

Proximate determinants: Corresponding to the fertility trends, the trends in the proximate determinants are mostly flat. Infecundity has the strongest inhibiting effect on fertility, with an index value in 2006 of 0.59. Non-marriage has the next-strongest inhibiting effect (about 0.76), while contraception plays the least significant role in shaping fertility trends (about 0.85) in 2006.

Extended postpartum infecundity, largely due to extended breastfeeding, is important but has played less of a role in reducing fertility over time, while non-marriage has become more important. In Figure 3 the bottom line shows the product of the Bongaarts indices, $C_m C_c C_i$. It is almost perfectly flat, confirming that the effects have largely cancelled each other out. In the panel for Benin in Table 1, the decline in the residual factor *R*, from 1.05 to 0.98, captures the combined effect of other factors that are responsible for the modest decline in the observed *TFR*.

Background variables: Under-five mortality has declined over time, while per capita income has increased; other variables have remained essentially flat. Improvements in mortality and per capita income suggest improvement in overall country development, key contextual elements associated with national-level fertility declines.

Indicator of satisfaction of fertility preferences: The trend in pregnancy planning status is encouraging in that, over time, women are less likely to report mistimed or unwanted fertility: In 1996, over one-quarter of women reported that their most recent pregnancy was mistimed or unwanted; this figure had declined to 18 percent by 2006.

Indicators of uptake of fertility-related public health messages: The percentage of births to women under age 18 has maintained a constant, relatively low level over time, at about 5 percent, while the proportion of births to women over age 34 has declined. The median birth interval is gradually increasing, and by 2006 had nearly attained the lower end of the recommended range of 36-59 months (3-5 years) for birth intervals.

Summary: Fertility decline in Benin appears to have stalled at fairly high levels, assuming that data quality is not impacting the trends. However, it appears to be an increasingly "healthy" stall, given that women are increasingly more likely to report that their births were wanted at the time the pregnancy occurred, birth interval length is increasing, and the proportion of births to older mothers is declining. The decrease in under-five mortality coupled with the increase in per capita income suggests that the stage is set in Benin for future fertility decline. Satisfying women's implied demand for contraceptive methods for spacing and limiting births would contribute to avoiding unintended births by increasing women's chances of having only the births that they want, at the time that they want them.

Figure 2. Changes in the observed *TFR* in Benin, DHS surveys 1996-2006

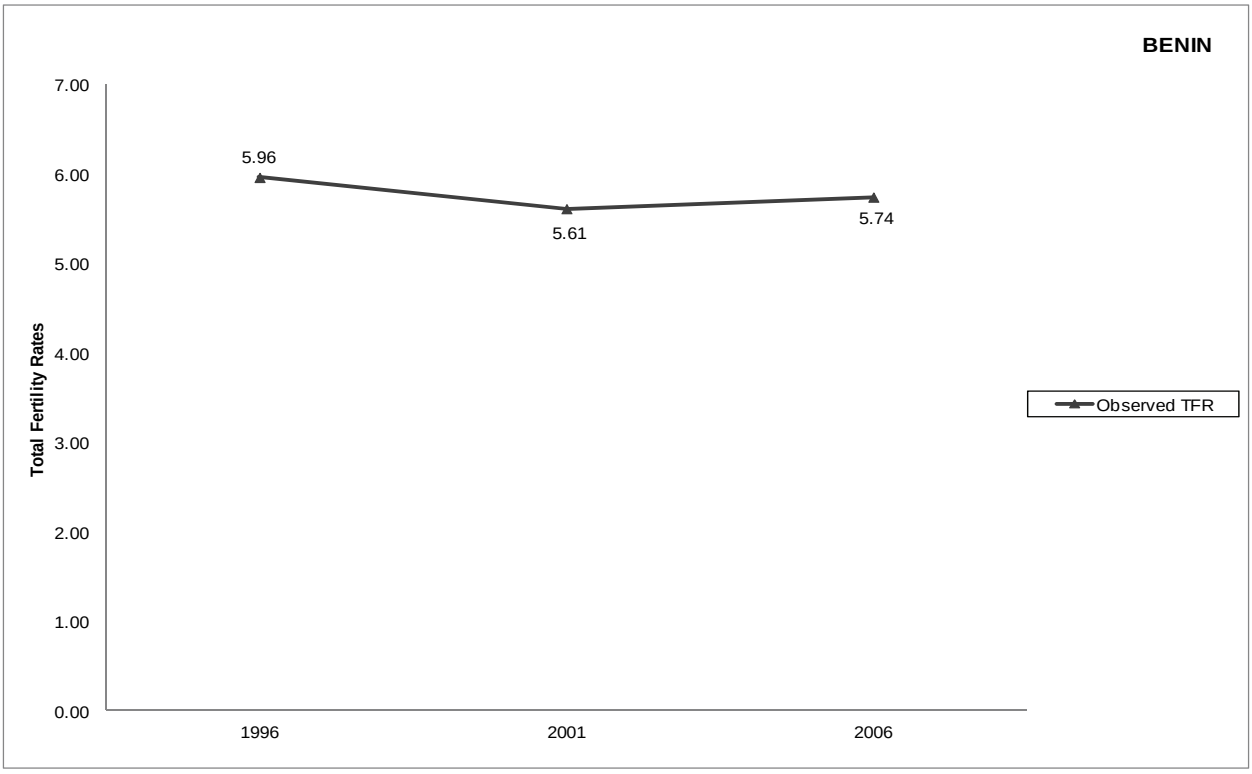


Figure 3. Changes in the proximate determinants in Benin, DHS surveys 1996-2006

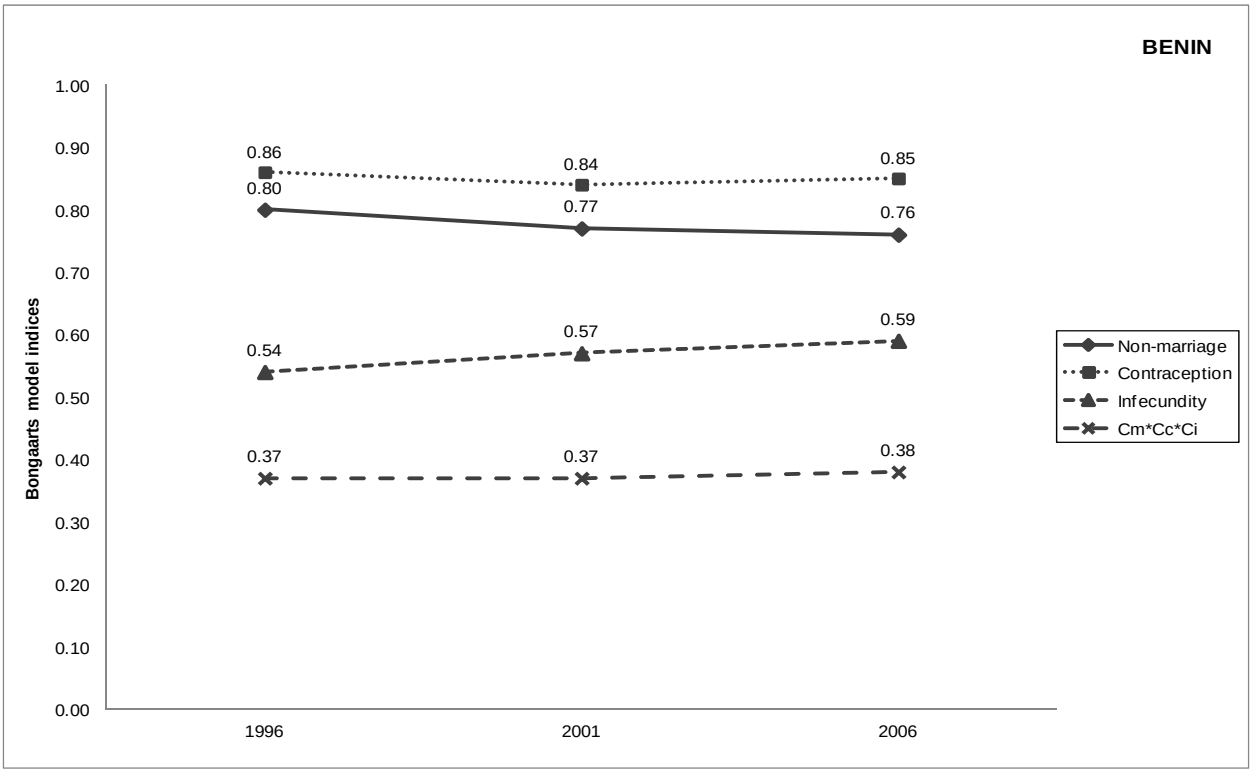
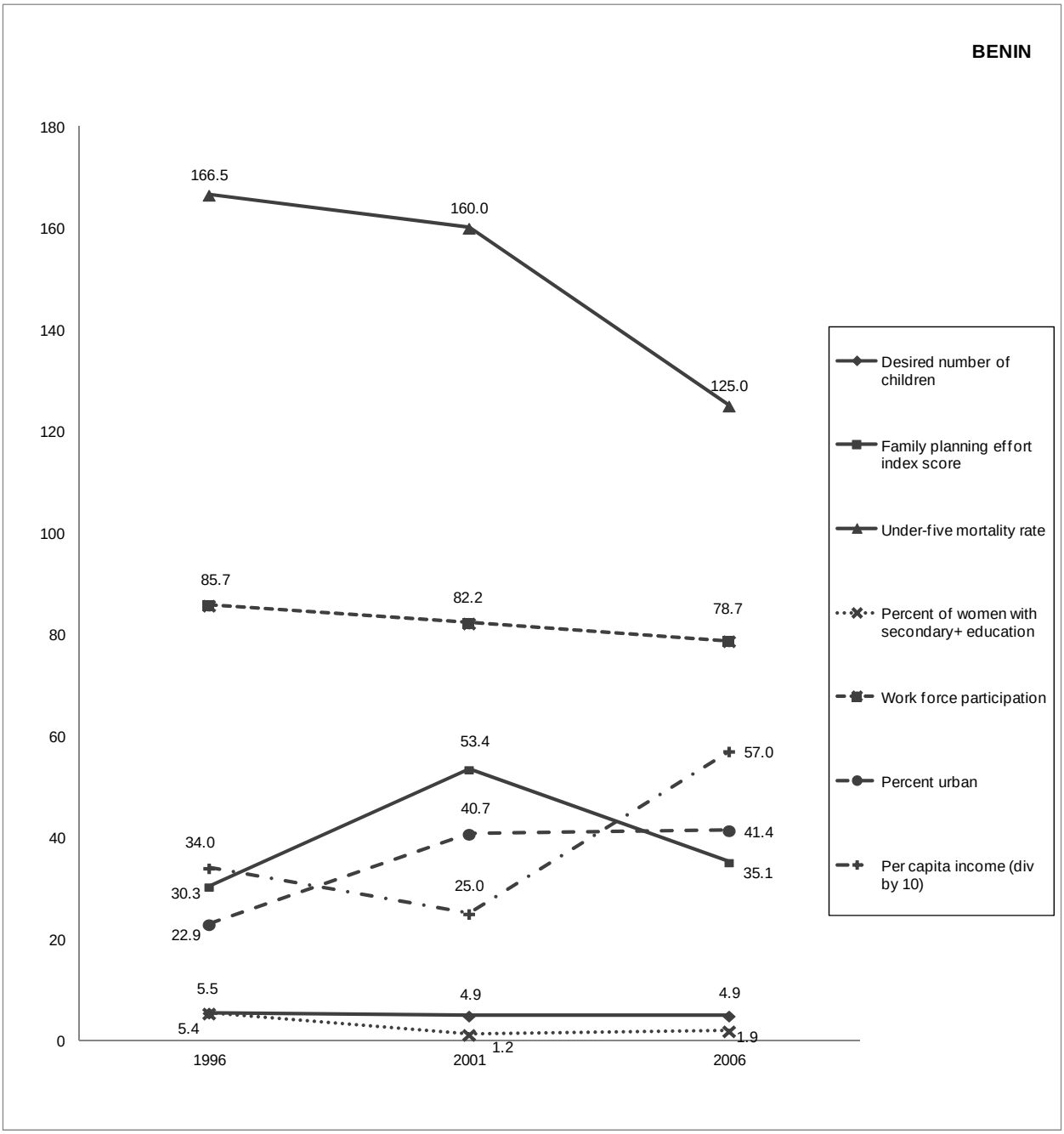


Figure 4. Changes in the indirect determinants in Benin, DHS surveys 1996-2006



BURKINA FASO

Total fertility rate: The observed *TFR* in Burkina Faso has declined gradually, from 6.52 in 1993 to 6.43 in 1999 and 5.88 in 2003; the net decline is about 10 percent.

Proximate determinants: The trends in the proximate determinants are mostly flat, with infecundity playing by far the greatest role in inhibiting fertility (with an average index value of 0.50 over the three survey years). Initially, contraception played a slightly larger role than non-marriage in shaping fertility trends; however, this relation changed, as non-marriage became a relatively more important fertility-inhibiting factor over time. Nevertheless, the index values of non-marriage and contraception, both over 0.80 in 2003, demonstrate the minimal effect these two determinants have on fertility in Burkina.

As with Benin, the combined effect of the three proximate determinants (the bottom line in Figure 6) is almost perfectly flat, implying that other (unmeasured) proximate determinants or factors are responsible for the modest decline in the observed *TFR*.

Background variables: Under-five mortality has essentially remained constant in Burkina Faso, despite an apparent increase in the 1999 survey year. Women's participation in work activities has increased over time; other variables remain flat.

Indicator of satisfaction of fertility preferences: The trend in pregnancy planning status has also remained flat. More than one-fifth of women report that their last pregnancy was unplanned–mistimed or unwanted.

Indicators of uptake of fertility-related public health messages: The percentage of births to women under age 18 has stayed at about 6 percent over the period covered by the three surveys, while the proportion of births to women over age 34 has held constant for the most recent two surveys, at a high level of 18 percent. The median birth interval appears to have increased by one month and is close to the lower end of the recommended range for birth intervals.

Summary: In Burkina Faso, fertility levels have declined very slowly, and the proximate determinants of fertility have changed little over the three survey periods. Failure to attain fertility preferences, as indicated by the planning status of women's most recent birth, has maintained a constant and high level; more than 20 percent of pregnancies that resulted in live births were either mistimed or unwanted at the time of conception. There has also been no decline in the proportion of births to mothers over age 35. There has been no decline in under-five mortality and no increase in per capita income. A policy approach that invests in ensuring that women's fertility preferences are met, and that improves the outreach of public health programming to encourage completion of childbearing prior to age 35, would help to improve the reproductive health situation for women in Burkina Faso, particularly if implemented in a context characterized by improvement in key development indicators, including under-five mortality.

Figure 5. Changes in the observed *TFR* in Burkina Faso, DHS surveys 1993-2003

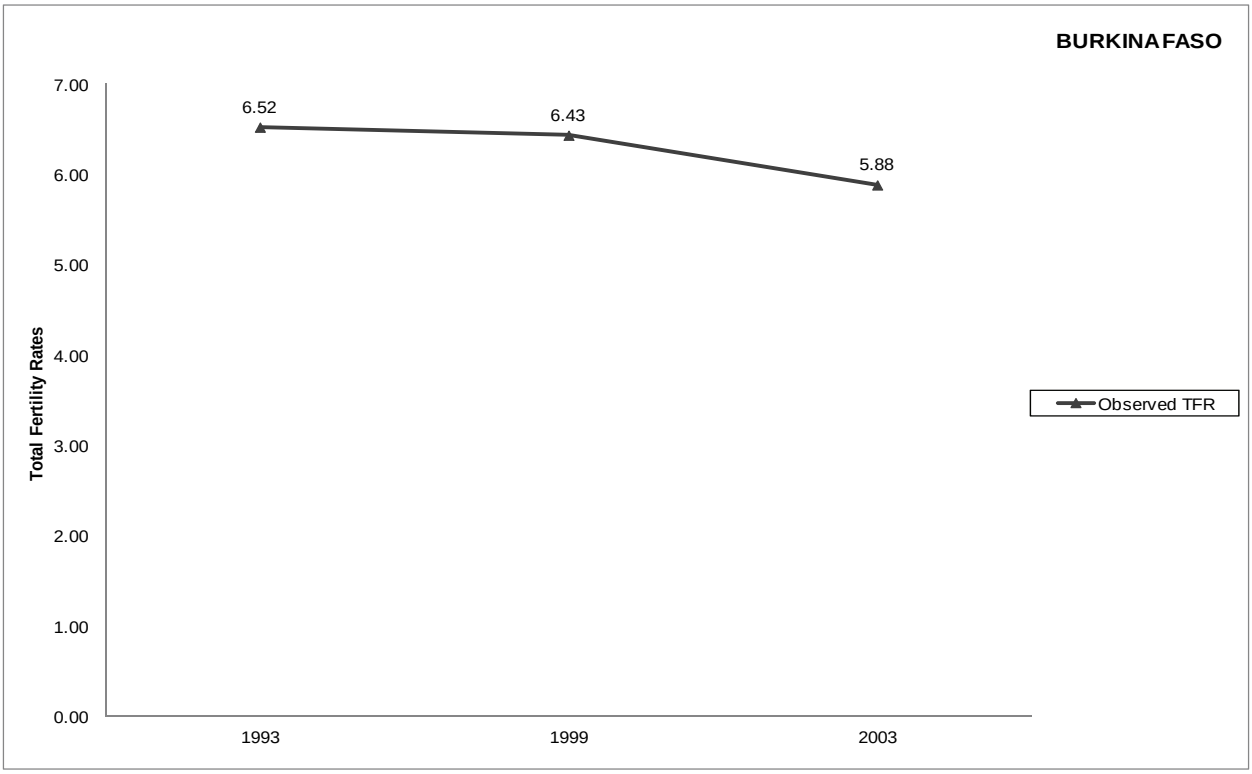


Figure 6. Changes in the proximate determinants in Burkina Faso, DHS surveys 1993-2003

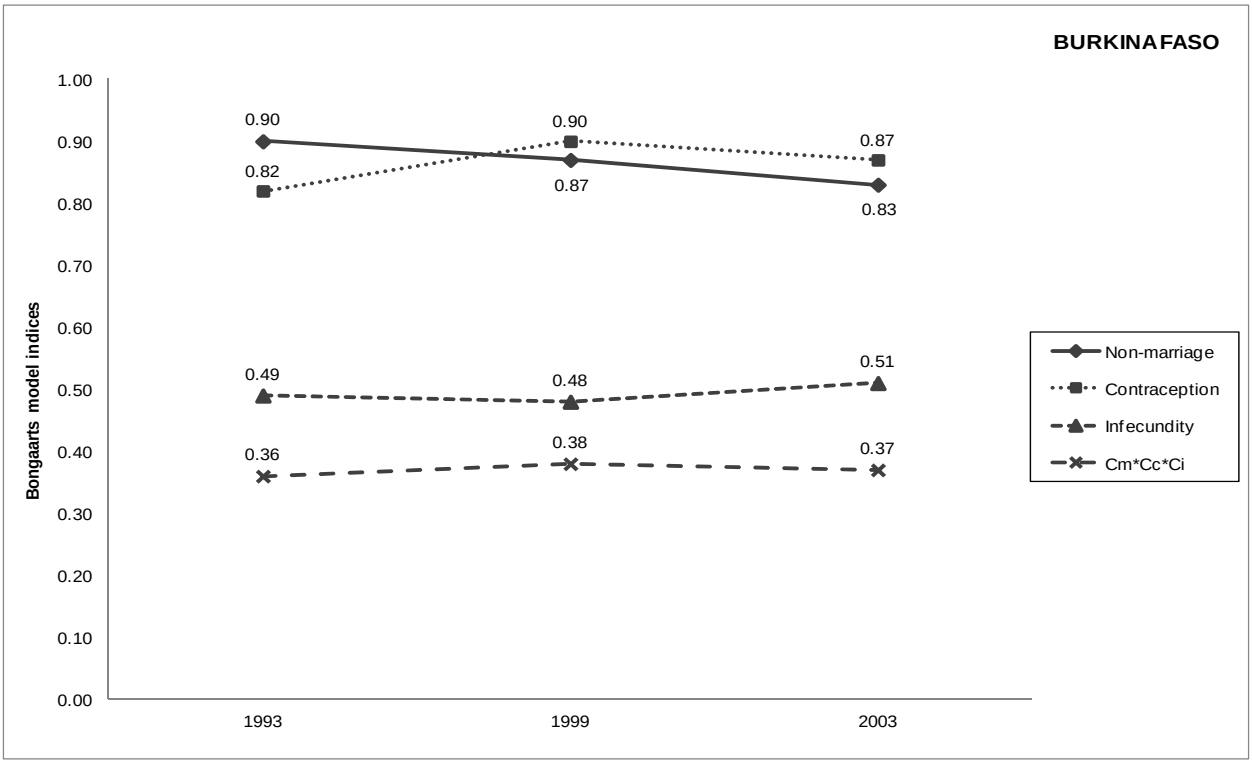
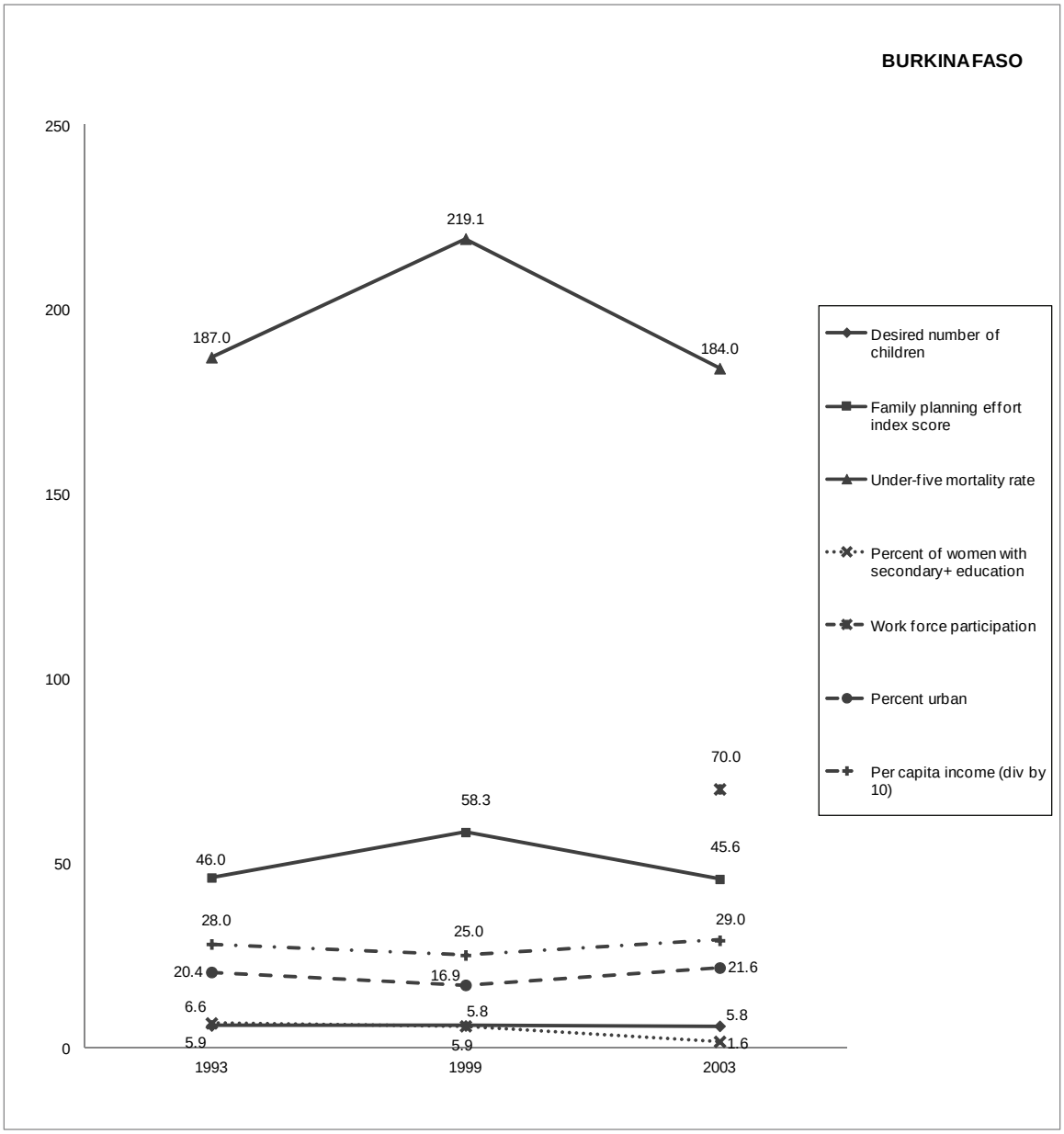


Figure 7. Changes in the indirect determinants in Burkina Faso, DHS surveys 1993-2003



CAMEROON

Total fertility rate: Cameroon registered a substantial decline in fertility between the 1991 and 1998 surveys, but between 1998 and 2004 the decline in fertility appears to have either stalled or possibly reversed. The observed *TFR* remains high, at 4.97 births per woman. The net decline across the three surveys was about 15 percent, completely concentrated between the first and second survey.

Proximate determinants: Across the three surveys, contraceptive use exerted a steadily increasing inhibiting effect on fertility, with index values declining from 0.85 in 1991 to 0.76 in 2004. However, the trend in contraception was offset by a steadily upward trend in the infecundity index, which has increased from a value of 0.57 in 1991 to 0.63 in 2004. Because these trends cancelled each other out, the observed change in the *TFR* can be traced to the third measured component, non-marriage, which acted to reduce fertility between the first and second surveys and then slightly reversed between the second and third surveys. Thus, despite considerable increases in the uptake of contraception (in 1991, 4 percent of married women used a modern contraceptive method compared with 22 percent in 1998 and 47 percent in 2004; data obtained from STATcompiler), fertility appeared to stall between the second and third survey.

Background variables: The proportion of women living in urban areas and attaining secondary or higher levels of education has increased over time. However, at the national level, under-five mortality has not declined. The trend in per capita income–among the highest of the countries studied–is flat over the course of the 15 years represented by these surveys; however, there was a drop in income during 1998, which coincided with an increase in mistimed/unwanted fertility, suggesting a particularly difficult economic period for the country.

Indicator of satisfaction of fertility preferences: Trends in pregnancy planning status have remained fairly flat: For the past 15 years, more than one-fifth of women report that their last pregnancy was unplanned–mistimed or unwanted. In 1998, 29 percent of women reported that their last pregnancy was unplanned, which is considerably higher than in 1991 (21 percent) and 2004 (23 percent).

Indicators of uptake of fertility-related public health messages: Cameroon has a relatively high proportion of births to mothers under age 18, about 11 percent; this figure has not changed over time. Similarly, about 11 percent of births are to mothers over age 34, marginally lower than in most other countries in this analysis; this figure also has a flat trend. The median birth interval has increased marginally over the course of the three survey periods. However, the median birth interval of 32 months observed in 2004 still does not fall within the recommended range of 36-59 months (3-5 years).

Summary: The family planning effort index score for Cameroon is among the lowest of the countries studied, with a score of 41. This may provide insight into the fertility dynamics in the country, where over 20 percent of women report unwanted or mistimed fertility, there is a high and unchanging level of teen pregnancy, the trend in median birth interval suggests that life-saving birth spacing messages are not reaching the population. Policy and programmatic initiatives that ensure women's fertility preferences are met, and that improve the outreach of public health programming to encourage families to focus on healthy childbearing between ages 18 and 34, would go a long way toward meeting women's reproductive needs and ensuring the best possible health outcomes for mothers and their infants. If indeed abortion is a significant factor in determining fertility dynamics in Cameroon, no effort should be spared to ensure that methods to avoid pregnancy are easily available to women at risk of unwanted fertility.

Figure 8. Changes in the observed *TFR* in Cameroon, DHS surveys 1991-2004

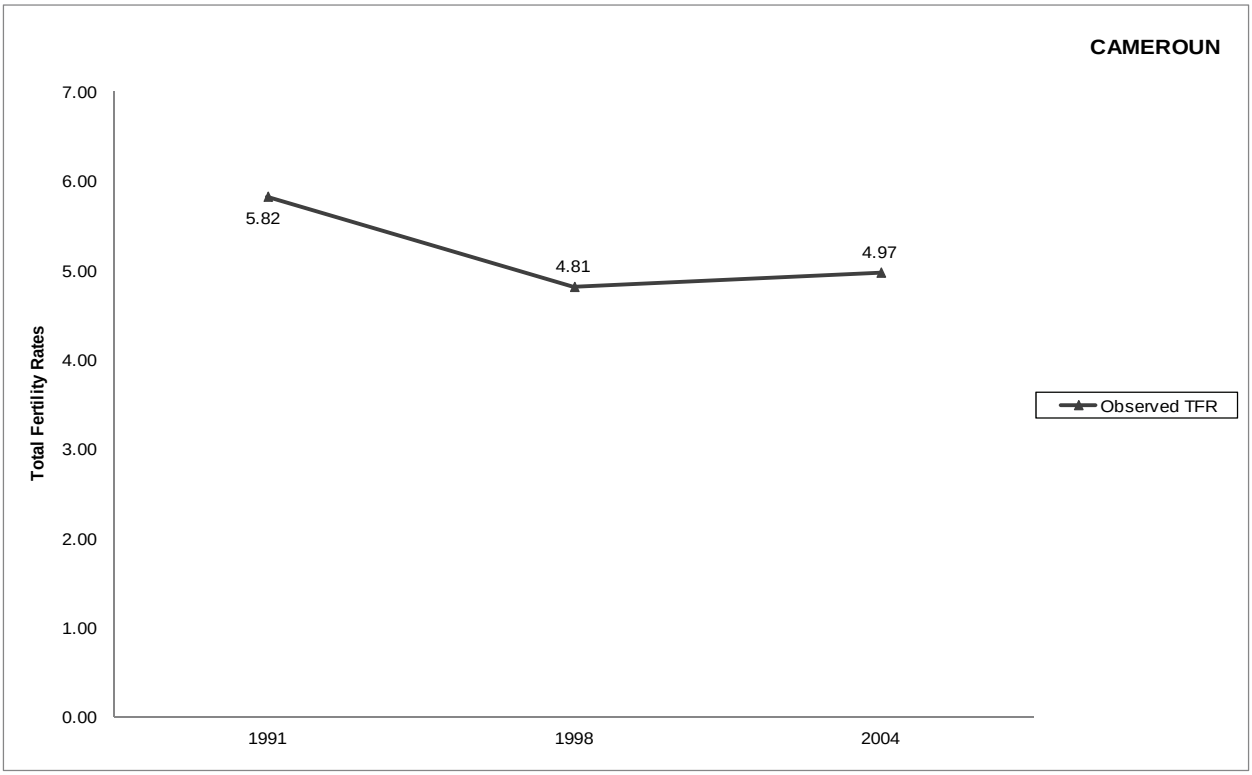


Figure 9. Changes in the proximate determinants in Cameroon, DHS surveys 1991-2004

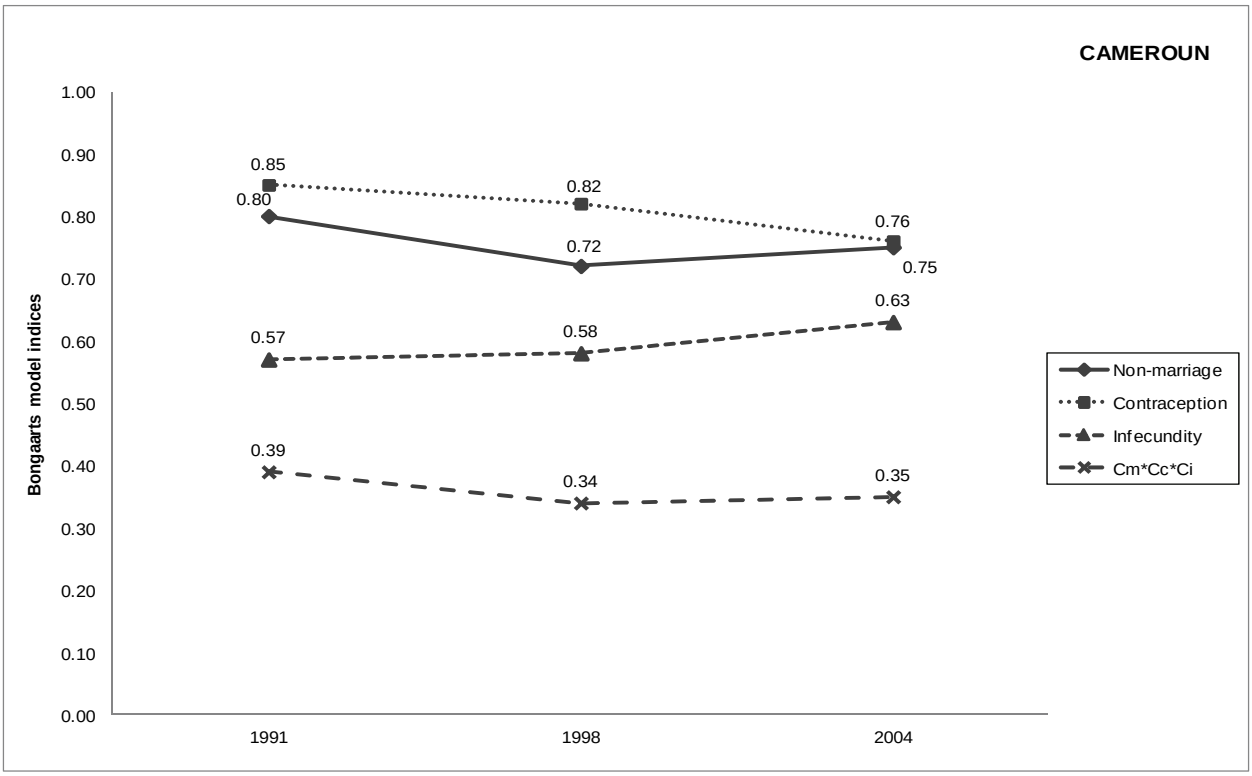
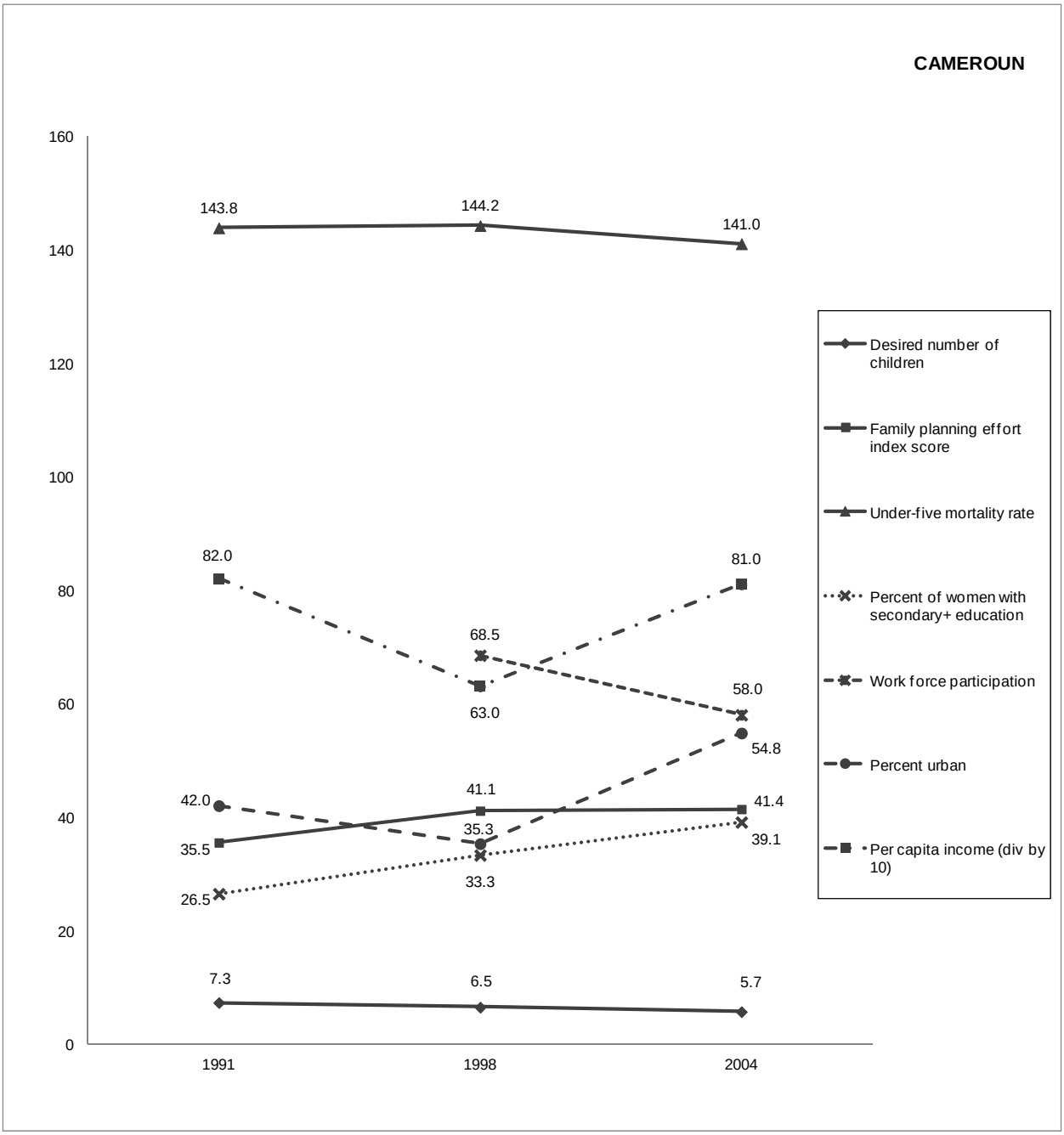


Figure 10. Changes in the indirect determinants in Cameroon, DHS surveys 1991-2004



GHANA

Total fertility rate: The *TFR* in Ghana demonstrates a pattern of continuous decline across five surveys, although much more steeply during the first half of this long series. The observed *TFR* declined from 6.41 in 1988 to 4.44 in 1998 and 4.03 in 2008. There was a 31 percent decline between the first and third surveys, and a 9 percent decline between the third and fifth, for an overall net decline of 37 percent in 20 years.

Proximate determinants: Both contraception and non-marriage moved substantially in the direction of fertility reduction across the 20 years, but the contribution of contraception was limited to the first 10 years. Infecundity moved in the opposite direction, toward increasing fertility, mainly in the first 10 years, serving to moderate the other two proximate determinants. Thus, during the interval from the third to the fifth survey, the modest continuing fertility decline can be traced solely to increases in non-marriage—that is, to later age at first union.

Background variables: Ghana shows trends in two background characteristics that are commonly found in countries with fertility decline: a decrease in under-five mortality and an increase in per capita income. The proportion of urban residents increased between 1998 and 2003 but did not change between 2003 and 2008. The proportion of women with secondary or higher education nearly doubled between 2003 and 2008. However, in the most recent period, the family planning effort index score shows a decline of nearly 10 percentage points, from a score of 55.5 to 46.4.

Indicator of satisfaction of fertility preferences: For the past three survey periods, no less than 37 percent of women have reported that their most recent birth was mistimed or unwanted; in 2003, 41 percent of women reported a mistimed or unwanted pregnancy. These high levels of unplanned pregnancy show no improvement over time.

Indicators of uptake of fertility-related public health messages: In Ghana, the percentage of births to mothers under age 18 has not changed over time, but is fairly low at about 4 percent. Women in Ghana, on average, have also achieved optimal birth spacing, with the median number of months between pregnancies trending slightly upward, to reach 39.7 months by 2008. However, the percentage of births to mothers over age 34 remains comparatively high at 17 percent and has not yet established a downward trend.

Summary: Ghana is experiencing a sustained decline in fertility. It has achieved fairly low levels of childbearing among women under age 18 and has achieved optimal birth spacing at the population level, both of which are associated with improved maternal and child health outcomes. Nevertheless, there remain areas of significant concern that would benefit from programmatic attention. The need for improved family planning services and outreach is clear, given 1) high and unchanging levels of mistimed and unwanted pregnancy; and 2) indications that abortion plays a consistent role in shaping fertility dynamics in Ghana. Ghana also has relatively high levels of births to women over age 34, which is not optimal for maternal or child health. Public health communication on the optimal ages for childbearing would help to achieve even healthier fertility dynamics in Ghana.

Figure 11. Changes in the observed *TFR* in Ghana, DHS surveys 1998-2008

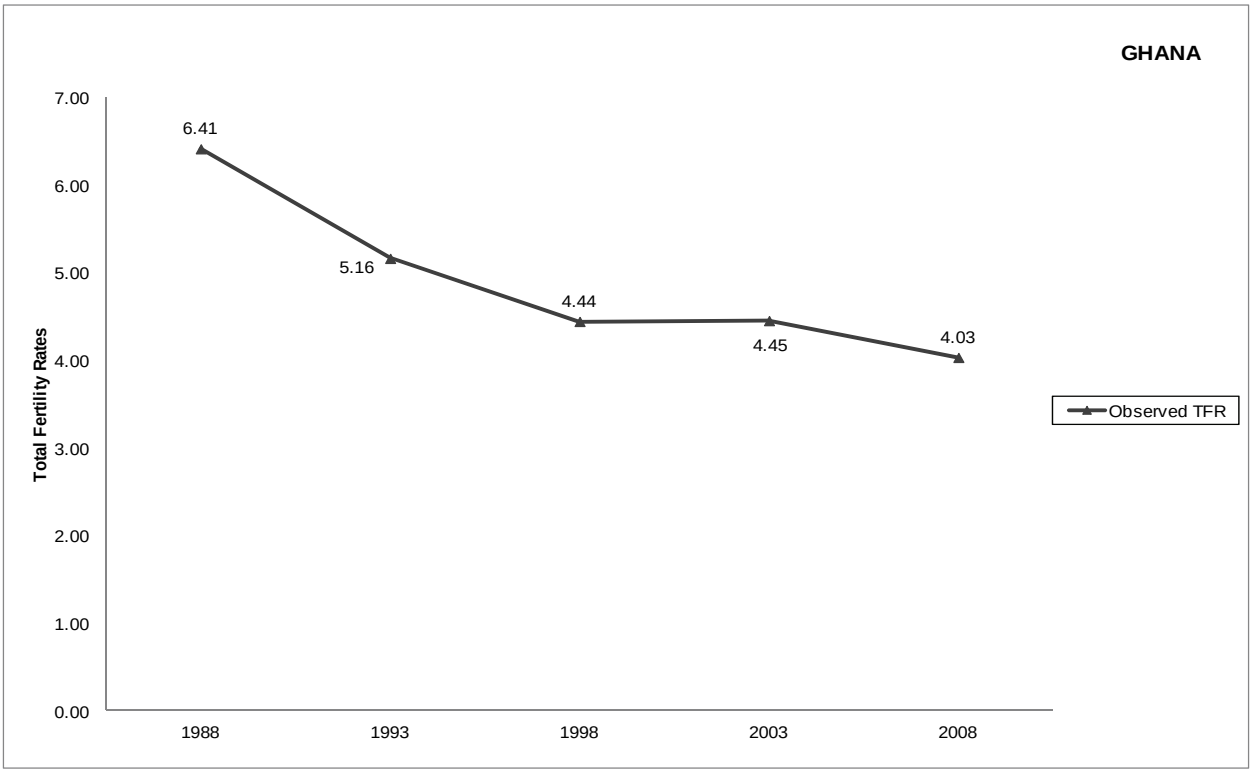


Figure 12. Changes in the proximate determinants in Ghana, DHS surveys 1998-2008

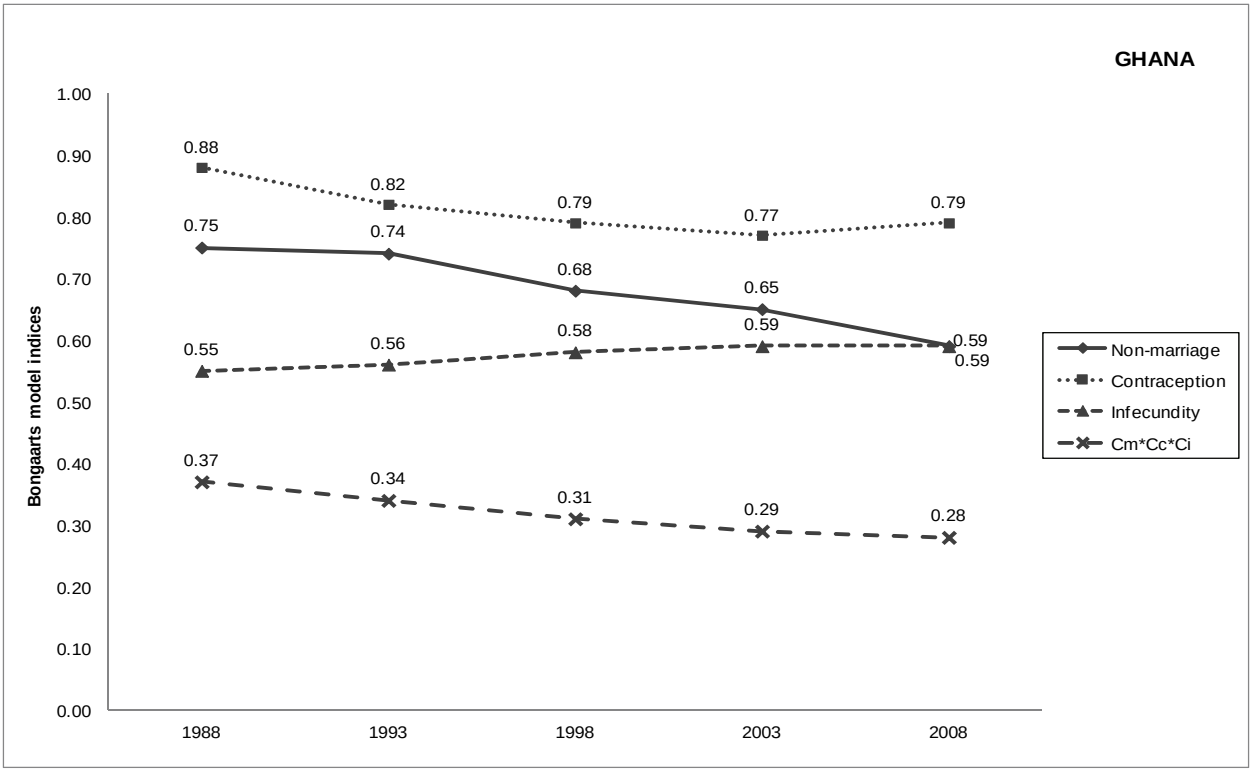
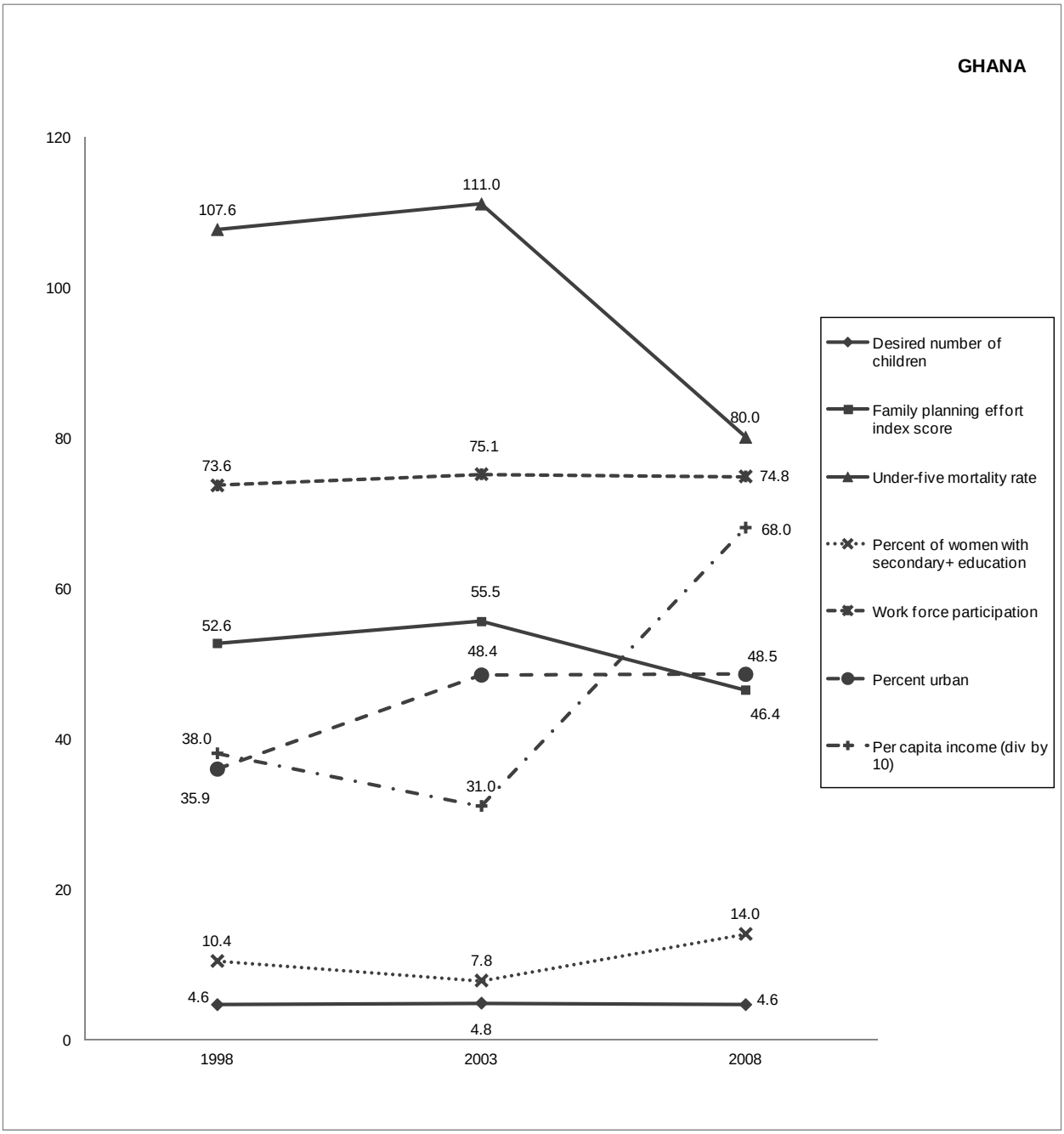


Figure 13. Changes in the indirect determinants in Ghana, DHS surveys 1998-2008



KENYA

Total fertility rate: Like Ghana, Kenya has a series of five surveys spanning 20 years. The *TFR* fell from 6.67 in 1989 to 4.70 in 1998, and 4.56 in 2009, an overall decline in fertility of 32 percent. But it occurred almost completely within the first half of the interval: a 30 percent decline between the first and third survey and a 3 percent decline between the third and fifth. With the publication of the country report on the Kenya 2003 DHS, concern over a feared "stall" in fertility decline in sub-Saharan Africa began to develop among demographers focused on the region, with numerous papers seeking to identify the factors associated with a flat line at high levels of fertility. Schoumaker (2009) has raised some concerns with the quality of the 2003 survey, but its estimate of the *TFR* is consistent with the estimates from the 1998 and 2009 surveys.

Proximate determinants: The measured proximate determinants have similar effects on fertility levels. Except for two data points, all three have been in a range from 0.61 to 0.70 for 20 years. Over this period, contraceptive use has changed the most, largely during the first 10 years, leading to the rapid decline in the *TFR* during those years. Non-marriage has had a more gradual impact in reducing fertility. The effect of postpartum infecundity was nearly constant, except for the most recent interval, between the 2003 and 2009 surveys, when it returned to the level of the 1989 survey and largely cancelled out a rise in contraceptive use.

Background variables: Like Ghana, Kenya shows trends in two background characteristics that are commonly found in countries with fertility decline: a decrease in under-five mortality and an increase in per capita income. The percentage of women with secondary or higher education has increased slowly, from 16 percent in 1998 to 18 percent in 2003 and 22 percent in 2008. The remaining background variables demonstrate fairly flat trends. Most concerning is the flat-to-declining trend in the family planning effort index score, given the high levels of births reported as mistimed or unwanted in Kenya.

Indicator of satisfaction of fertility preferences: Although levels of mistimed and unwanted pregnancies have declined marginally, from 49 percent in 1998 to 43 percent in 2008-09, Kenya nevertheless has among the highest rates of unplanned pregnancy of all of the countries in this study.

Indicators of uptake of fertility-related public health messages: The percentage of births to women under age 18 is about average among the countries represented in this study (6-7 percent), as is the percentage of births to women over age 34 (11-12 percent). The median birth interval is about 33 months, which is less than the minimum recommendation of 36 months. Trend lines for all three fertility-related indicators of maternal and child health are flat.

Summary: Kenya's fertility decline appears to have slowed considerably, perhaps constituting a stalled fertility transition. However, recent changes in key background variables, including declines in under-five mortality and an increase in per capita income, along with clear demand for family planning services (given the high levels of births reported as mistimed or unwanted) suggest that with appropriate policy approaches and program implementation, Kenya could improve the population's fertility dynamics, particularly with regard to ensuring that women's reproductive needs are better fulfilled. In Kenya, ensuring access to family planning services and improving the dissemination of fertility-related public health messaging, especially in the context of declining child mortality and increasing per capita income, would likely result in additional fertility decline.

Figure 14. Changes in the observed *TFR* in Kenya, DHS surveys 1989-2009

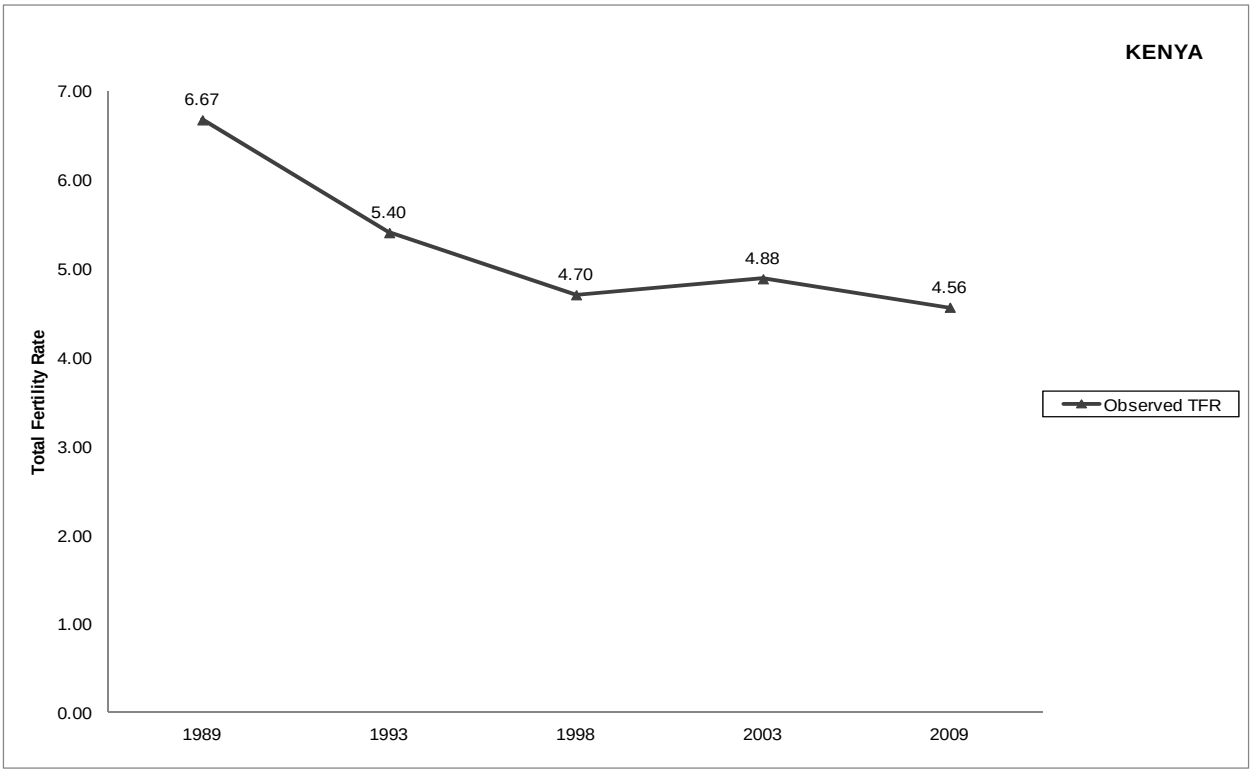


Figure 15. Changes in the proximate determinants in Kenya, DHS surveys 1989-2009

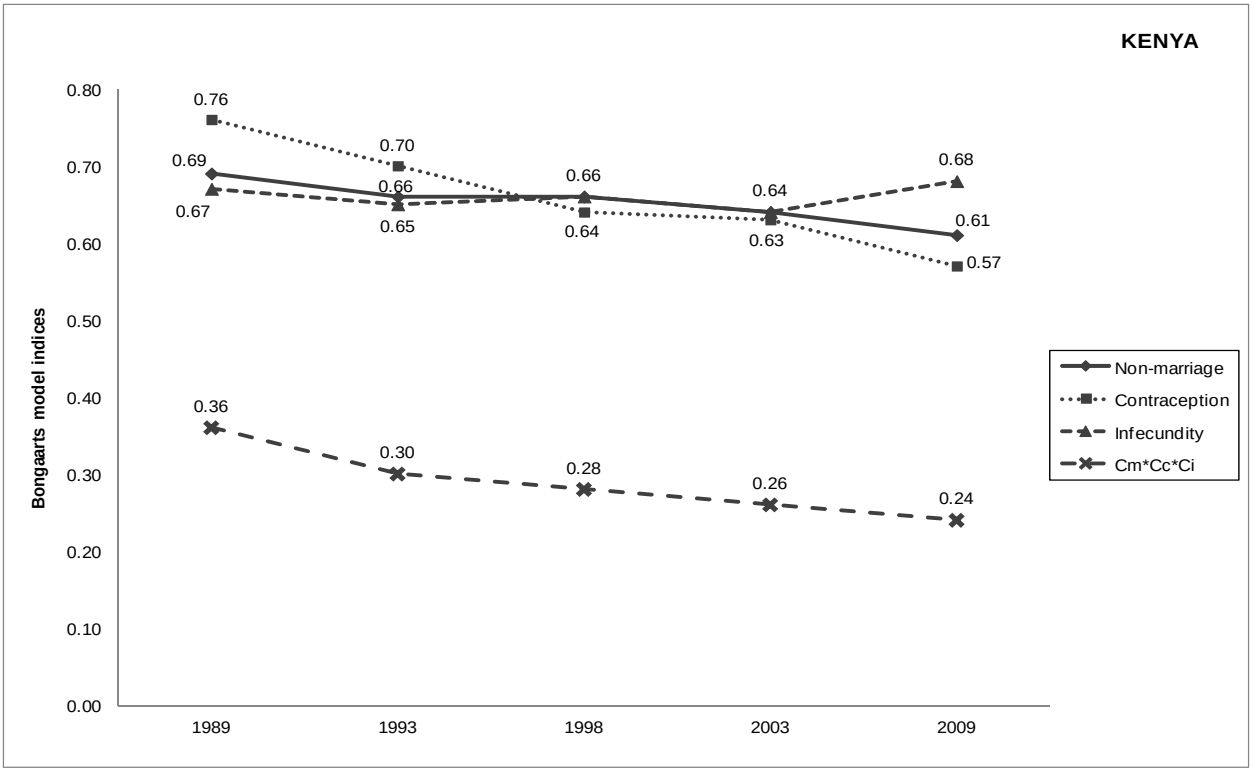
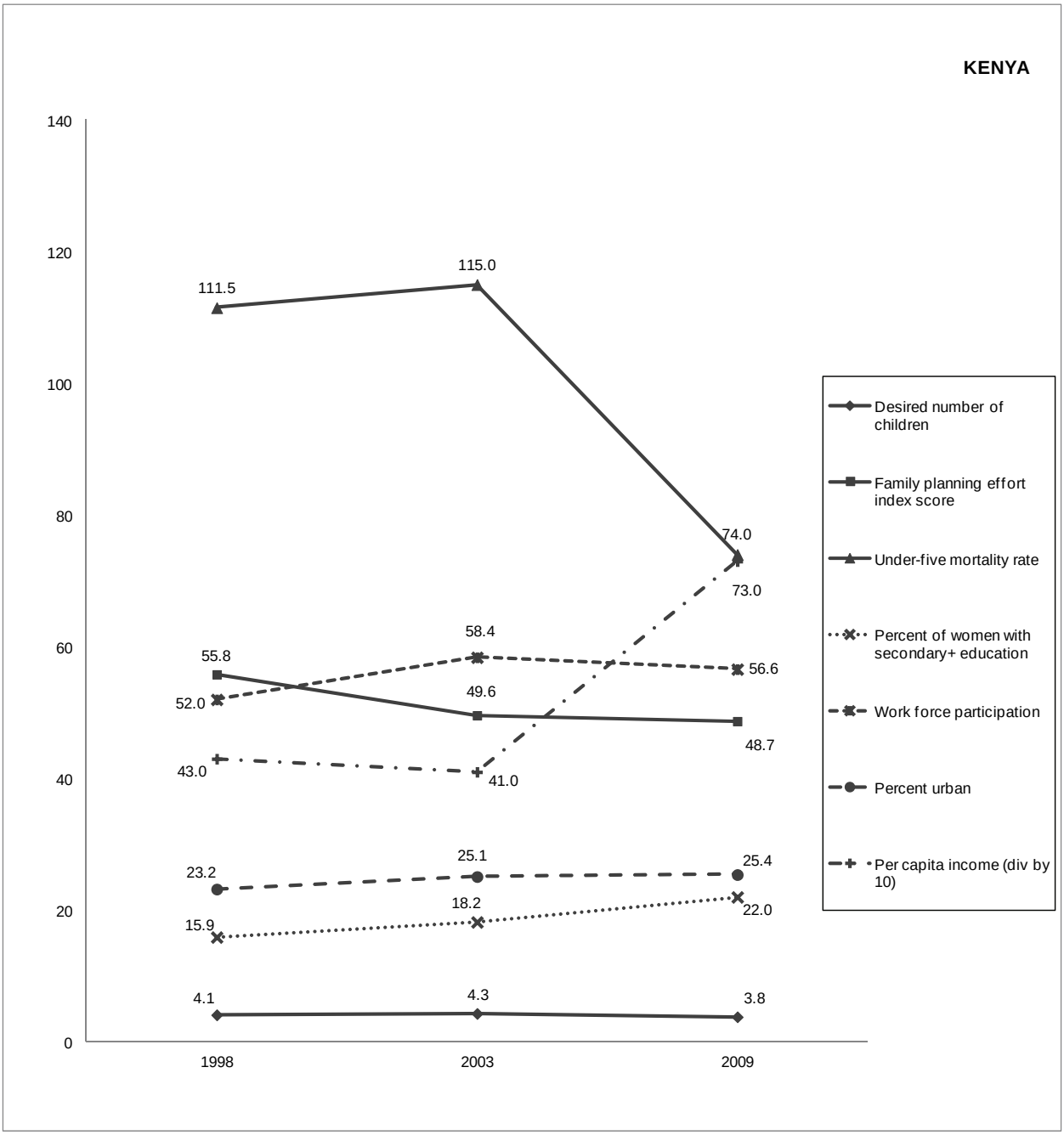


Figure 16. Changes in the indirect determinants in Kenya, DHS surveys 1989-2009



MADAGASCAR

Total fertility rate: The observed fertility rates in Madagascar have exhibited a slow but steady decline over the past four surveys, from 6.13 in 1992 to 4.82 in 2008-09, a net decline of 21 percent. There is little evidence of a stall in fertility decline, but fertility remains higher than the level at which a stall has appeared in other countries.

Proximate determinants: During the 16-year interval, contraceptive use has greatly increased, and at an accelerating rate. However, it has been offset by monotonic changes in both non-marriage and infecundity in the opposite direction. Few countries show such sharply contrasting trends in the proximate determinants. There has been an increase in the proportion of women in union, from 60 percent in 1992 to 69 percent in 2008-09, as well as an increase in the proportion of women in union before age 20, from 62 percent in 1997 to 70 percent in 2008-09 (data not shown). The increase in exposure to the risk of pregnancy has reduced the effect of increasing contraceptive use.

Background variables: The under-five mortality rate has decreased dramatically in Madagascar. At the same time, there has been a considerable improvement in the family planning effort index score, which nearly doubled between the 1997 and 2008-09 surveys. There has also been an increase in per capita income between the 2003-04 survey and the 2008-09 survey.

Indicator of satisfaction of fertility preferences: Mistimed and unwanted fertility has declined dramatically in Madagascar, from 27 percent of recent births reported as mistimed in 1997 to 17 percent in 2003-04 and 13 percent in 2008-09.

Indicators of uptake of fertility-related public health messages: Childbearing among women under age 18 is relatively high and stable in Madagascar. About 10 percent of births are to girls age 15-17. Only Cameroon has comparable rates of childbearing at these ages. Unlike Cameroon, however, where excess teenage fertility is offset by comparatively less fertility at older ages, Madagascar also has moderate levels of fertility at older ages, and these levels exhibit a slightly upward trend. Median birth intervals seem to be increasing over time; however, by the 2008-09 survey the median birth interval was 32.7 months–still below the recommended birth interval (36-59 months).

Summary: The increase in the family planning effort index score over time has approximately the same slope as does the increase in influence of contraception on fertility dynamics, as indicated by the Bongaarts contraception index. This, plus the steady decline in mistimed and unwanted pregnancy in Madagascar suggests that family planning programs are effective in reaching women who need contraception. Simple observation of the *TFR* over time might not give the same impression of effectiveness of the programming, given the offsetting effect of a reduced influence of non-marriage and infecundity on fertility trends. Madagascar has been very successful in halving the levels of mistimed and unwanted pregnancy. The next challenge is improving public health messaging around teen pregnancy. Advocating older ages at marriage could both reduce teen pregnancy and improve educational opportunities and life outcomes for girls and women. Public health messages regarding pregnancy at older ages and the benefits to mother and child of observing optimum birth spacing recommendations would also be appropriate in Madagascar.

Figure 17. Changes in the observed *TFR* in Madagascar, DHS surveys 1992-2009

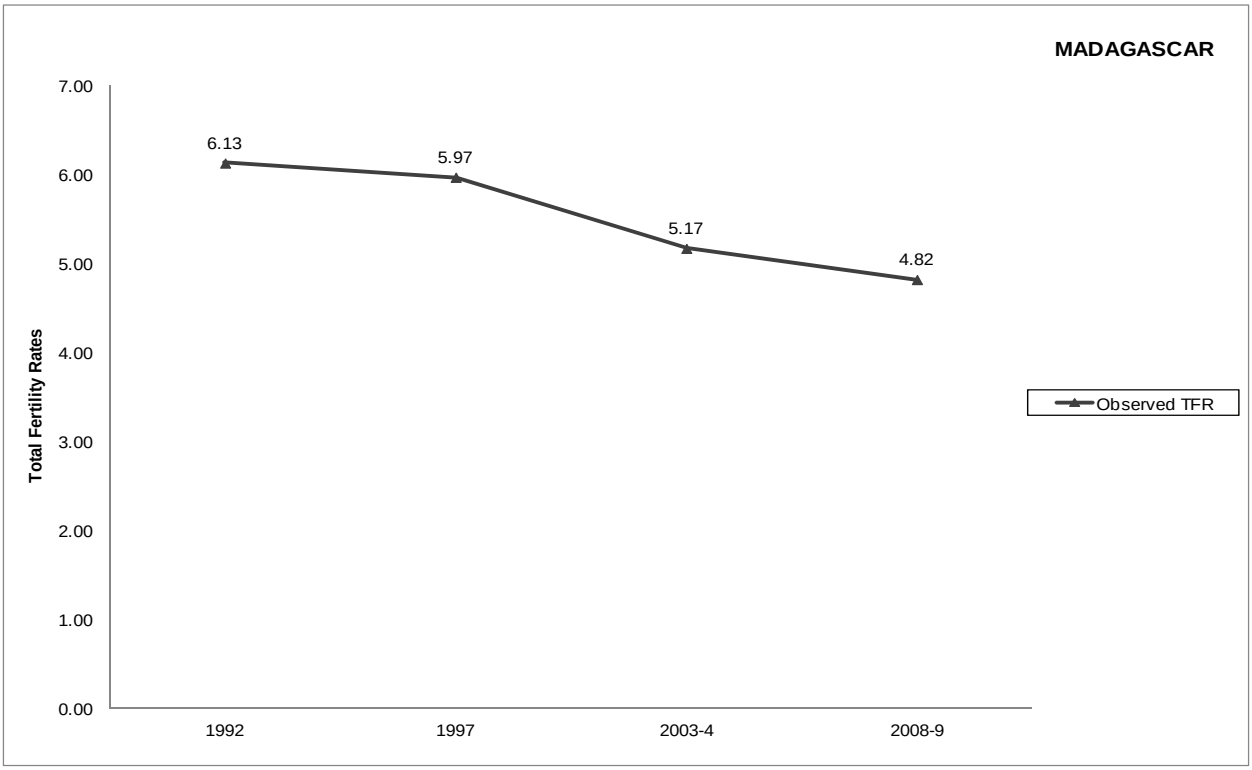


Figure 18. Changes in the proximate determinants in Madagascar, DHS surveys 1992-2009

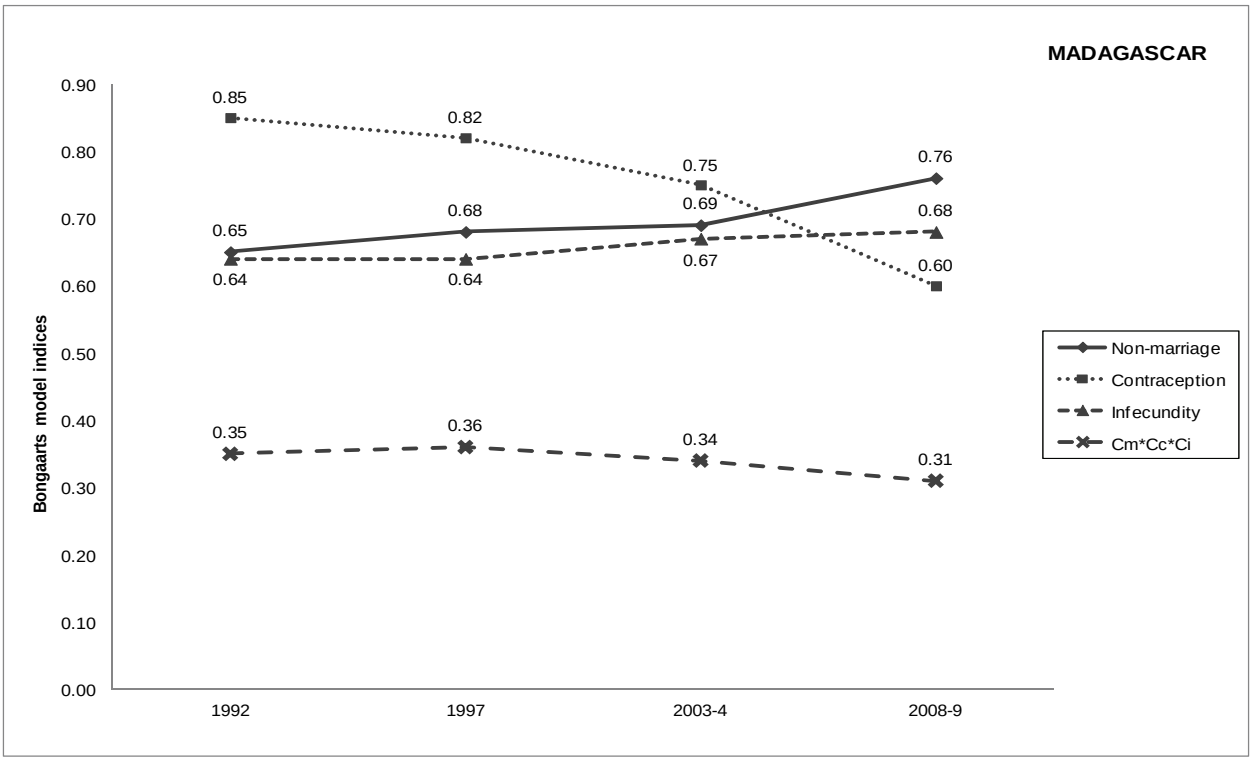
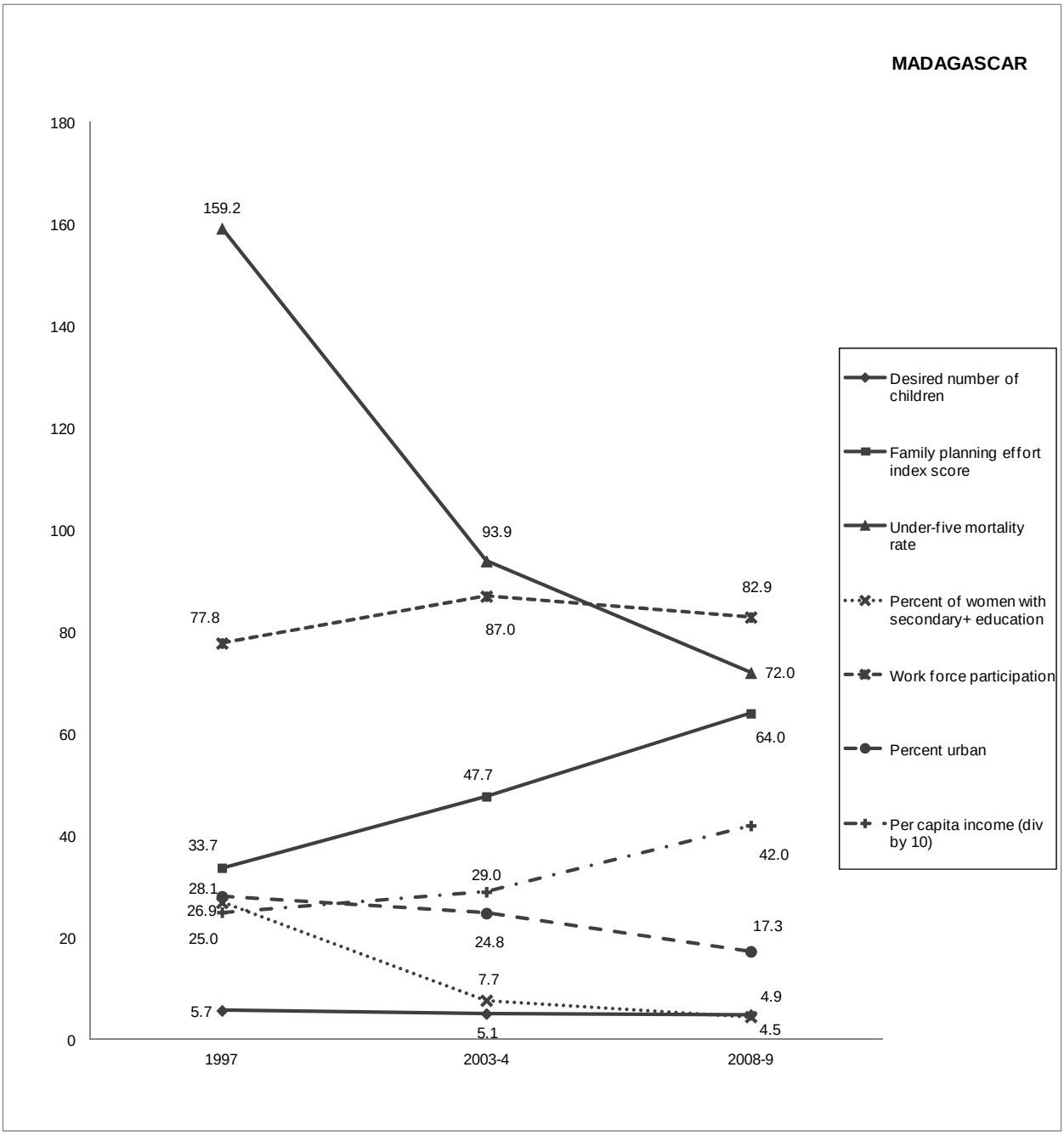


Figure 19. Changes in the indirect determinants in Madagascar, DHS surveys 1992-2009



MALAWI

Total fertility rate: The observed *TFR* in Malawi has declined slowly, from 6.73 in 1992 to 6.04 in 2004, a net decline of 10 percent in 12 years, but still high.

Proximate determinants: The coefficients for non-marriage and infecundity were virtually unchanged across the full time interval. The coefficient for contraceptive use moved substantially in the direction of fertility reduction, but nearly all of that change occurred in the first part of the period, between 1992 and 2000.

Background variables: All background variables in Malawi remained flat over time with the exception of under-five mortality, which exhibited a considerable decline between each survey period.

Indicator of satisfaction of fertility preferences: Malawi has among the highest levels of mistimed and unwanted pregnancy, holding steady at about 41 percent at each survey year.

Indicators of uptake of fertility-related public health messages: Levels of childbearing under age 18 are comparatively high, at a steady 8 percent. Childbearing at older ages was relatively high in 1992 (18 percent) but has since declined considerably, to 12 percent in 2004. Birth intervals have been increasing slowly in Malawi, so that by 2004, Malawian women, on average, had attained optimum birth spacing.

Summary: Malawi's fertility levels continue to exceed five children per women, with increased risks for maternal mortality and morbidity. Women are clearly in need of family planning services, given the level of mistimed and unwanted pregnancy. The priority of Malawian policymakers and program managers should be to ensure that women have ready access to family planning methods and counseling, in order to ensure that Malawian women can better meet their reproductive goals.

Figure 20. Changes in the observed *TFR* in Malawi, DHS surveys 1992-2004

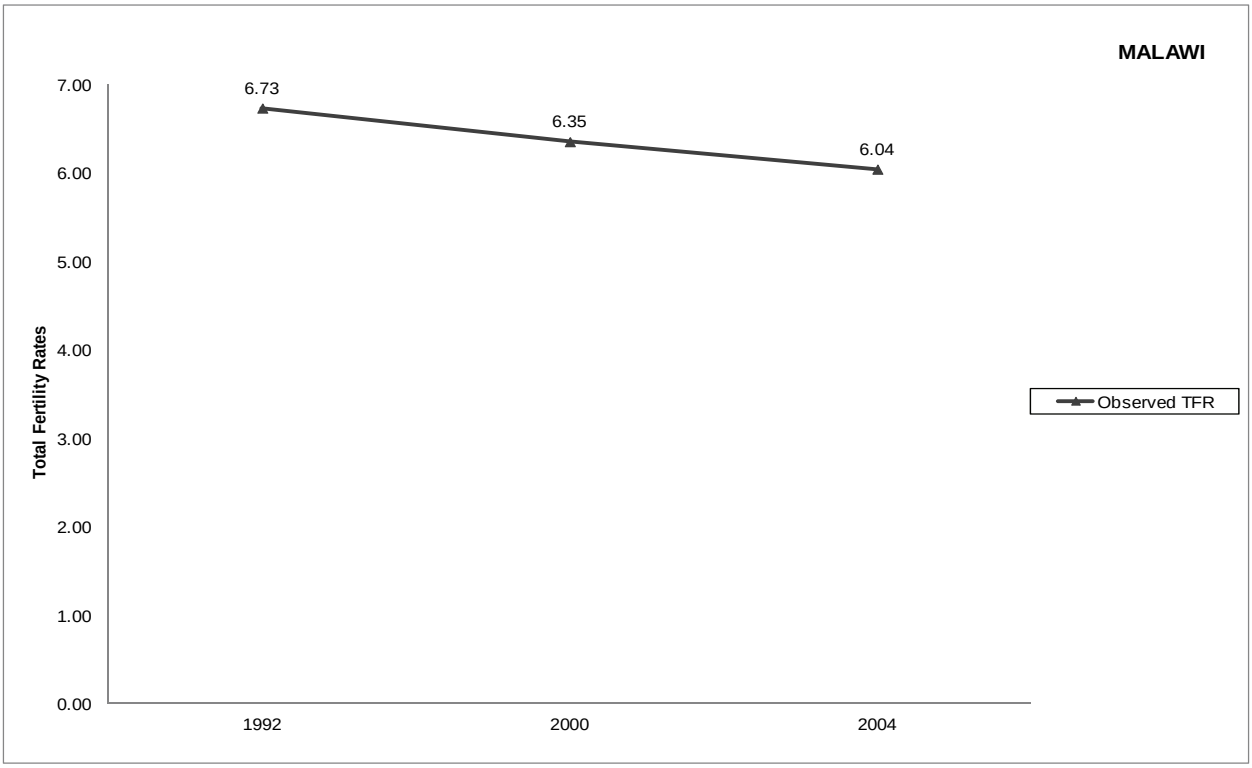


Figure 21. Changes in the proximate determinants in Malawi, DHS surveys 1992-2004

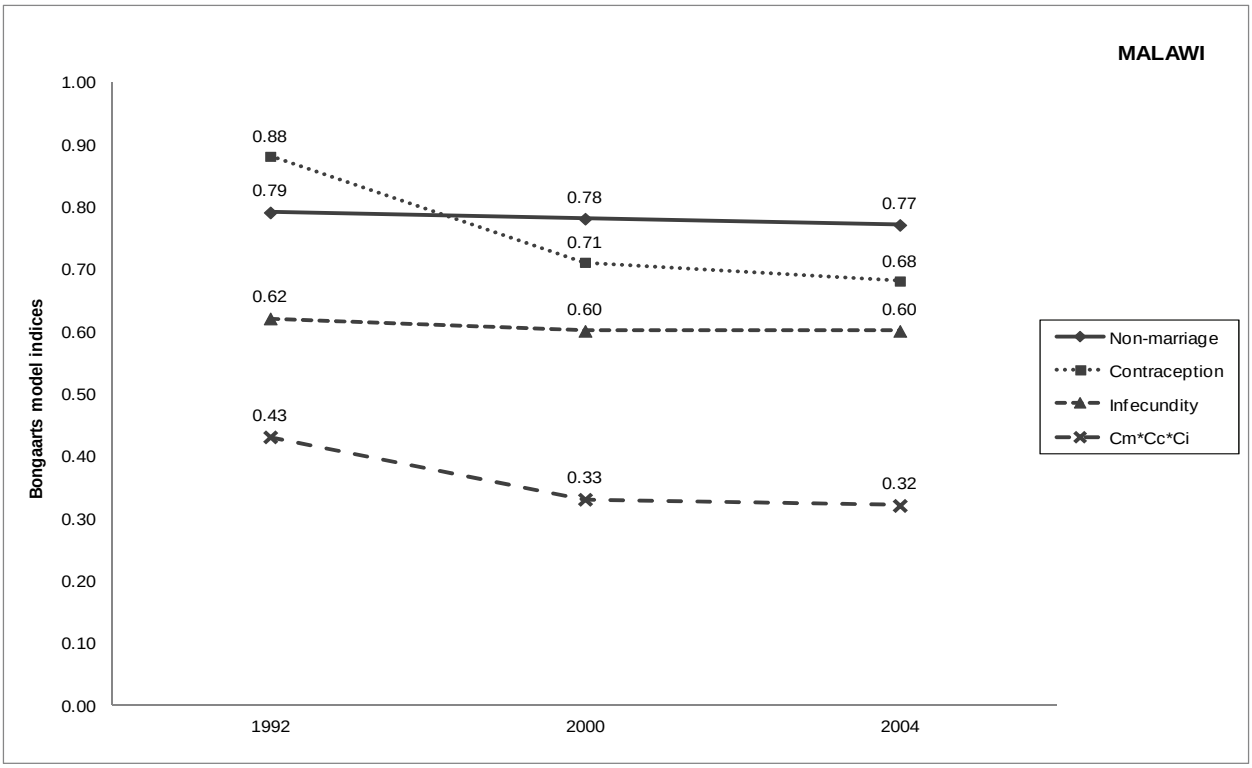
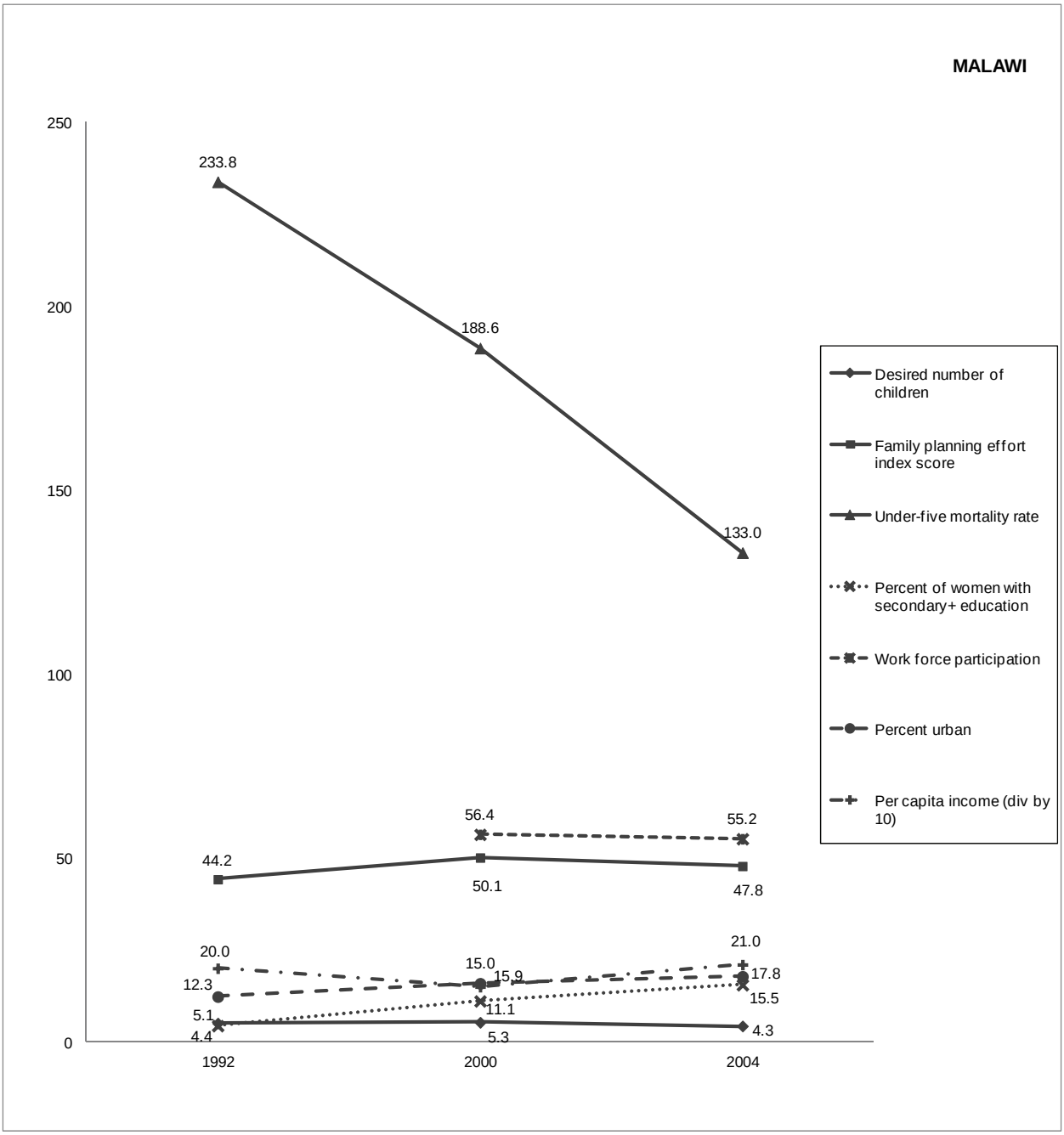


Figure 22. Changes in the indirect determinants in Malawi, DHS surveys 1992-2004



NAMIBIA

Total fertility rate: Namibia has the lowest fertility rate among all the countries in the study, with an observed *TFR* of 3.57 in 2006-7, a 34 percent decline from the 1992 level of 5.37. The rate of decline was steeper from 1992 to 2000 than from 2000 to 2006-7.

Proximate determinants: Non-marriage is by far the most important of the proximate determinants in Namibia, and it became even more important mechanism for fertility reduction across the 15-year period, with Bongaarts index scores of 0.41 in 1992, 0.37 in 2000, and 0.30 in 2006-07. Contraceptive use increased steadily during this period and accounted for most of the decline in fertility. Between 1992 and 2000, increasing postpartum infecundity was a third source of fertility decline, but between 2000 and 2006-07 it reversed direction and, as observed in several of the other countries in this study, neutralized some of the impact of contraception on fertility.

Background variables: The under-five mortality rate in Namibia was already comparatively low in 1992, at 83.2; declining to 69.0 in 2006-07. Women's work force participation increased between 2000 and 2006-07 (no data are available for this indicator in 1992), from 33 percent to 44 percent. Per capita income exhibited the most noticeable increase, rising from 184 in 1992 to 203 in 2000, then to 389 in 2006-07.

Indicator of satisfaction of fertility preferences: Despite Namibia's relatively lowbelow-replacement fertility levels, Namibian women report by far the highest levels of mistimed and unwanted pregnancy of any country studied, and these levels are increasing. In 1992, 35 percent of women reported that their last birth was mistimed or unwanted at the time of conception; by 2000 this figure had risen to 46 percent, and by 2006-07, 54 percent of women reported that their last pregnancy was mistimed or unwanted. About half of this figure represents unwanted fertility.

Indicators of uptake of fertility-related public health messages: Childbearing among women under age 18 is low in Namibia: a consistent 6 percent of births. Births to women over age 34 are not particularly low but exhibit a steady downward trend, from 18 percent in 1992, to 17 percent in 2000 and 15 percent in 2006-07. This trend suggests that public health messaging about optimal childbearing ages is reaching Namibian women. Similarly, the median birth interval has lengthened steadily. Namibian women attained optimal birth spacing at the population level in 2000 (at a median interval of 39.9 months between births) and the interval continued to extend to a median of 42.3 months in 2006-07.

Summary: Fertility in Namibia is low, but if more women were able to achieve their reproductive preferences, the fertility would be even lower. The high levels of mistimed and unwanted births in a country with low fertility levels prompt a search for explanation. It is probable that the HIV epidemic is causing changes in women's fertility preferences. Approximately one-fifth of the population in Namibia is HIV-positive. Previous research has shown that HIV-positive women who likely know their HIV serostatus have different fertility preferences than women who know they are HIV-negative: HIV-positive women are more likely to want to curtail childbearing (Johnson et al. 2009). Efforts need to be made so that women in Namibia are better provided with the means to achieve their fertility preferences. One avenue for improving service delivery may be full integration of family planning and HIV health service provision.

Figure 23. Changes in the observed *TFR* in Namibia, DHS surveys 1992-2007

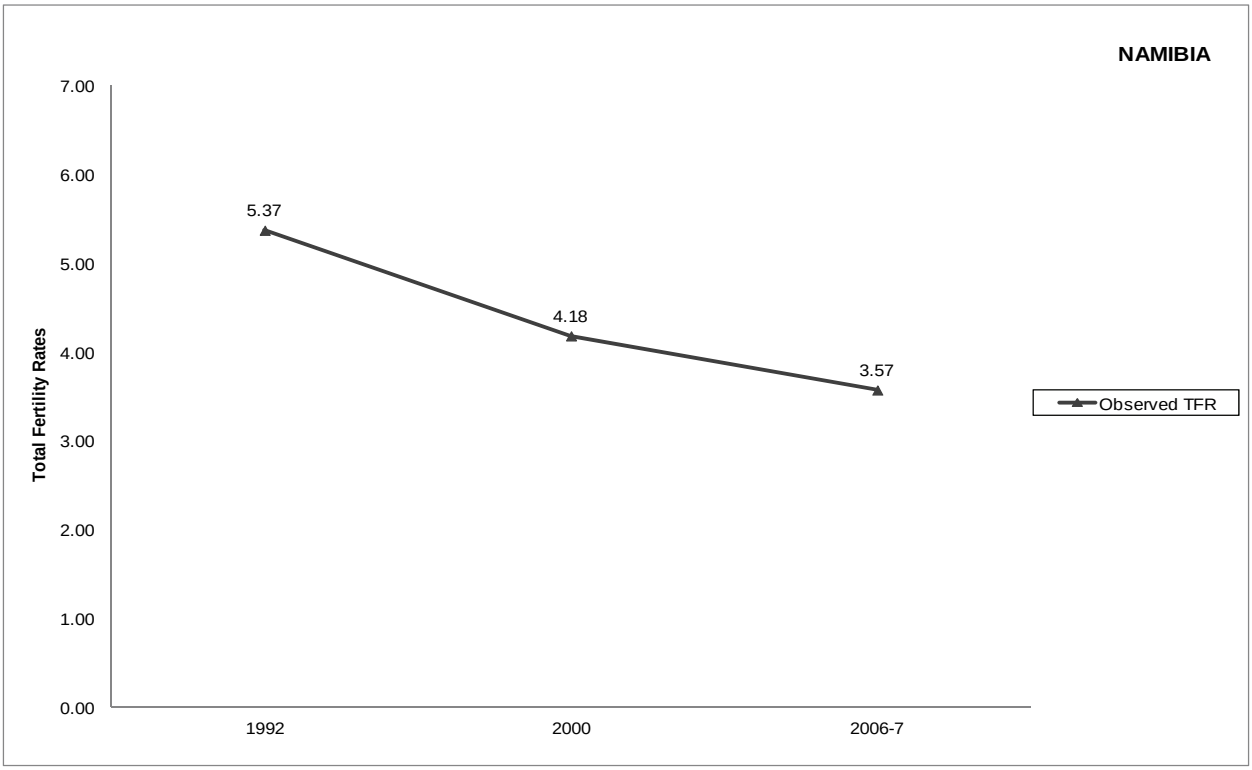


Figure 24. Changes in the proximate determinants in Namibia, DHS surveys 1992-2007

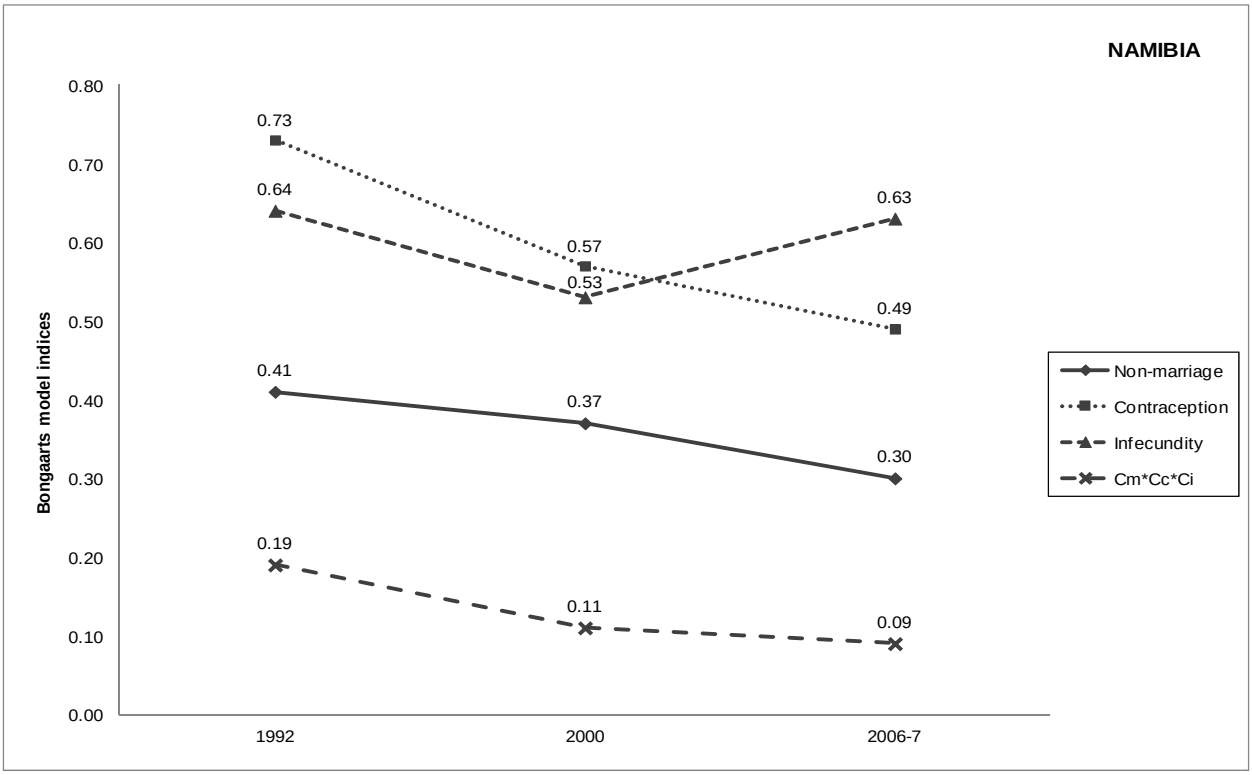
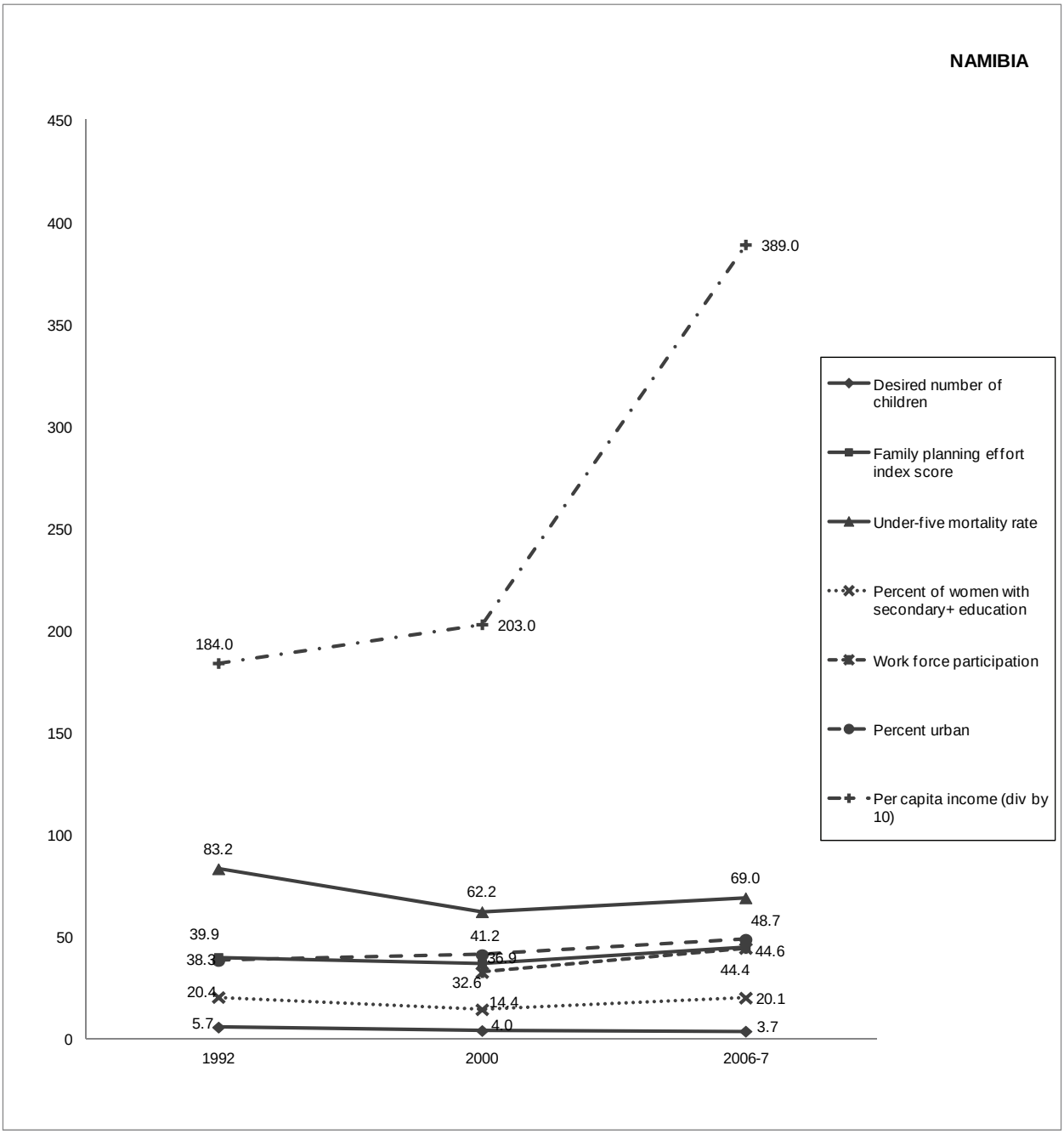


Figure 25. Changes in the indirect determinants in Namibia, DHS surveys 1992-2007



RWANDA

Total fertility rate: Fertility levels in Rwanda are high and stable, with an observed *TFR* of 6.23 in 1992, 5.84 in 2000, and 6.08 in 2005. These levels provide evidence that a fertility transition had begun but then stalled.

Proximate determinants: Non-marriage and infecundity are the primary determinants that shape fertility dynamics in Rwanda. They changed only slightly but tended to change in opposite directions. Contraceptive prevalence was low throughout the time interval, and its impact on fertility weakened, especially between 1992 and 2000. In combination, the changes in the three direct determinants almost completely neutralized one another.

Background variables: Most background factors in Rwanda maintained a fairly flat trend. It is notable that women's employment seems to have declined between 2000 and 2005 (no data available for 1992), as has the family planning effort index score. The genocide of 1994 certainly had its effects on fertility dynamics and all related background factors; however, those effects are not obvious from the trend data, save for the apparent uptick in under-five mortality in 2000, which had fallen to 1992 levels by 2005.

Indicator of satisfaction of fertility preferences: Rwanda has high levels of mistimed and unwanted fertility, although the level declined from 51 percent in 1992 to 36 percent in 2000, and rose to 40 percent in 2005.

Indicators of uptake of fertility-related public health messages: Rwanda is among the countries with the lowest levels of teenage pregnancy, which were low in 1992 and 2000 (2 percent of births were to women under age 18) and declined further to 1 percent in 2005. Not unexpectedly, however, given the high levels of fertility, the survey data show that women in Rwanda defer childbearing to somewhat older ages, with 20-22 percent of births in Rwanda to mothers over age 34. Similarly, birth intervals are relatively short, at a median of 31 months in 2005. Neither of these two indicators (older age at childbearing, median birth interval) has changed over time.

Summary: Rwanda's fertility levels approach six children per woman, indicating increased risks for maternal mortality and morbidity. There are also relatively high levels of mistimed and unwanted pregnancies, indicating a need for improved access to family planning services, both to improve women's health status and to avoid unintended births. While very low levels of teen childbearing are to be applauded, more public health communication is required in order to improve indicators such as births to mother over age 34 and the median birth interval.

Figure 26. Changes in the observed *TFR* in Rwanda, DHS surveys 1992-2005

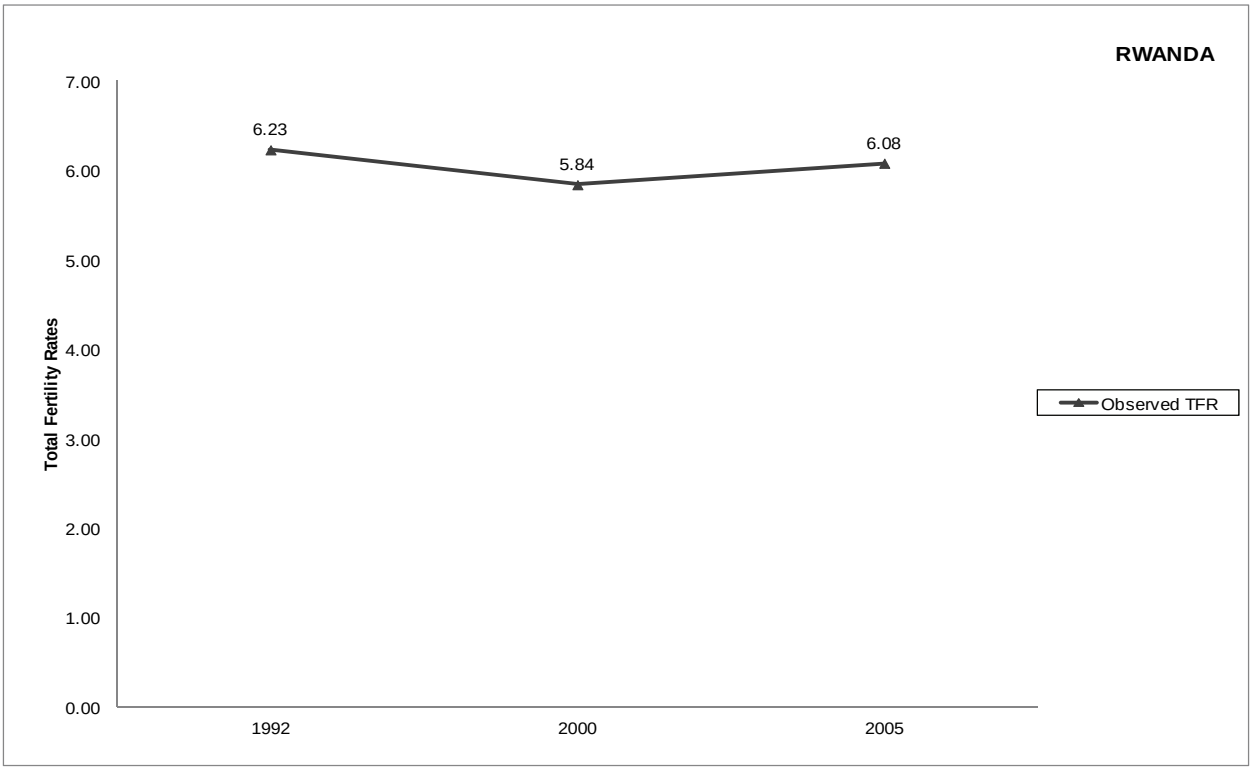


Figure 27. Changes in the proximate determinants in Rwanda, DHS surveys 1992-2005

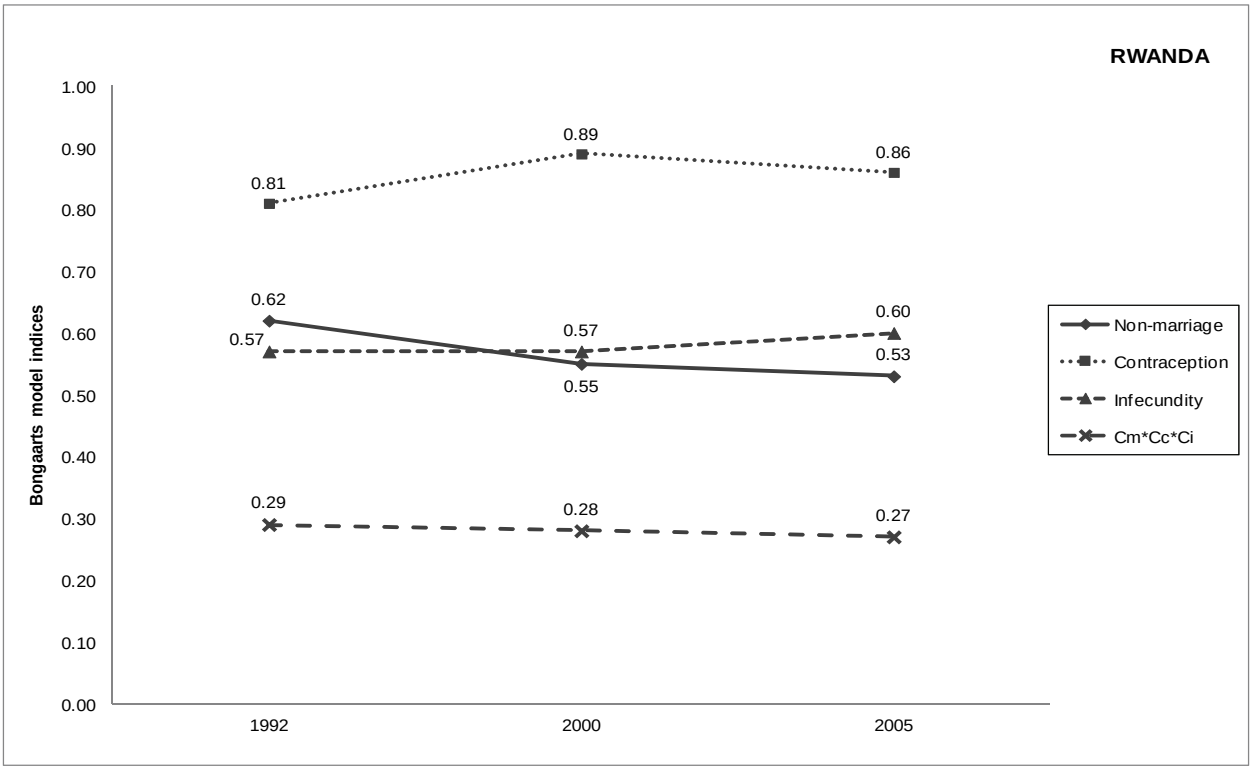
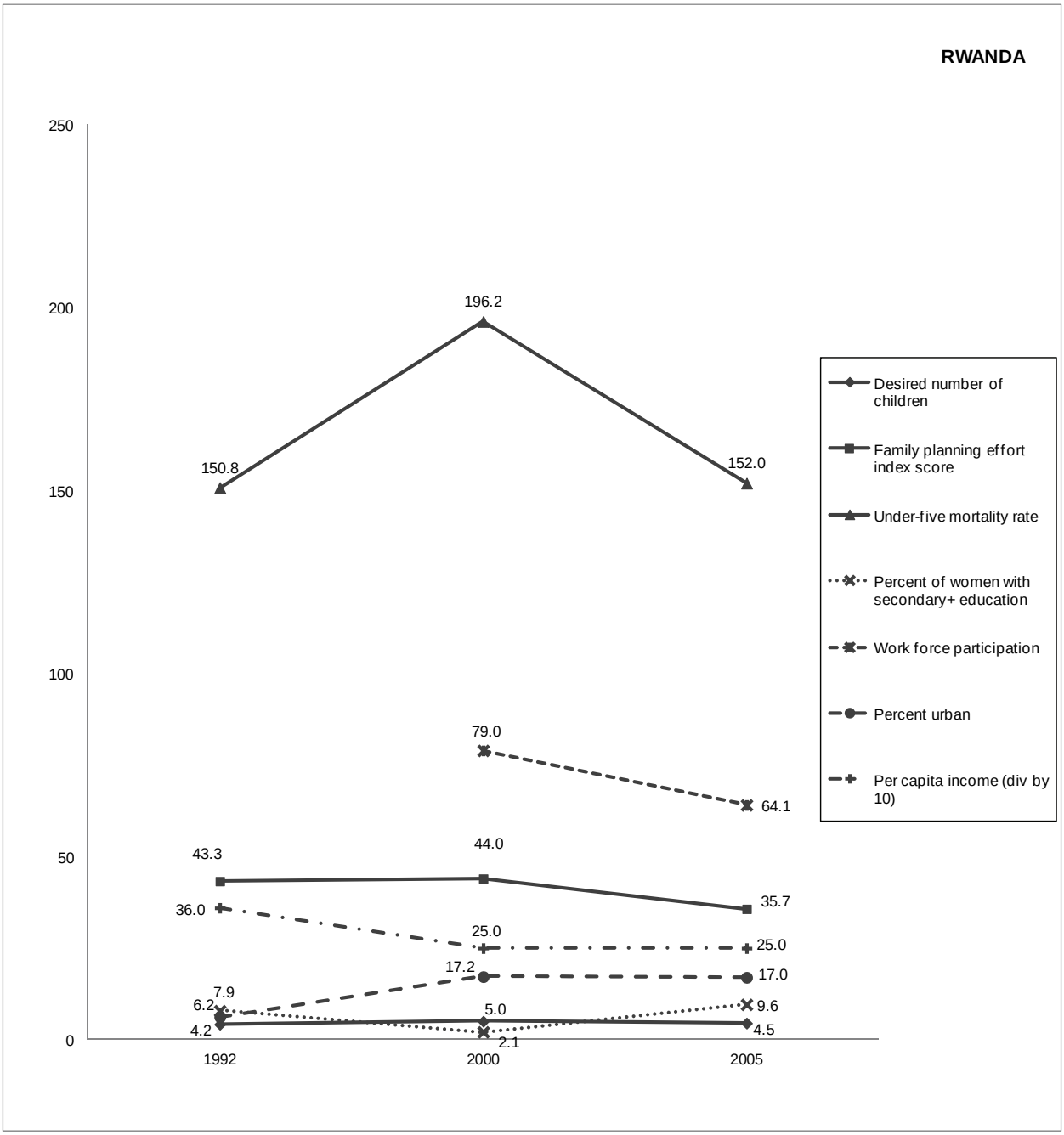


Figure 28. Changes in the indirect determinants in Rwanda, DHS surveys 1992-2005



SENEGAL

Total fertility rate: The observed *TFR* in Senegal shows a gradual but steady decline over the past four survey periods, with a *TFR* of 6.39 in 1986, 6.03 in 1991, 5.67 in 1997 and 5.26 in 2005. The overall decline is 18 percent in 19 years.

Proximate determinants: Infecundity and contraception have been virtually flat over the full time interval. Most of the *TFR* decline between the first and third surveys can be attributed to non-marriage. The most recent decline in fertility cannot be attributed to any of the measured proximate determinants but is associated with the residual factor, *R*.

Background variables: Women's work force participation and per capita income have both increased, particularly in the most recent survey period. The under-five mortality rate first rose and then fell; the rate for the 2005 survey period was estimated at 121.

Indicator of satisfaction of fertility preferences: Mistimed and unwanted pregnancies are high and stable in Senegal, at about 30 percent.

Indicators of uptake of fertility-related public health messages: All indicators reflecting uptake of fertility-related public health recommendations show essentially no change over time in Senegal. The percentage of childbearing among women under age 18 is about 7 percent, while the corresponding figure for women over age 34 is about 16 percent. The median length of birth intervals in Senegal is about 33 months, below the recommended range.

Summary: Women in Senegal have on average approximately five children during the course of their lifetime, down one child since 1986. High fertility persists despite a gradual decline in the *TFR*. The persistence of high fertility is a concern because women of parity five or greater are exposed to poorer maternal health outcomes compared with those at lower parities. The percentage of births to older mothers remains fairly high, and the median birth interval has not attained the recommended duration at the population level. Nearly one-third of births in Senegal are mistimed or unwanted. Ensuring that more women are able to achieve their fertility preferences would likely bring down the fertility rate to a level that is safer for maternal health, as would improving outreach with public health messaging on optimal ages for childbearing and optimal duration of birth intervals.

Figure 29. Changes in the observed *TFR* in Senegal, DHS surveys 1986-2005

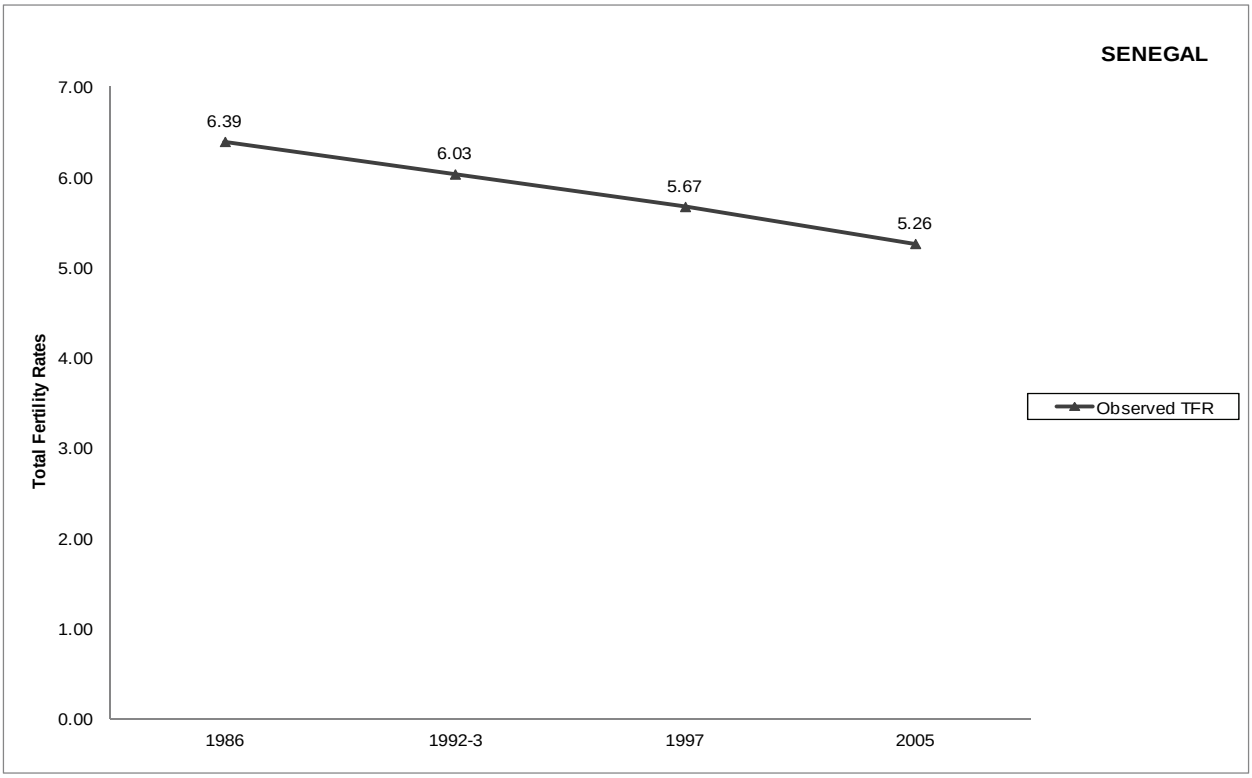


Figure 30. Changes in the proximate determinants in Senegal, DHS surveys 1986-2005

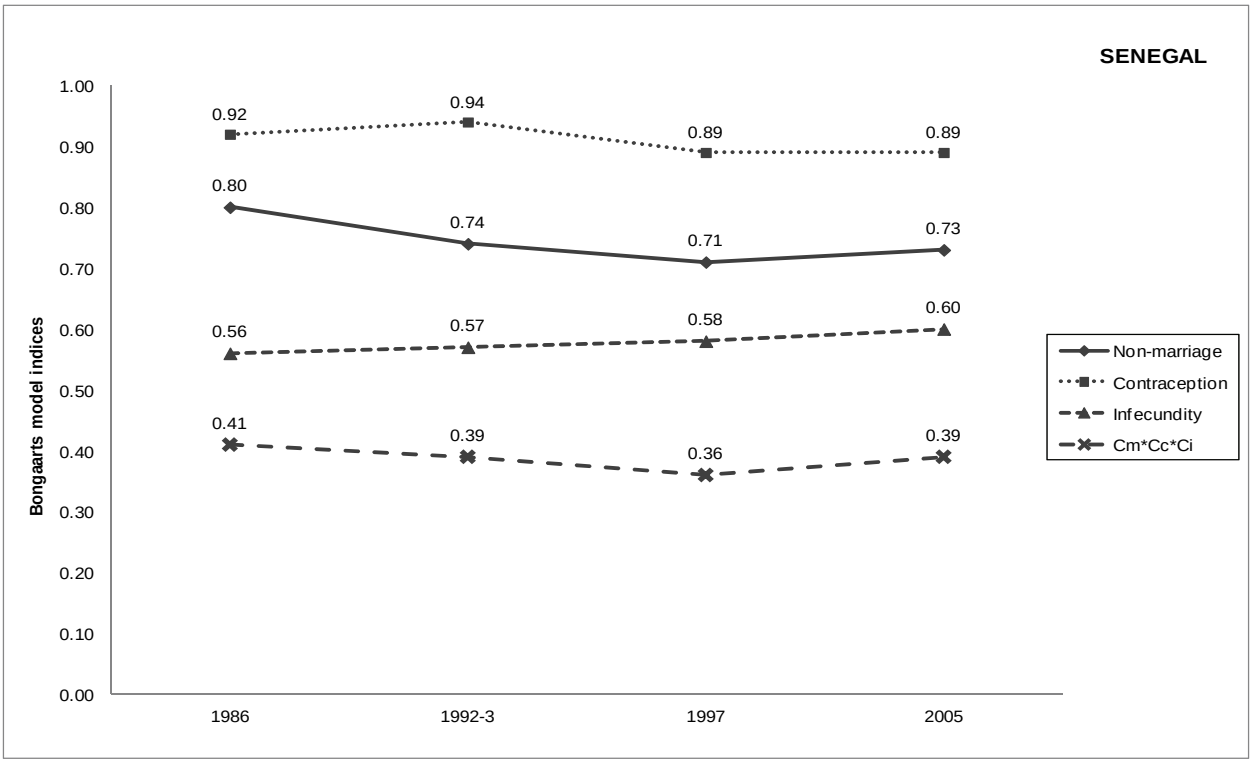
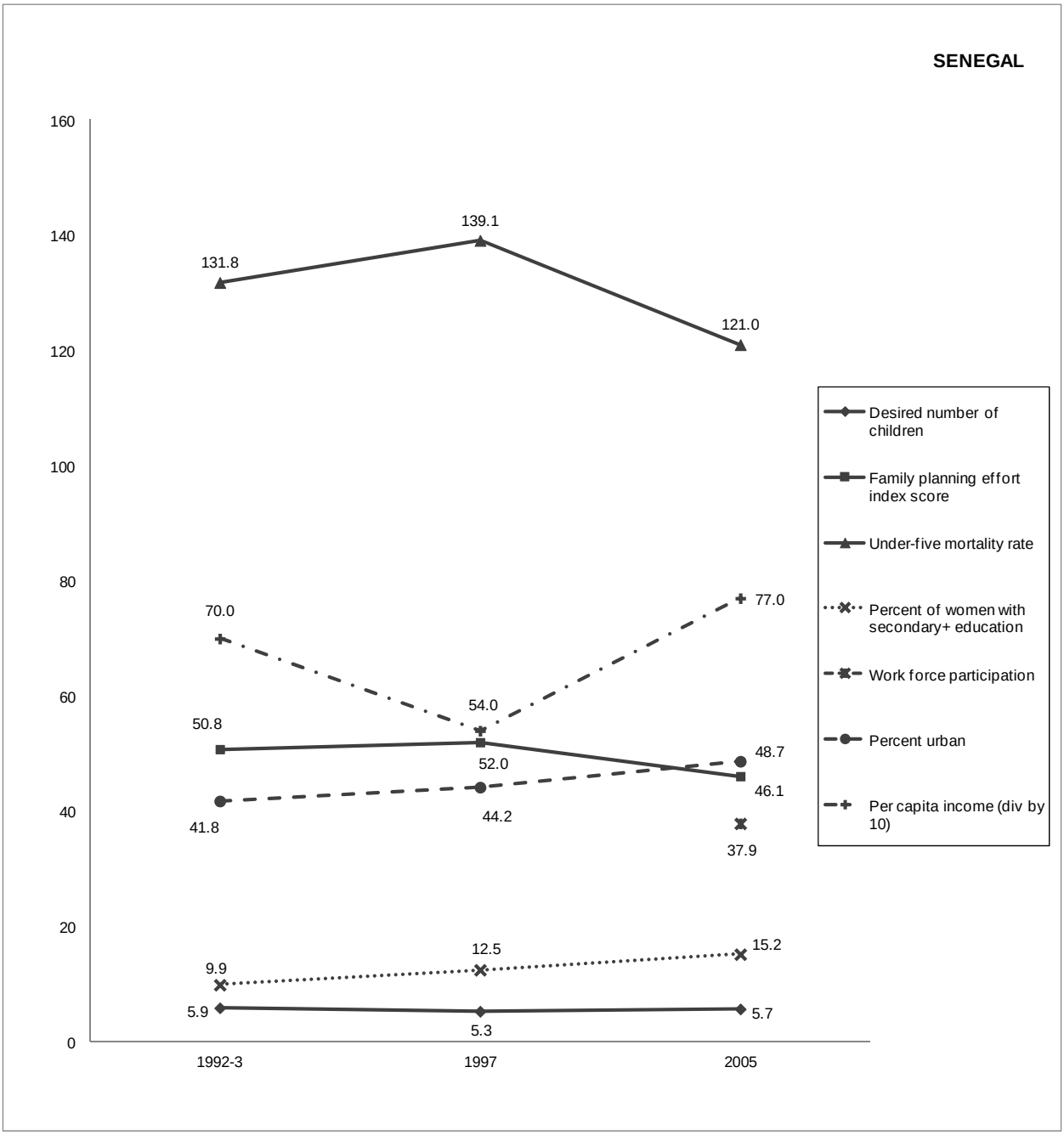


Figure 31. Changes in the indirect determinants in Senegal, DHS surveys 1986-2005



TANZANIA

Total fertility rate: The *TFR*, at 6.24 in 1991-2, declined steadily to 5.55 in 1999. This was an 11 percent decline in seven or eight years. By 2004-5, it had increased slightly to 5.66.

Proximate determinants: With the exception of an increase in contraception between 1991-92 and 1999, the proximate determinants moved only slightly across the 13 year interval. The decline in fertility between the first and third surveys is completely accounted for by the corresponding increase in contraception, and both were essentially unchanged from the third to the fourth survey.

Background variables: Under-five mortality declined between 1999 and 2004-05, while per capita income increased somewhat over time. The family planning effort index score was in the low 40s in 1991-92 and 2004-05, but experienced an jump in 1999 that seemed out of place.

Indicator of satisfaction of fertility preferences: About one-quarter of Tanzanian women reported that their last birth was mistimed or unwanted at the time of conception; this level is constant over the three survey periods.

Indicators of uptake of fertility-related public health messages: All indicators reflecting uptake of fertility-related public health recommendations show essentially no change over time in Tanzania. The percentage of childbearing among women under age 18 is about 7 percent, while the corresponding figure for those over age 34 is about 12 percent. The median length of birth intervals in Tanzania is about 33 months.

Summary: Women in Tanzania have an average of slightly more than five children during the course of their lifetime. Women of parity five or greater are exposed to poorer maternal health outcomes compared with those at lower parities. The percentage of births to older mothers remains fairly high, and, the median birth interval, at 33 months, is longer than the recommended duration at the population level. Furthermore, about one fourth of births in Tanzania are mistimed or unwanted. Ensuring that women are able to achieve their fertility preferences would also likely bring down the fertility rate to a level that is safer for maternal health, as would improving outreach with public health messaging on optimal ages for childbearing and optimal duration of birth intervals.

Figure 32. Changes in the observed *TFR* in Tanzania, DHS surveys 1991-2005

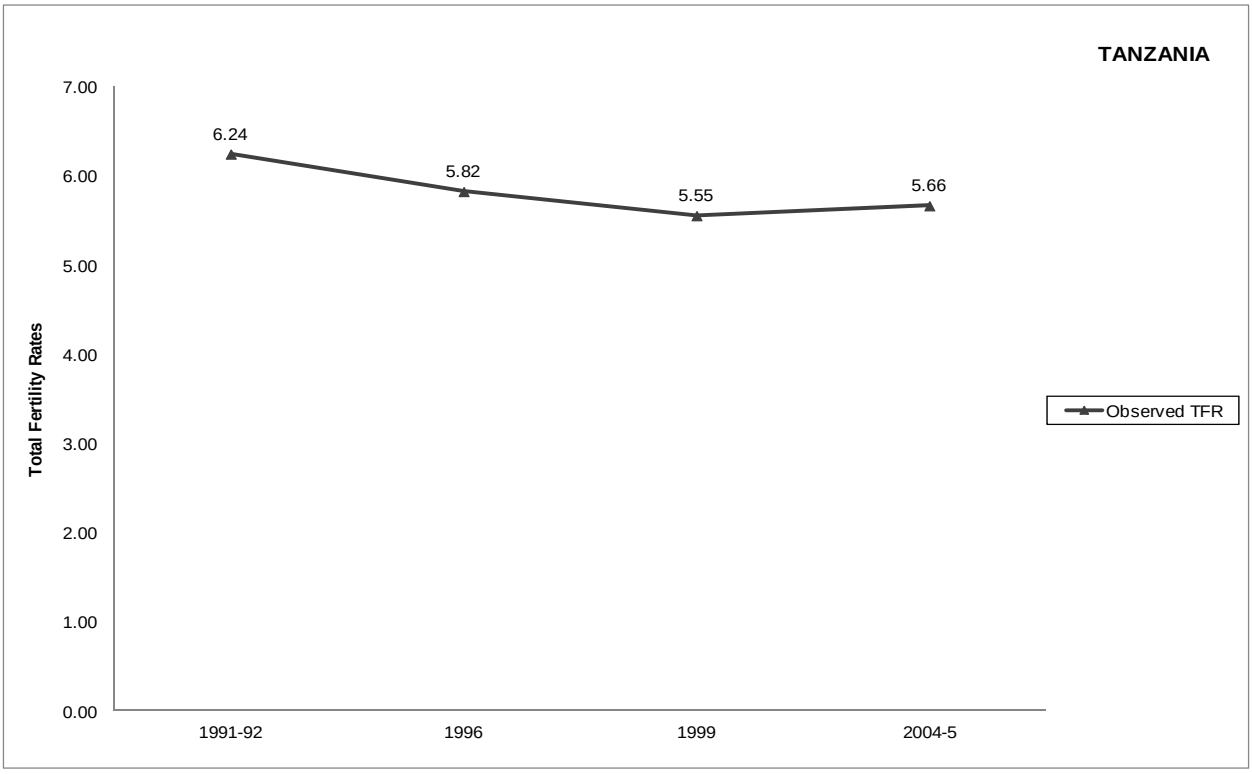


Figure 33. Changes in the proximate determinants in Tanzania, DHS surveys 1991-2005

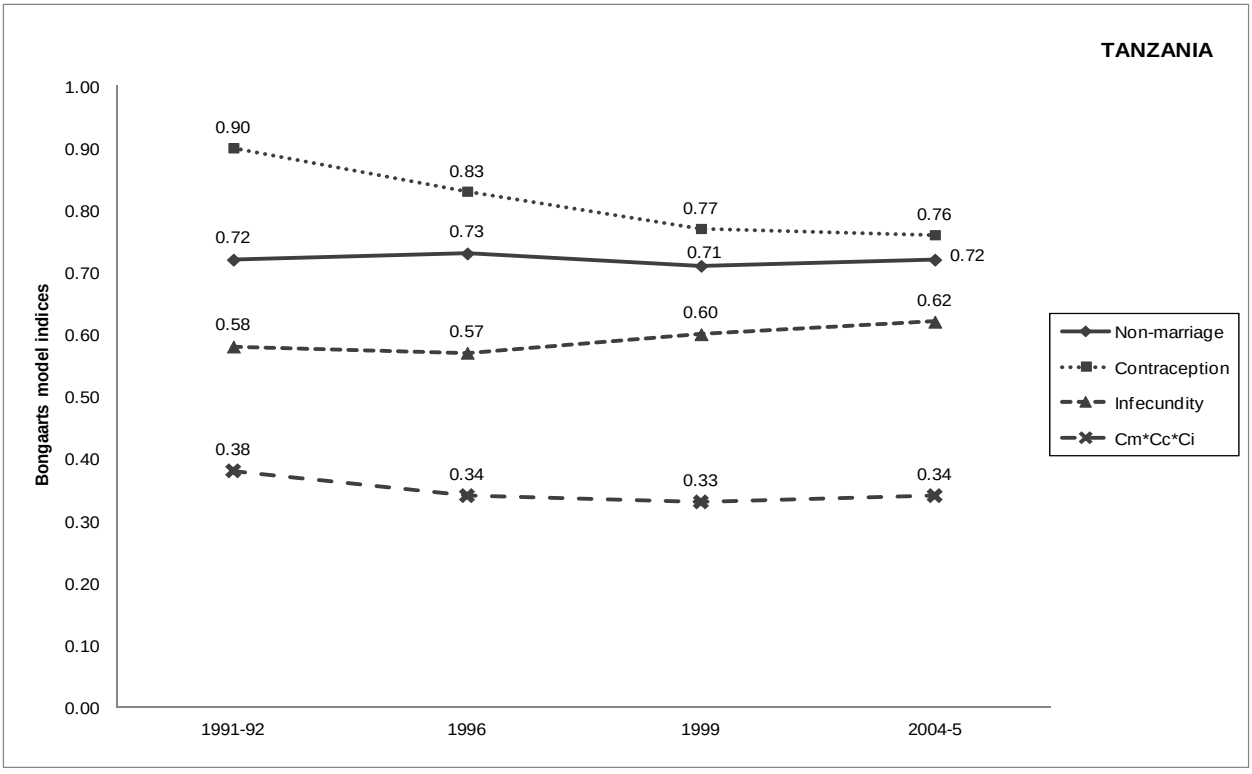
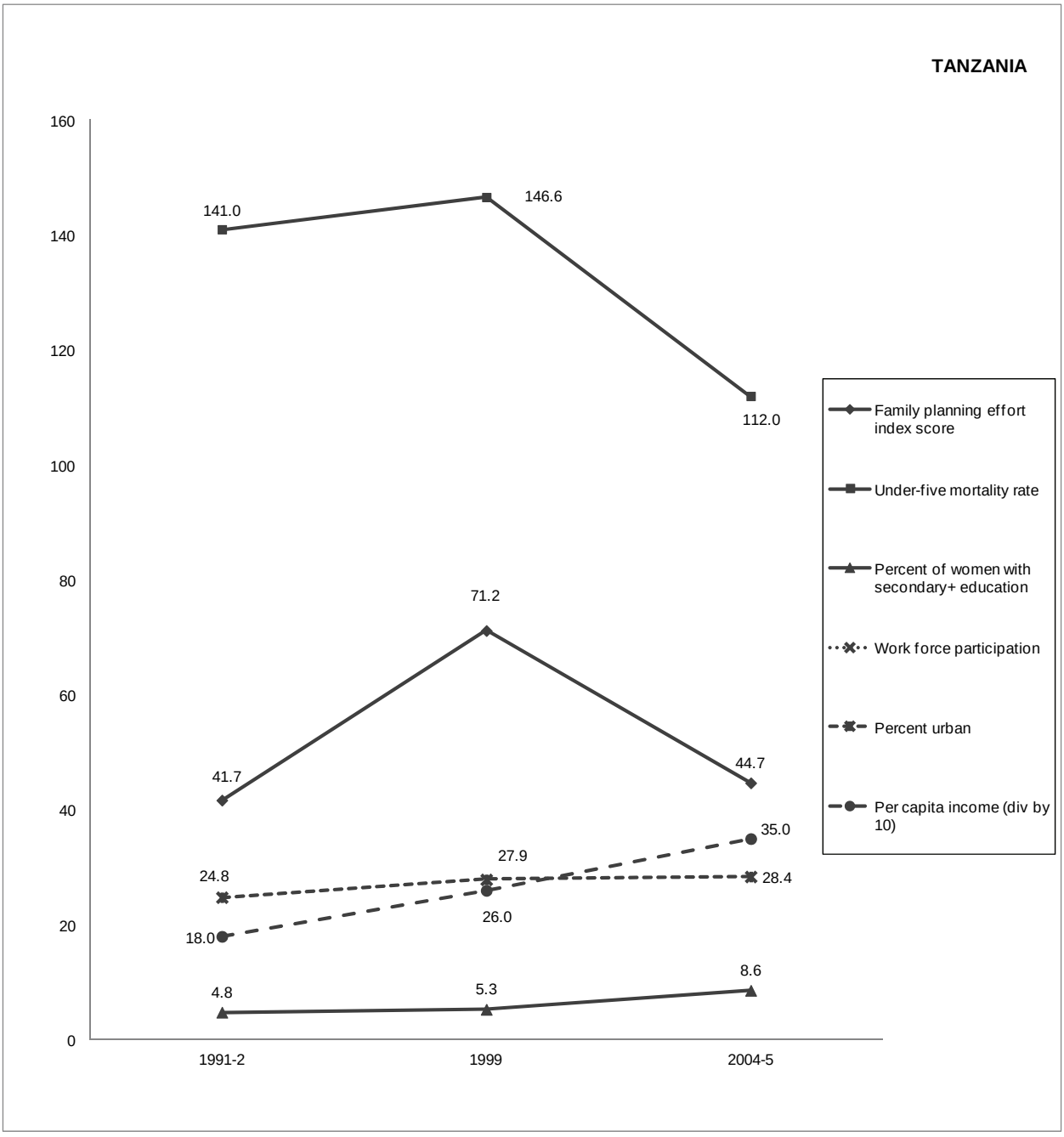


Figure 34. Changes in the indirect determinants in Tanzania, DHS surveys 1991-2005



ZAMBIA

Total fertility rate: The *TFR* declined by 9 percent between 1992 and 2001-02, from 6.46 to 5.88. It then increased to 6.17 in 2007.

Proximate determinants: Infecundity and non-marriage were virtually unchanged during this 15-year interval, except for a small increase in infecundity between the third and fourth surveys. Contraceptive use increased steadily, but between the third and fourth surveys its effect on fertility was largely nullified by reductions in infecundity.

Background variables: While trends in most of the background variables remain flat over the past three survey periods, under-five mortality shows a pronounced decline, and per capita income displays an increase, from 190 in 1996 to 410 in 2007.

Indicator of satisfaction of fertility preferences: Zambia exhibits a trend in planning status for most recent births that is typical of countries with a significant HIV epidemic: The proportion of women reporting that their most recent birth was mistimed or unwanted has increased in Zambia, from 37 percent in 1996 to 41 percent in 2001-02 and 42 percent in 2007.

Indicators of uptake of fertility-related public health messages: In Zambia, childbearing among women under age 18 has been relatively high, at 9 percent in 1996 and 10 percent in 2001-02, but shows encouraging signs of decline in 2007, to 7 percent. Childbearing among women over age 34 is fairly stable and comparatively low. It is worth pointing out that in 2007 the observed reduction in higher-risk childbearing during the teen years appears to have been offset by an increase in higher-risk childbearing during older ages. Trends in the median birth interval are moderate but encouraging, increasing by about one month with each survey period. By 2007, the median birth interval was 34.4 months, close to the bottom of the optimal birth spacing range.

Summary: While trends in the actual fertility rate indicate a stall in fertility decline at high levels of childbearing (more than five children per woman), this pattern does not correspond with the trends in the Bongaarts indices nor with the background factors, which exhibit patterns in key variables (under-five mortality and to some extent per capita income) that are typically associated with declines in fertility. Problems with data quality should not be ruled out.

Zambia's high levels of unplanned births occur in a context where contraceptive use has been exerting a stronger effect on fertility dynamics over time. It should be a policy and programmatic priority to ensure that women in Zambia have access and freedom to methods that they can use to implement their fertility preferences. This will ensure that women's reproductive desires are respected, and can also have a significant impact on reducing overall levels of mother-to-child transmission of HIV.

Figure 35. Changes in the observed *TFR* in Zambia, DHS surveys 1992-2007

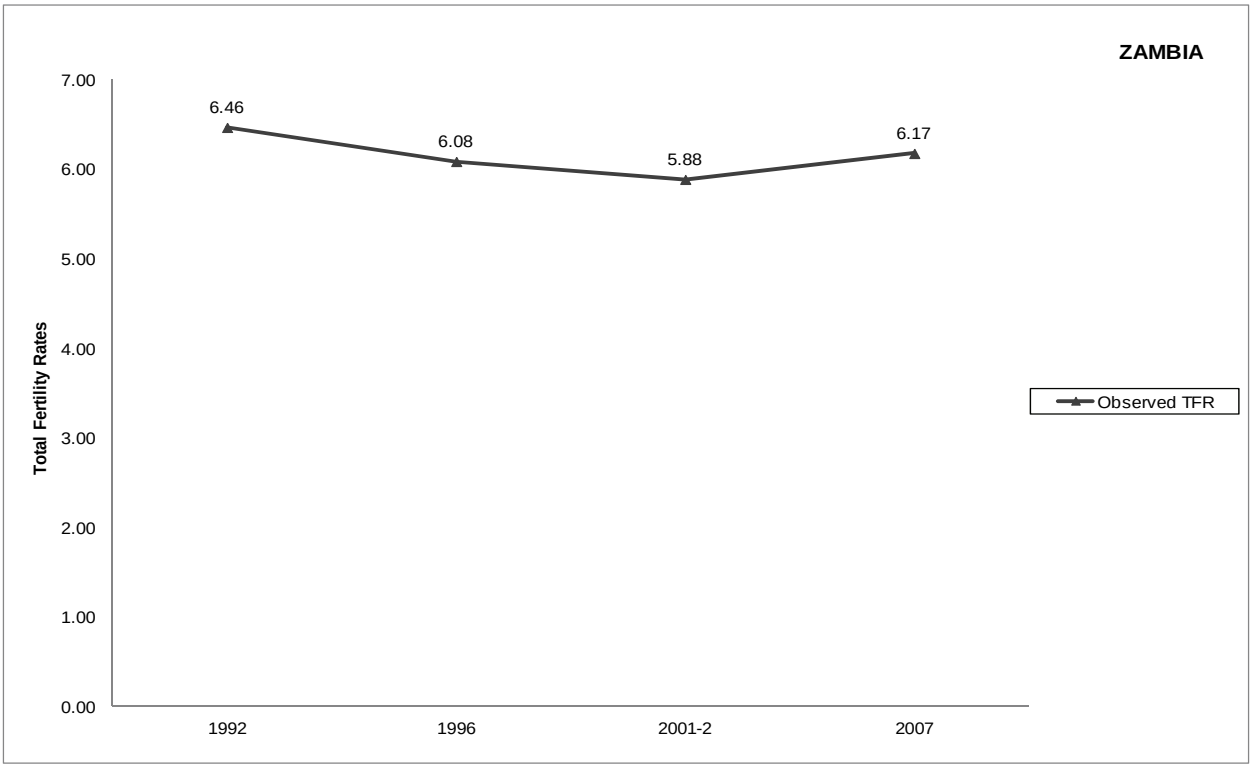


Figure 36. Changes in the proximate determinants in Zambia, DHS surveys 1992-2007

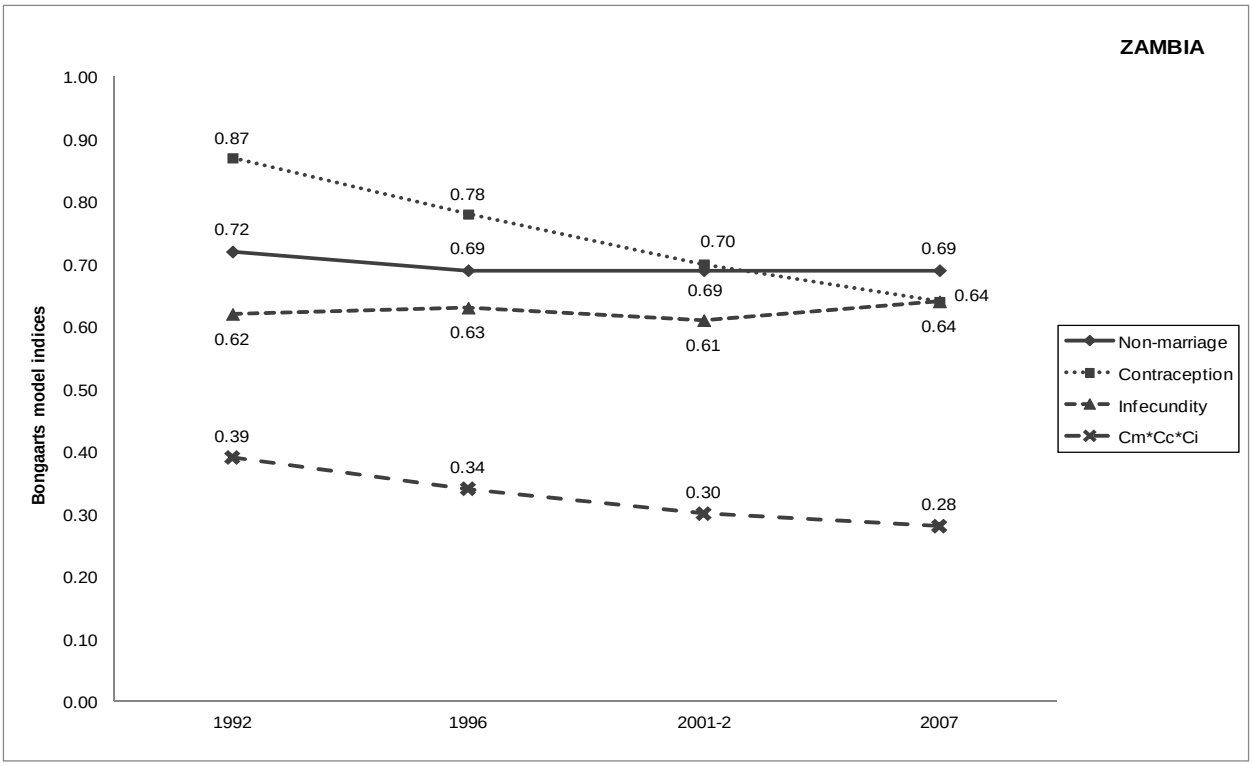
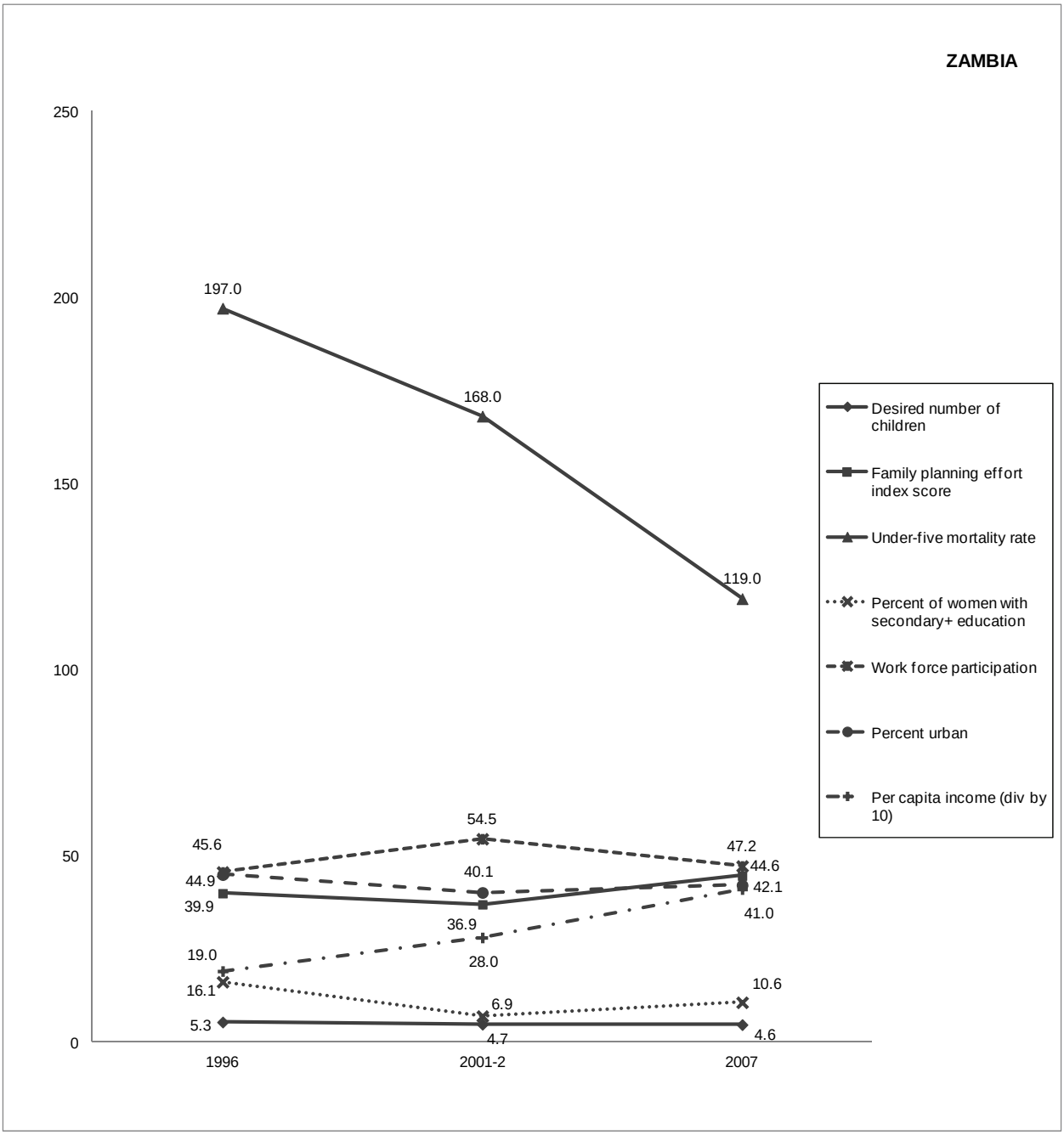


Figure 37. Changes in the indirect determinants in Zambia, DHS surveys 1992-2007



ZIMBABWE

Total fertility rate: The observed *TFR* in Zimbabwe declined from 5.43 in 1988 to 4.29 in 1994 and 3.96 in 1999, and marginally further to 3.80 in 2005-06. The overall decline was 30 percent in 17 or 18 years, with the majority of this decline from 1988 to 1994, after which there was little change.

Proximate determinants: Contraception increased steadily across the full interval, but this did not translate into a steady decline in the *TFR*, particularly from 1988 to 1994. Between 1988 and 1994, non-marriage also moved in the direction of fertility reduction, but with little apparent impact.

Background variables: The background variables observed in Zimbabwe have likely been affected by the ongoing governmental crisis, with workforce participation and per capita income declining. However, the percentage of women with secondary or higher education continues a monotonic increase over time, while the family planning effort index score increased from 1994 to 1999, then held steady through 2005-06 at a level among the highest in this study, with a score of 59.9.

Indicator of satisfaction of fertility preferences: Zimbabwe has made reasonable progress in reducing mistimed and unwanted pregnancy. However, levels of unplanned pregnancy were comparatively high in 1994, at 44 percent; thus, the declines to 38 percent in 1999 and 34 percent by 2005-06 still leave more than one-third of women with unsatisfied reproductive preferences.

Indicators of uptake of fertility-related public health messages: The level of teen childbearing in Zimbabwe is about 7 percent and has remained stable, while the percentage of births to women over age 34 has declined, from 14 percent in 1994 to 12 percent in 1999 and 10 percent in 2005-06. Further evidence of effective public health programming can be seen in the increase in the median duration of birth intervals: In 1994, the median birth interval was 37.4 months–already within the recommended range. It increased further to 39.9 months in 1999, and further still to 41.6 months in 2005-06.

Summary: Zimbabwe is making progress on a number of fertility-related health indicators and in meeting women's reproductive needs, including reductions in the percentage of women whose most recent pregnancy was mistimed or unwanted, reductions in childbearing at older ages, and a longer median interval between births. Despite having made progress in reducing unplanned pregnancy, 34 percent of women in Zimbabwe nevertheless report mistimed or unwanted pregnancies; this should be a key area for programmatic intervention. While contraception has played a progressively larger role in shaping the fertility regime in Zimbabwe, questions remain as to whether fertility decline itself has stalled in Zimbabwe or whether data quality concerns are affecting fertility estimates.

Figure 38. Changes in the observed *TFR* in Zimbabwe, DHS surveys 1988-2006

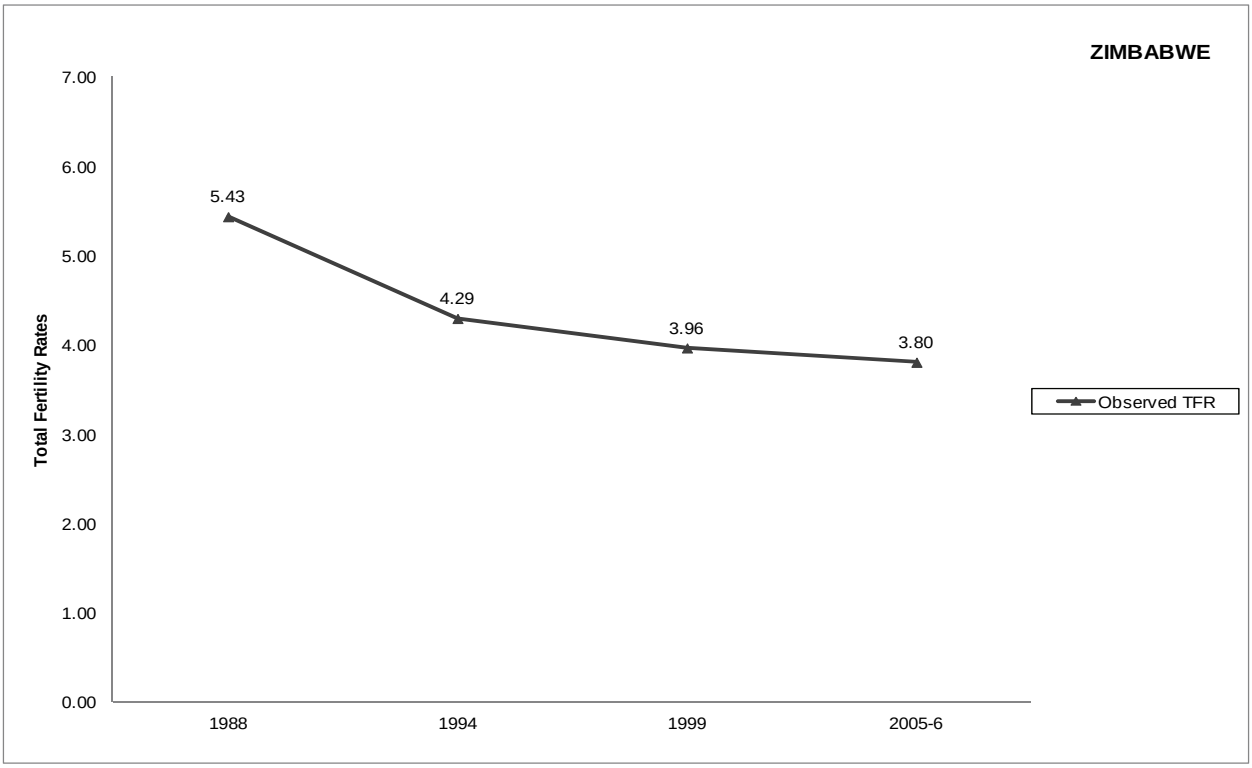


Figure 39. Changes in the proximate determinants in Zimbabwe, DHS surveys 1988-2006

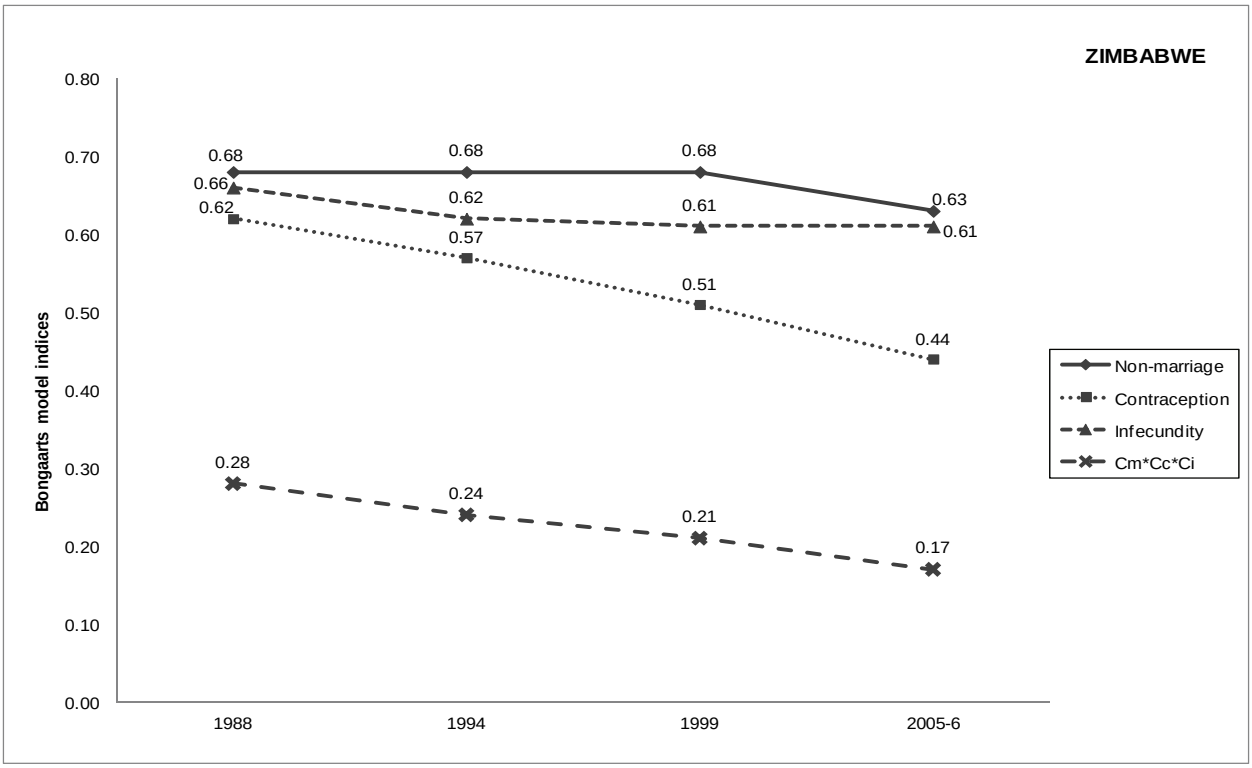


Figure 40. Changes in the indirect determinants in Zimbabwe, DHS surveys 1988-2006

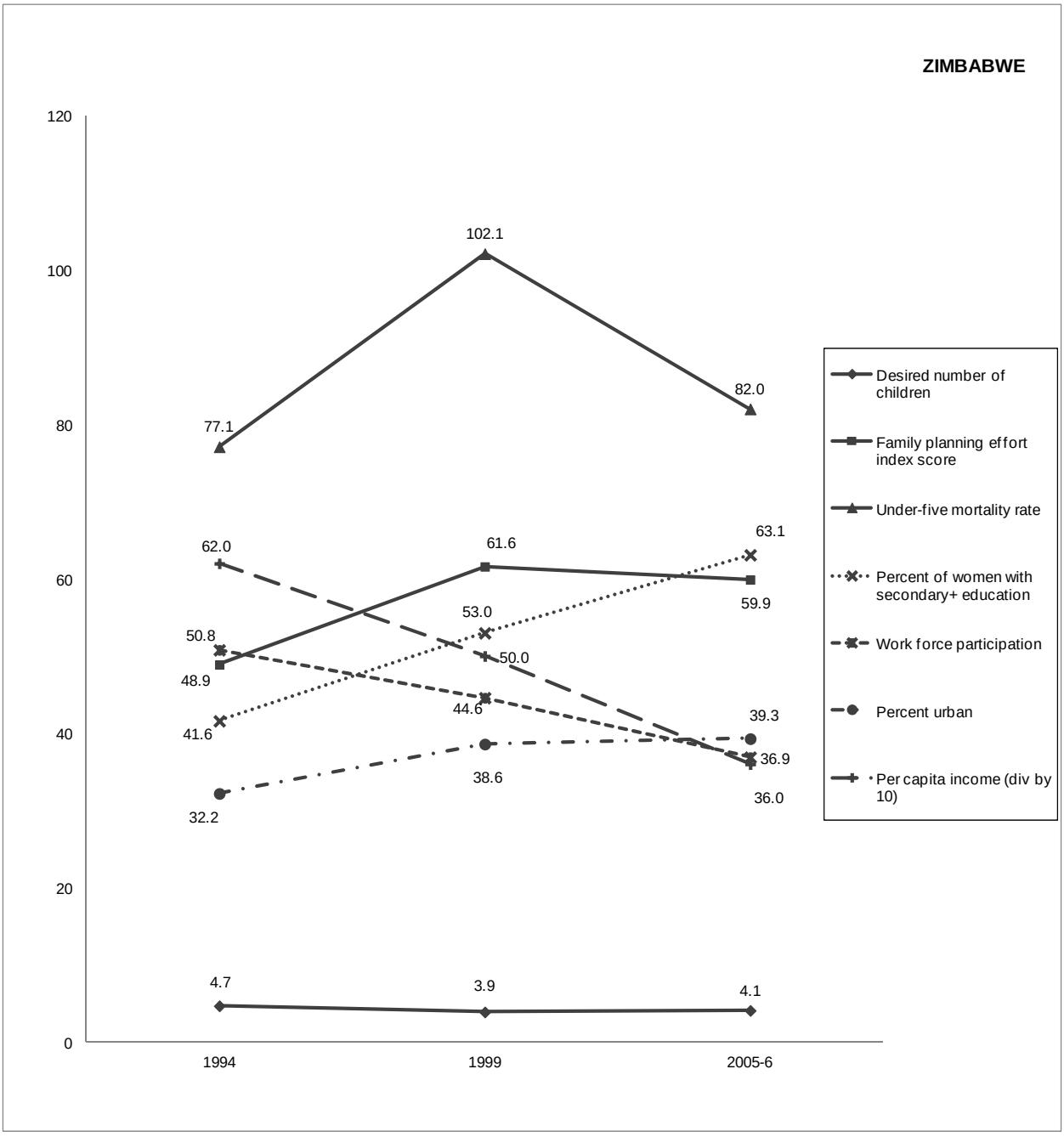


Table 1. Trends in the effect of each proximate determinant of fertility (Bongaarts indices) on the total fertility rate (*TFR)*, selected sub-Saharan African Demographic and Health Surveys.

BENIN			
	1996	**2001**	**2006**
Observed *TFR*	5.96	5.61	5.74
Non-marriage	0.80	0.77	0.76
Contraception	0.86	0.84	0.85
Infecundity	0.54	0.57	0.59
$C_m*C_c*C_i$	0.37	0.37	0.38
Residual factor	1.05	0.99	0.98

BURKINA FASO			
	1993	**1999**	**2003**
Observed *TFR*	6.52	6.43	5.88
Non-marriage	0.90	0.87	0.83
Contraception	0.82	0.90	0.87
Infecundity	0.49	0.48	0.51
$C_m*C_c*C_i$	0.36	0.38	0.37
Residual factor	1.20	1.11	1.04

CAMEROON			
	1991	**1998**	**2004**
Observed *TFR*	5.82	4.81	4.97
Non-marriage	0.80	0.72	0.75
Contraception	0.85	0.82	0.76
Infecundity	0.57	0.58	0.63
$C_m*C_c*C_i$	0.39	0.34	0.35
Residual factor	0.99	0.91	0.92

GHANA					
	1988	**1993**	**1998**	**2003**	**2008**
Observed *TFR*	6.41	5.16	4.44	4.45	4.03
Non-marriage	0.75	0.74	0.68	0.65	0.59
Contraception	0.88	0.82	0.79	0.77	0.79
Infecundity	0.55	0.56	0.58	0.59	0.59
$C_m*C_c*C_i$	0.37	0.34	0.31	0.29	0.28
Residual factor	1.13	1.00	0.92	0.99	0.96

RWANDA			
	1992	**2000**	**2005**
Observed *TFR*	6.23	5.84	6.08
Non-marriage	0.62	0.55	0.53
Contraception	0.81	0.89	0.86
Infecundity	0.57	0.57	0.60
$C_m*C_c*C_i$	0.29	0.28	0.27
Residual factor	1.42	1.37	1.47

KENYA					
	1989	**1993**	**1998**	**2003**	**2009**
Observed *TFR*	6.67	5.40	4.70	4.88	4.56
Non-marriage	0.69	0.66	0.66	0.64	0.61
Contraception	0.76	0.70	0.64	0.63	0.57
Infecundity	0.67	0.65	0.66	0.64	0.68
$C_m*C_c*C_i$	0.36	0.30	0.28	0.26	0.24
Residual factor	1.22	1.20	1.09	1.24	1.25

MADAGASCAR				
	1992	**1997**	**2003-4**	**2008-9**
Observed *TFR*	6.13	5.97	5.17	4.82
Non-marriage	0.65	0.68	0.69	0.76
Contraception	0.85	0.82	0.75	0.60
Infecundity	0.64	0.64	0.67	0.68
$C_m*C_c*C_i$	0.35	0.36	0.34	0.31
Residual factor	1.13	1.09	0.98	1.02

MALAWI			
	1992	**2000**	**2004**
Observed *TFR*	6.73	6.35	6.04
Non-marriage	0.79	0.78	0.77
Contraception	0.88	0.71	0.68
Infecundity	0.62	0.60	0.60
$C_m*C_c*C_i$	0.43	0.33	0.32
Residual factor	1.02	1.26	1.25

NAMIBIA			
	1992	**2000**	**2006-7**
Observed *TFR*	5.37	4.18	3.57
Non-marriage	0.41	0.37	0.30
Contraception	0.73	0.57	0.49
Infecundity	0.64	0.53	0.63
$C_m*C_c*C_i$	0.19	0.11	0.09
Residual factor	1.84	2.51	2.49

ZAMBIA				
	1992	**1996**	**2001-2**	**2007**
Observed *TFR*	6.46	6.08	5.88	6.17
Non-marriage	0.72	0.69	0.69	0.69
Contraception	0.87	0.78	0.70	0.64
Infecundity	0.62	0.63	0.61	0.64
$C_m*C_c*C_i$	0.39	0.34	0.30	0.28
Residual factor	1.08	1.17	1.30	1.42

(Continued...)

Table 1 – *Continued*

SENEGAL				
	1986	**1992-3**	**1997**	**2005**
Observed *TFR*	6.39	6.03	5.67	5.26
Non-marriage	0.80	0.74	0.71	0.73
Contraception	0.92	0.94	0.89	0.89
Infecundity	0.56	0.57	0.58	0.60
$C_m*C_c*C_i$	0.41	0.39	0.36	0.39
Residual factor	1.01	1.00	1.02	0.89

TANZANIA				
	1991-2	**1996**	**1999**	**2004-5**
Observed *TFR*	6.24	5.82	5.55	5.66
Non-marriage	0.72	0.73	0.71	0.72
Contraception	0.90	0.83	0.77	0.76
Infecundity	0.58	0.57	0.60	0.62
$C_m*C_c*C_i$	0.38	0.34	0.33	0.34
Residual factor	1.09	1.11	1.10	1.09

ZIMBABWE				
	1988	**1994**	**1999**	**2005-6**
Observed *TFR*	5.43	4.29	3.96	3.80
Non-marriage	0.68	0.68	0.68	0.63
Contraception	0.62	0.57	0.51	0.44
Infecundity	0.66	0.62	0.61	0.61
$C_m*C_c*C_i$	0.28	0.24	0.21	0.17
Residual factor	1.26	1.15	1.22	1.46

Table 2. Trends in fertility rates, proximate determinants of fertility, and relevant background variables, selected sub-Saharan African Demographic and Health Surveys.

		Proximate determinants					Background variables						
Country and Year	Observed *TFR*	Age at marriage (25-49)	Age at marriage (20-49)	Percentage of currently married women using a contraceptive method to space	Percentage of currently married women using a contraceptive method to limit	Median number of months of postpartum infecundity	Desired number of children	Family planning effort index score	Under-five mortality rate	Percentage of women with secondary+ education	Work force participation (%)	Percent urban	Per capita income (div by 10)
Benin 1996	5.96	18.4	18.5	11.3	5.1	18.9	5.5	30.3	166.5	5.4	85.7	22.9	34.0
Benin 2001	5.61	18.8	18.9	12.0	6.6	15.1	4.9	53.4	160.0	1.2	82.2	40.7	25.0
Benin 2006	5.74	18.6	18.8	10.2	6.8	14.4	4.9	35.1	125.0	1.9	78.7	41.4	57.0
(T2-T1)	-0.35	0.4	0.4	0.7	1.5	-3.8	-0.6	23.1	-6.5	-4.2	-3.5	17.8	-9.0
(T3-T2)	0.13	-0.2	-0.1	-1.8	0.2	-0.7	0.0	-18.3	-35.0	0.7	-3.5	0.7	32.0
(T3-T1)	-0.22	0.20	0.30	-1.10	1.70	-4.50	-0.6	4.8	-41.5	-3.5	-7.0	18.5	23.0
Burkina Faso 1993	6.52	17.5	17.5	19.0	5.9	22.2	5.9	46.0	187.0	6.6	na	20.4	28.0
Burkina Faso 1998-99	6.43	17.6	17.6	9.0	2.8	22.6	5.9	58.3	219.1	5.8	na	16.9	25.0
Burkina Faso 2003	5.88	17.7	17.7	9.9	3.9	19.9	5.8	45.6	184.0	1.6	70.0	21.6	29.0
(T2-T1)	-0.09	0.1	0.1	-10.0	-3.1	0.4	0.0	12.3	32.1	-0.8	na	-3.5	-3.0
(T3-T2)	-0.55	0.1	0.1	0.9	1.1	-2.7	-0.1	-12.7	-35.1	-4.2	na	4.7	4.0
(T3-T1)	-0.64	0.2	0.2	-9.1	-2.0	-2.3	-0.1	-0.4	-3.0	-5.0	na	1.2	1.0
Cameroon 1991	5.82	16.5	16.7	11.0	5.0	16.0	7.3	35.5	143.8	26.5	na	42.0	82.0
Cameroon 1998	4.81	17.4	17.7	12.1	7.3	15.5	6.5	41.1	144.2	33.3	68.5	35.3	63.0
Cameroon 2004	4.97	17.6	17.8	17.7	8.3	13.7	5.7	41.4	141.0	39.1	58.0	54.8	81.0
(T2-T1)	-1.01	0.9	1.0	1.1	2.3	-0.5	-0.8	5.6	0.4	6.8	na	-6.7	-19.0
(T3-T2)	0.16	0.2	0.1	5.6	1.0	-1.8	-0.8	0.3	-3.2	5.8	-10.5	19.5	18.0
(T3-T1)	-0.85	1.1	1.1	6.7	3.3	-2.3	-1.6	5.9	-2.8	12.6	na	12.8	-1.0
Ghana 1998	4.44	19.1	19.1	12.3	9.7	14.0	4.6	52.6	107.6	10.4	73.6	35.9	38.0
Ghana 2003	4.45	19.4	19.6	13.7	11.4	13.8	4.8	55.5	111.0	7.8	75.1	48.4	31.0
Ghana 2008	4.03	19.8	na	12.3	11.2	12.4	4.6	46.4	80.0	14.0	74.8	48.5	68.0
(T2-T1)	0.01	0.3	0.5	1.4	1.7	-0.2	0.2	2.9	3.4	-2.6	1.5	12.5	-7.0
(T3-T2)	-0.42	0.4	na	-1.4	-0.2	-1.4	-0.2	-9.1	-31.0	6.2	-0.3	0.1	37.0
(T3-T1)	-0.41	0.7	na	0.0	1.5	-1.6	0.0	-6.2	-27.6	3.6	1.2	12.6	30.0

(Continued...)

Table 2 – *Continued*

		Proximate determinants					Background variables						
Country and Year	Observed *TFR*	Age at marriage (25-49)	Age at marriage (20-49)	Percentage of currently married women using a contraceptive method to space	Percentage of currently married women using a contraceptive method to limit	Median number of months of postpartum infecundity	Desired number of children	Family planning effort index score	Under-five mortality rate	Percentage of women with secondary+ education	Work force participation (%)	Percent urban	Per capita income (div by 10)
Kenya 1998	4.70	19.2	19.5	13.4	25.6	11.1	4.1	55.8	111.5	15.9	52.0	23.2	43.0
Kenya 2003	4.88	19.7	19.9	14.3	25.0	11.8	4.3	49.6	115.0	18.2	58.4	25.1	41.0
Kenya 2008-09	4.56	20.0	na	17.5	28.0	10.3	3.8	48.7	74.0	22.0	56.6	25.4	73.0
(T2-T1)	0.18	0.5	0.4	0.9	-0.6	0.7	0.2	-6.2	3.5	2.3	6.4	1.9	-2.0
(T3-T2)	-0.32	0.3	na	3.2	3.0	-1.5	-0.5	-0.9	-41.0	3.8	-1.8	0.3	32.0
(T3-T1)	-0.14	0.8	na	4.1	2.4	-0.8	-0.3	-7.1	-37.5	6.1	4.6	2.2	30.0
Madagascar 1999	5.97	18.5	18.6	7.9	11.6	12.0	5.7	33.7	159.2	26.9	77.8	28.1	25.0
Madagascar 2003-04	5.17	19.1	19.1	12.3	14.9	11.1	5.1	47.7	93.9	7.7	87.0	24.8	29.0
Madagascar 2008-09	4.82	18.9	18.7	19.0	21.0	10.7	4.9	64.0	72.0	4.5	82.9	17.3	42.0
(T2-T1)	-0.80	0.6	0.5	4.4	3.3	-0.9	-0.6	14.0	-65.3	-19.2	9.2	-3.3	4.0
(T3-T2)	-0.35	-0.2	-0.4	6.7	6.1	-0.4	-0.2	16.3	-21.9	-3.2	-4.1	-7.5	13.0
(T3-T1)	-1.15	0.4	0.1	11.1	9.4	-1.3	-0.8	30.3	-87.2	-22.4	5.1	-10.8	17.0
Malawi 1992	6.73	17.8	17.7	7.4	5.7	na	5.1	44.2	233.8	4.4	na	12.3	20.0
Malawi 2000	6.35	na	17.9	12.7	17.9	14.5	5.3	50.1	188.6	11.1	56.4	15.9	15.0
Malawi 2004	6.04	na	18.0	15.5	17.0	12.9	4.3	47.8	133.0	15.5	55.2	17.8	21.0
(T2-T1)	-0.38	na	na	5.3	12.2	na	na	5.9	na	6.7	na	3.6	-5.0
(T3-T2)	-0.31	na	0.1	2.8	-0.9	-1.6	-1.0	-2.3	-55.6	4.4	-1.2	1.9	6.0
(T3-T1)	-0.69	na	na	8.1	11.3	na	na	3.6	na	11.1	na	5.5	1.0
Namibia 1992	5.37	24.8	na	11.2	17.7	12.8	5.7	39.9	83.2	20.4	na	38.3	184.0
Namibia 2000	4.18	26.2	na	13.1	30.7	18.3	4.0	36.9	62.2	14.4	32.6	41.2	203.0
Namibia 2006-07	3.57	29.1	34.4	17.6	37.5	13.1	3.7	44.6	69.0	20.1	44.4	48.7	389.0
(T2-T1)	-1.19	1.4	na	1.9	13.0	5.5	-1.7	-3.0	-21.0	-6.0	na	2.9	19.0
(T3-T2)	-0.61	2.9	na	4.5	6.8	-5.2	-0.3	7.7	6.8	5.7	11.8	7.5	186.0
(T3-T1)	-1.80	4.3	na	6.4	19.8	0.3	-2.0	4.7	-14.2	-0.3	na	10.4	205.0

(Continued...)

Table 2 – *Continued*

Country and Year	Observed *TFR*	Proximate determinants: Age at marriage (25-49)	Age at marriage (20-49)	Percentage of currently married women using a contraceptive method to space	Percentage of currently married women using a contraceptive method to limit	Median number of months of postpartum infecundity	Background variables: Desired number of children	Family planning effort index score	Under-five mortality rate	Percentage of women with secondary+ education	Work force participation (%)	Percent urban	Per capita income (div by 10)
Rwanda 1992	6.23	20.0	na	10.2	11.0	17.1	4.2	43.3	150.8	7.9	na	6.2	36.0
Rwanda 2000	5.84	20.7	na	7.3	5.9	15.3	5.0	44.0	196.2	2.1	79.0	17.2	25.0
Rwanda 2005	6.08	20.7	na	7.4	9.9	15.3	4.5	35.7	152.0	9.6	64.1	17.0	25.0
(T2-T1)	-0.39	0.7	na	-2.9	-5.1	-1.8	0.8	0.7	45.4	-5.8	na	11.0	-11.0
(T3-T2)	0.24	na	na	0.1	4.0	na	-0.5	-8.3	-44.2	7.5	-14.9	-0.2	0.0
(T3-T1)	-0.15	na	na	-2.8	-1.1	na	0.3	-7.6	1.2	1.7	na	10.8	-11.0
Senegal 1992-93	6.03	16.2	16.6	4.4	3.1	16.2	5.9	50.8	131.8	9.9	na	41.8	70.0
Senegal 1997	5.67	17.4	18.0	8.0	4.9	15.1	5.3	52.0	139.1	12.5	na	44.2	54.0
Senegal 2005	5.26	18.3	18.5	7.3	4.5	12.6	5.7	46.1	121.0	15.2	37.9	48.7	77.0
(T2-T1)	-0.36	na	na	3.6	1.8	-1.1	-0.6	1.2	7.3	2.6	na	2.4	-16.0
(T3-T2)	-0.41	na	na	-0.7	-0.4	-2.5	0.4	-5.9	-18.1	2.7	na	4.5	23.0
(T3-T1)	-0.77	2.1	1.9	2.9	1.4	-3.6	-0.2	-4.7	-10.8	5.3	na	6.9	7.0
Tanzania 1991-92	6.24	17.9	18.3	5.9	4.5	15.6	5.5	41.7	141.0	4.8	na	24.8	18.0
Tanzania 1999	5.55	18.1	18.4	15.1	10.3	14.7	5.3	71.2	146.6	5.3	na	27.9	26.0
Tanzania 2004-05	5.66	18.6	18.6	15.5	10.9	13.0	5.0	44.7	112.0	8.6	na	28.4	35.0
(T2-T1)	-0.69	0.2	0.1	9.2	5.8	-0.9	0.2	29.5	5.6	0.5	na	3.1	8.0
(T3-T2)	0.11	0.5	0.2	0.4	0.6	-1.7	0.3	-26.5	-34.6	3.3	na	0.5	9.0
(T3-T1)	-0.58	0.7	0.3	9.6	6.4	-2.6	0.5	3.0	-29.0	3.8	na	3.6	17.0
Zambia 1996	6.08	17.7	18.0	15.8	10.0	14.1	5.3	39.9	197.0	16.1	45.6	44.9	19.0
Zambia 2001-02	5.88	17.8	18.1	19.2	15.0	14.9	4.7	36.9	168.0	6.9	54.5	40.1	28.0
Zambia 2007	6.17	18.2	18.4	24.8	15.9	12.5	4.6	44.6	119.0	10.6	47.2	42.1	41.0
(T2-T1)	-0.20	0.1	0.1	3.4	5.0	0.8	-0.6	-3.0	-29.0	-9.2	8.9	-4.8	9.0
(T3-T2)	0.29	0.4	0.3	5.6	0.9	-2.4	-0.1	7.7	-49.0	3.7	-7.3	2.0	13.0
(T3-T1)	0.09	0.5	0.4	9.0	5.9	-1.6	-0.7	4.7	-78.0	-5.5	1.6	-2.8	22.0

(Continued...)

Table 2 – *Continued*

		Proximate determinants					Background variables						
Country and Year	Observed *TFR*	Age at marriage (25-49)	Age at marriage (20-49)	Percentage of currently married women using a contraceptive method to space	Percentage of currently married women using a contraceptive method to limit	Median number of months of postpartum infecundity	Desired number of children	Family planning effort index score	Under-five mortality rate	Percentage of women with secondary+ education	Work force participation (%)	Percent urban	Per capita income (div by 10)
Zimbabwe 1994	4.29	18.9	19.2	27.0	21.1	14.1	4.7	48.9	77.1	41.6	50.8	32.2	62.0
Zimbabwe 1999	3.96	19.3	19.4	29.4	24.1	15.6	3.9	61.6	102.1	53.0	44.6	38.6	50.0
Zimbabwe 2005-06	3.80	19.3	19.4	31.2	29.1	15.6	4.1	59.9	82.0	63.1	36.9	39.3	36.0
(T2-T1)	-0.33	0.4	0.2	2.4	3.0	1.5	-0.8	12.7	25.0	11.4	-6.2	6.4	na
(T3-T2)	-0.16	0.0	0.0	1.8	5.0	0.0	0.2	-1.7	-20.1	10.1	-7.7	0.7	-14.0
(T3-T1)	-0.49	0.4	0.2	4.2	8.0	1.5	-0.6	11.0	4.9	21.5	-13.9	7.1	na

Table 3. Indicators of satisfaction of women's fertility preferences and of uptake of fertility-related public health messages, selected sub-Saharan African Demographic and Health Surveys.

Country and survey year	Percentage of women with a birth in the past year who report that the pregnancy was not wanted, or was mistimed	Percentage of births to mothers under age 18	Percentage of births to mothers over age 34	Median birth interval, in months
Benin 1996	26.4	5.0	17.6	33.8
Benin 2001	22.8	5.9	14.3	34.7
Benin 2006	18.0	4.8	12.8	35.0
Burkina Faso 1993	25.4	5.9	15.8	34.7
Burkina Faso 1998-99	21.2	6.5	17.8	34.8
Burkina Faso 2003	23.1	5.7	17.7	35.8
Cameroon 1991	21.0	11.5	11.4	30.3
Cameroon 1998	29.1	11.0	12.1	31.5
Cameroon 2004	22.7	10.9	10.9	32.0
Ghana 1998	37.1	4.3	18.1	38.2
Ghana 2003	40.6	3.9	19.8	38.4
Ghana 2008	37.7	4.4	17.1	39.7
Kenya 1998	48.6	6.4	10.7	32.9
Kenya 2003	44.8	6.9	12.3	32.6
Kenya 2008-09	42.8	6.4	11.4	33.1
Madagascar 1997	26.5	10.7	14.0	29.4
Madagascar 2003-04	16.7	9.8	14.6	na
Madagascar 2008-09	13.1	11.0	15.5	32.7
Malawi 1992	41.2	8.1	18.1	32.7
Malawi 2000	40.4	7.7	12.8	33.8
Malawi 2004	40.5	7.6	11.6	35.9
Namibia 1992	35.0	5.7	18.0	33.5
Namibia 2000	46.0	6.4	17.1	39.9
Namibia 2006-07	53.7	6.4	14.5	42.3
Rwanda 1992	51.0	2.2	20.2	31.6
Rwanda 2000	35.7	2.0	22.0	32.3
Rwanda 2005	40.2	1.4	20.8	31.3
Senegal 1992-93	29.8	7.8	16.4	32.4
Senegal 1997	35.9	6.0	18.4	33.0
Senegal 2005	29.3	7.4	15.5	33.4
Tanzania 1991-92	24.5	6.8	14.5	33.3
Tanzania 1999	22.5	7.0	12.8	33.3
Tanzania 2004-05	23.6	6.8	12.2	33.4

(Continued...)

Table 3 – *Continued*

Country and survey year	Percentage of women with a birth in the past year who report that the pregnancy was not wanted, or was mistimed	Percentage of births to mothers under age 18	Percentage of births to mothers over age 34	Median birth interval, in months
Zambia 1996	37.3	8.5	11.4	31.9
Zambia 2001-02	40.6	9.7	11.5	33.3
Zambia 2007	41.7	6.8	13.2	34.4
Zimbabwe 1994	43.6	7.6	14.1	37.4
Zimbabwe 1999	37.6	7.7	11.9	39.9
Zimbabwe 2005-06	33.5	7.0	9.5	41.6

5. Discussion and Conclusions

For most of the 13 countries in this analysis, the Bongaarts model for the proximate determinants of fertility provides a useful framework for understanding fertility change. The model can show, for example, how a decline in fertility is due more to a delay in first union than to increased use of family planning, or how the potential impact of increased contraception is effectively cancelled out by a reduction in postpartum infecundity.

The internal consistency of the model is reflected by the stability of the residual factor *R*, shown in Table 1, across surveys within a country. Fluctuations in *R* can arise from a variety of sources, such as the omission of the proximate determinant for abortion; fluctuations in data quality; a change in the pattern across age, which is ignored in the model; or the imperfect synchronization of the measurements of fertility and the proximate determinants, particularly contraceptive use. A sharp fluctuation in *R* from one survey to the next is a warning that the model should be used with caution.

To assist with an overview of patterns in the 13 countries, Figures 41-44 show the changes in the *TFR* and the three *C*'s, with all the countries in the same figure. The dates of the surveys are roughly classified into five time intervals: the late (l) 1980s (T0); early (e) 1990s (T1); late (l) 1990s (T2); early (e) 2000s (T3); and late (l) 2000s (T4).

Figure 41 shows the pattern of the *TFR*. Comparing each survey with the one that came before it in the same country, in the great majority of comparisons there was a fertility decline, even if small, from one survey to the next. For only a handful of comparisons was there no change at all or an increase. Nevertheless, most changes since the late 1990s (T2) could fairly be described as minor. Conspicuous declines from T0 to T1 and from T1 to T2 did not extend into more recent years. Most countries had a *TFR* of nearly five or more at the time of their most recent survey. The *TFR* remains high even for Kenya, Ghana, and Zimbabwe, which saw early declines.

C_m, the index for the effect of non-marriage on fertility, is graphed in Figure 42. Except for Madagascar (its full sequence) and Cameroon (between its 1998 and 2004 surveys), the effect has uniformly been in the direction of reduced exposure, manifested in later age at first union and first birth. The changes are small but similar across countries and time periods.

Figure 43 combines all countries in terms of C_c, the index for the effect of contraception on fertility. This is of course the proximate determinant of main interest. Again, with just a few exceptions, the movement is consistently in the direction of lower fertility, but from T2 to T3, and from T3 to T4, apart from Madagascar, the declines have been small.

Finally, Figure 44 gives C_i, the index for the effect of extended postpartum infecundity on fertility. Although small, these changes have been overwhelmingly in the direction of *increasing* fertility. Briefly put, declines in breastfeeding have shortened the interval of postpartum amenorrhea and increased the amount of time when a woman is at risk of conceiving.

Thus, as a broad generalization, two of the proximate determinants have been shifting in the direction of reducing fertility, through a later age at first union and greater use of contraception. Postpartum infecundity, mainly because of less use of breastfeeding, has moved in the opposite direction, effectively cancelling out a substantial part of the potential impact of the other two proximate determinants and contributing to a stall or stagnation in fertility decline. This pattern is not at all unusual during a fertility transition. The simultaneous combination of later marriage, increased contraception, and reduced breastfeeding has been seen in many fertility transitions. But in sub-Saharan Africa, gains in contraceptive

use have been so limited and gradual that they are nearly overwhelmed by the contrary movement of infecundity.

Figure 41. Changes in the observed TFR in 13 sub-Saharan countries, DHS surveys

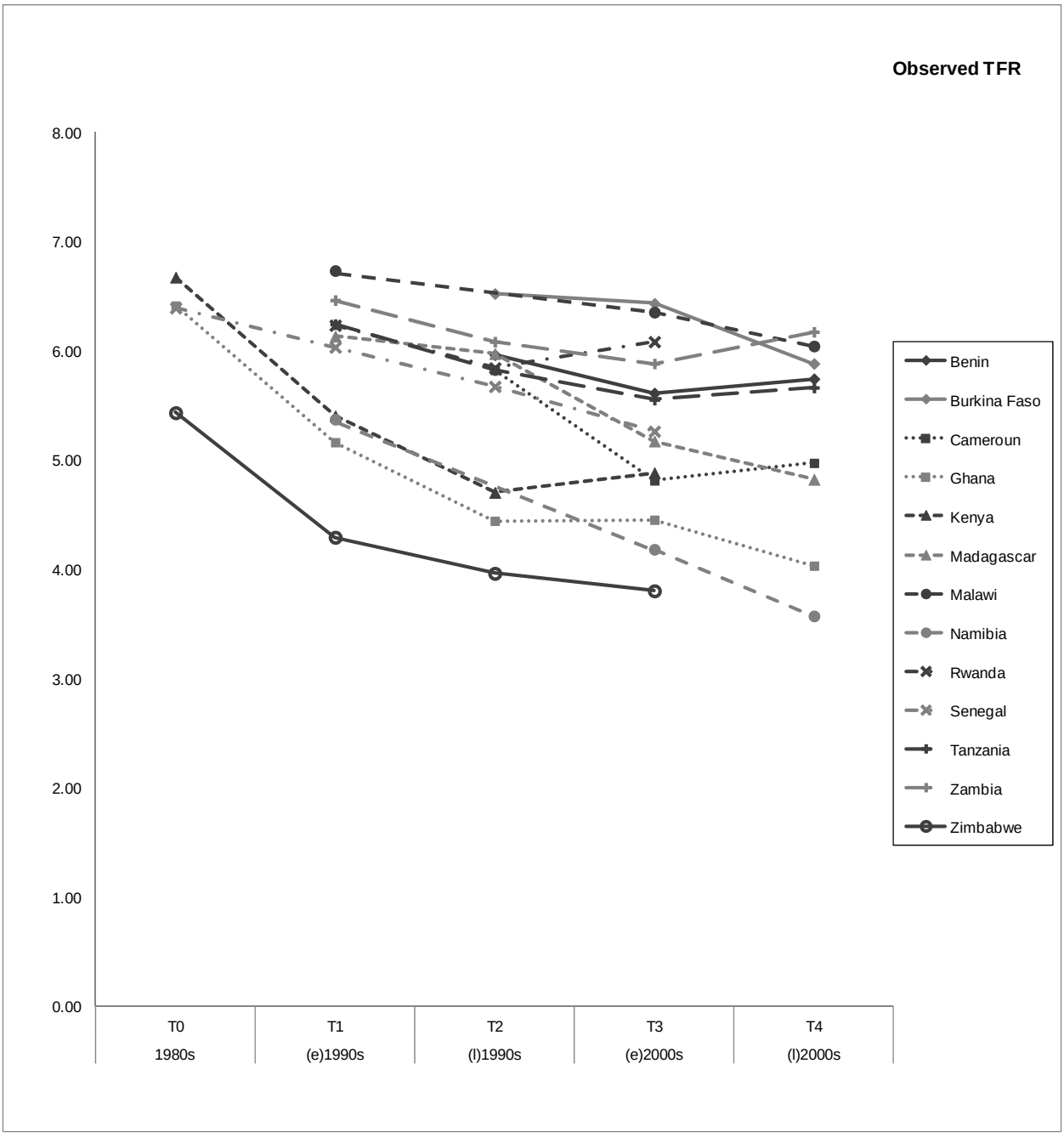


Figure 42. Changes in the Bongaarts index of non-marriage, C_m, in 13 sub-Saharan African countries, DHS surveys 1986-2009

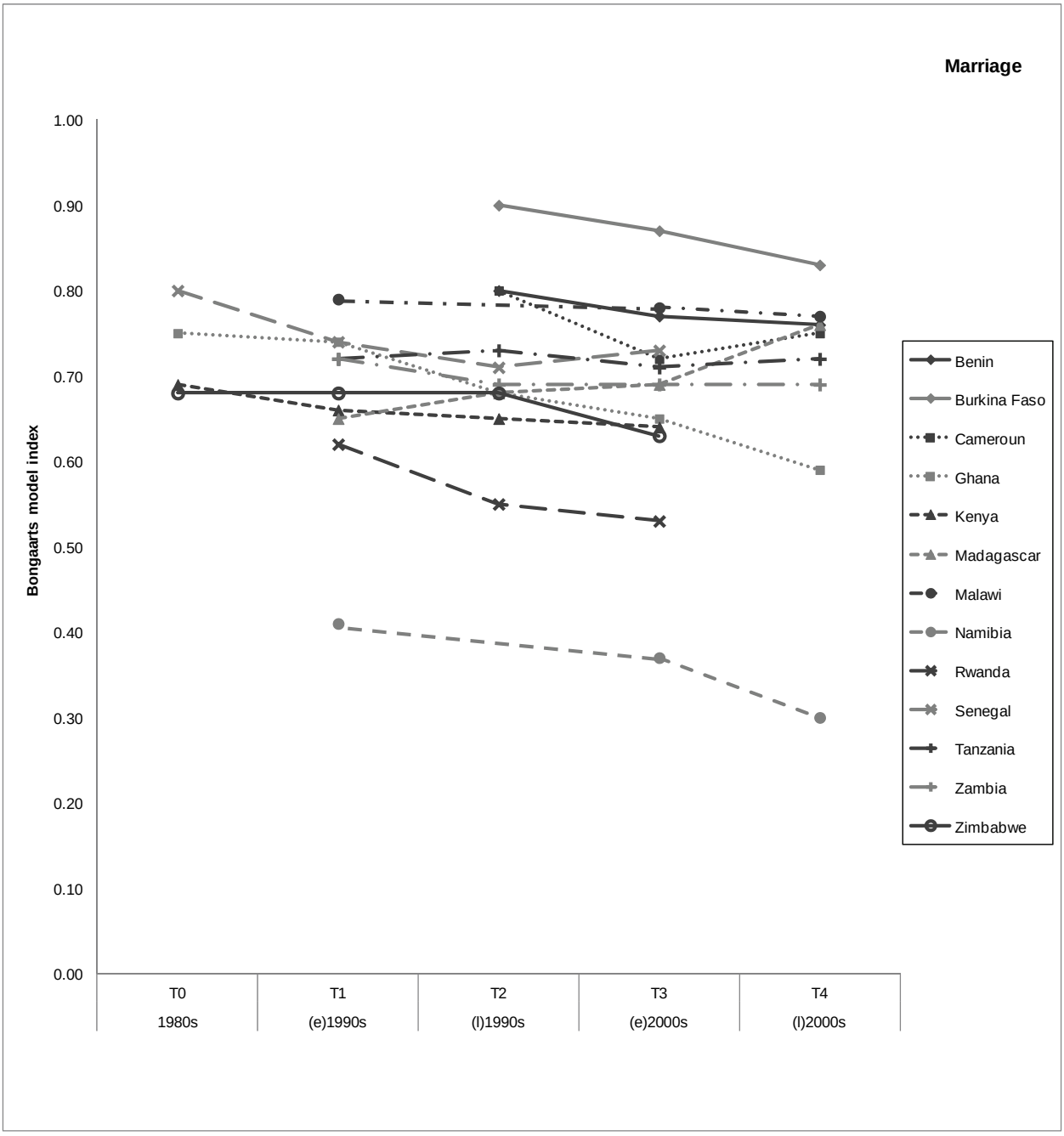


Figure 43. Changes in the Bongaarts index of contraception, C_c, in 13 sub-Saharan African countries, DHS surveys 1986-2009

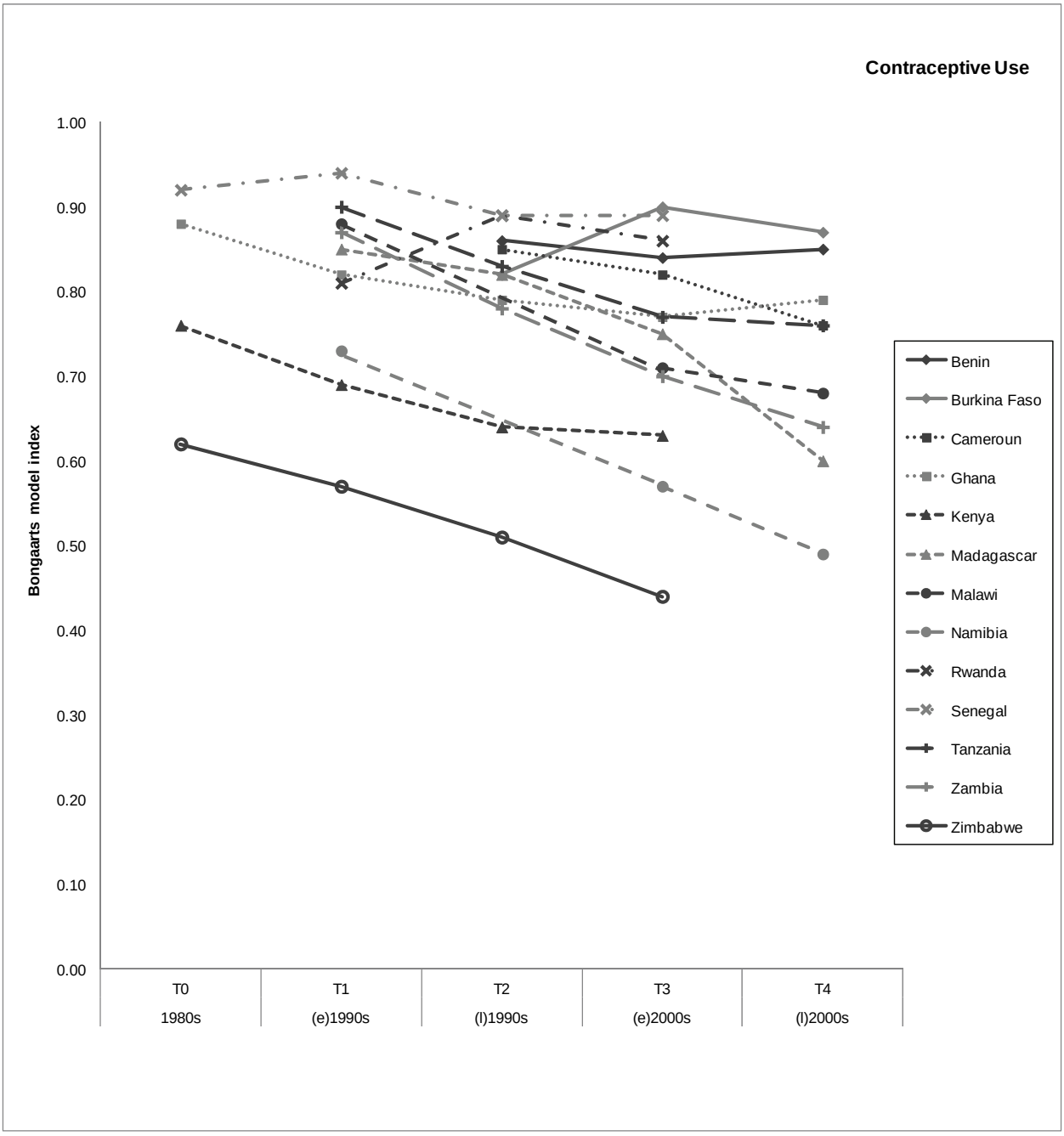
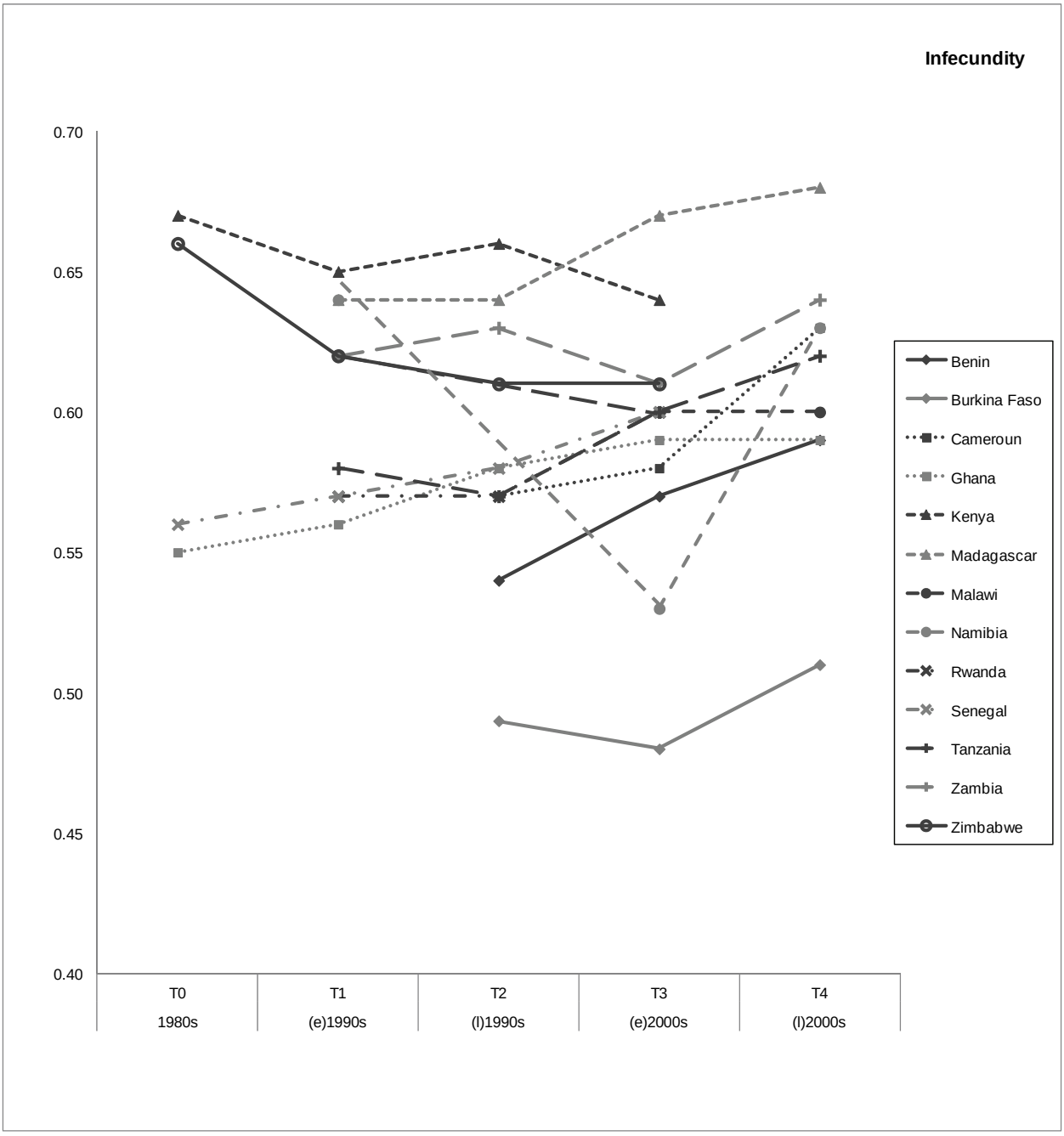


Figure 44. Changes in the Bongaarts index of infecundity, C_i, in 13 sub-Saharan African countries, DHS surveys 1986-2009



A more thorough analysis would look at within-country variations in contraceptive use, etc., but a detailed articulation of the connections between the background variables (or indirect determinants) and the proximate (or direct) determinants has not been attempted. The data in Table 2, and the corresponding figures for each country, can help show whether socioeconomic conditions are favorable for fertility decline. Methods for a multivariate analysis of the proximate determinants and background variables in their effect on fertility were developed by Hobcraft and Little (1984) and have been adapted to the study of fertility change by Pullum, Casterline, and Shah (1987), but are not applied here.

International fertility-related population and health policy priorities center on ensuring that women's reproductive needs are better met and on improving maternal and child health outcomes. It is therefore useful from a programmatic perspective to assess the fertility dynamics of a country in a way that is aligned to those same priorities. That has been our objective in this analysis.

In our examination of trends in the proximate determinants of fertility, in the context of the key background characteristics that affect those proximate determinants, we find that:

- Demand for family planning, as indicated by planning status of most recent birth, is probably the single best predictor of consistent fertility decline. Countries where levels of unplanned pregnancy are highest are the same countries where fertility has been on a steady decline.

- There are high levels of unplanned pregnancy (both mistimed and unwanted) in all countries. This is probably the most important focus for intervention: ensuring that women have only the births that they want, at the time that they want them.

- The biological and behavioral impact that the HIV epidemic has had on fertility trends in some countries cannot be disregarded:

    1) Women who are HIV-positive are more likely than other women to want to curtail childbearing, and we may see the effect of that in Kenya, Malawi, Zambia, and especially Namibia, where the percentage of women reporting that they wanted no more children at the time of their most recent pregnancy nearly doubled between the 1992 and the 2000 surveys, from 12 percent to 23 percent; it increased again to 27 percent in the 2006-07 survey.

    2) HIV depresses fertility by about 20 percent, which may also affect overall fertility levels in countries with high levels of seroprevalence (Johnson and Way 2006).

Trends in fertility and the proximate determinants of fertility take different patterns. In this report we have shown examples of countries with stalls in fertility decline at high levels but which nevertheless show progress on key fertility indicators related to meeting women's reproductive needs and improving maternal and child health, and appear to be poised for significant fertility decline in the near future. We have also shown evidence from a country with rapid, consistent declines in fertility over time which nevertheless exhibits severe problems in terms of levels of mistimed and unwanted pregnancies (Namibia); this case demonstrates the importance for healthy fertility dynamics of examining fertility trends and related indicators for all countries, not only countries with high levels of fertility.

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