DHS ANALYTICAL REPORTS

9

Change in the Desired Number of Children: A Cross-Country Cohort Analysis of Levels and Correlates of Change

DHS
DEMOGRAPHIC AND HEALTH SURVEYS

The Demographic and Health Surveys (DHS) is a 13-year project to assist government and private agencies in developing countries to conduct national sample surveys on population and maternal and child health. Funded primarily by the United States Agency for International Development (USAID), DHS is administered by Macro International Inc. in Calverton, Maryland.

The main objectives of the DHS program are (1) to promote widespread dissemination and utilization of DHS data among policymakers, (2) to expand the international population and health database, (3) to advance survey methodology, and (4) to develop in participating countries the skills and resources necessary to conduct high-quality demographic and health surveys.

For information about the Demographic and Health Surveys program, write to DHS, Macro International Inc., 11785 Beltsville Drive, Suite 300, Calverton, MD 20705, U.S.A. (Telephone 301-572-0200; Fax 301-572-0999).

Demographic and Health Surveys
Analytical Reports No. 9

Change in the Desired Number of Children: A Cross-Country Cohort Analysis of Levels and Correlates of Change

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Preface

One of the most significant contributions of the 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 Analytical Reports* series and the *DHS Comparative Studies* series examine those data across countries in a comparative framework, focusing on specific topics.

The overall objectives of DHS comparative research are to describe similarities and differences between countries and regions, to highlight subgroups with specific needs, to provide information for policy formulation at the international level, and to examine individual country results in an international context. Whereas *Comparative Studies* are primarily descriptive, *Analytical Reports* take a more analytical approach.

The comparative analysis of DHS data is carried out primarily by staff members at the DHS headquarters in Calverton, Maryland. The topics covered are selected by staff members in conjunction with the DHS Scientific Advisory Committee and USAID.

The *Analytical Reports* series comprises 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 under study. A range of methodologies is used, including multivariate statistical techniques.

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

Martin Vaessen
Project Director

Executive Summary

Change in women's desired number of children is held to be a key determinant in the demand for family planning and the decline in fertility rates. Recent studies have differed as to the role that organized family planning programs have taken in the reduction of fertility. Some authors assume that the programs only provide a supply of contraceptive services; other authors believe that family planning programs can also affect desires for children by means of informational, educational, and communication activities. This study is based on the results of large demographic survey programs, the World Fertility Survey and the Demographic and Health Surveys, analyzing those data on the amounts and the determinants of changes in fertility by tracking changes in preferences of cohorts of women and changes due to differences between cohorts.

To orient the study, a theoretical framework of the dynamics of fertility desire, behavior, and use of family planning was constructed. Study of pooled data sets from both survey programs for the analyses revealed that about half of the amount of change in average desired number of children for a country over time can be explained by changes in women's desires over time, and that half of the amount can be explained by the change in composition of women in the reproductive ages that is caused by aging. Even women with no education have changed their desired numbers of children over time—contrary to the belief of some scholars that rises in education are essential for declines in fertility.

The determinants of change in women's desires for numbers of children are analyzed over time. Greater decline in desired number of children is found to be associated with higher levels of family planning effort in a country, decreases in per capita income, and increases in national levels of schooling. It is also found that there is a "rationalizing" of fertility desires that accompanies an increased number of children. The analysis of the determinants of differences in fertility desires according to cohort of birth finds that the greater the urbanization and education of a cohort in its formative period, the lower the level of desired number of children. Higher levels of income and fertility (proxying for parents' family size) during the formative period increases the level of desired number of children.

The results of this study are very encouraging. They show that countries do not have to wait to become developed before they can reduce their rates of population growth.

1 Introduction

Recent publications have opened anew the question of the role of family planning programs in reducing fertility. On the one hand, Robey, Rutstein, and Morris espouse the view that family planning programs have actively contributed to a fertility decline by legitimizing small families and the use of modern contraceptive methods (Robey et al. 1992; Robey, Rutstein, and Morris 1992). On the other hand, Pritchett contends that development—mainly in the form of increased levels of education—leads to decreases in family size preference, which in turn lead to increased contraceptive use (Pritchett and Summers 1994; Pritchett 1994). In his view, family planning programs are essentially passive, satisfying the demand for contraception created by development but not themselves leading to increased use of contraception.[1] Perhaps no one would assert that education is unrelated to preferences in family size and hence the demand for contraception, but is it not possible that family planning programs also influence preferences and the demand for contraception? This report is an attempt to shed some light on that question by investigating changes in fertility preferences among women in developing countries and the factors underlying those changes.

The demographic surveys carried out under the World Fertility Survey (WFS) and Demographic and Health Survey (DHS) programs allow us to study the correlates of fertility preferences and changes in those preferences. In particular, for countries with more than one survey, changes in preferences can be identified for cohorts of women as they age and move through time. Overall change in the fertility preferences of a country can then be decomposed into the change within cohorts of women over time and the passing out and incorporation of new cohorts of women into the reproductive age range. Those changes can then be related to prior status and to changes in potential determinants, such as family planning programs; information, education, and communication programs (IE&C); knowledge of contraception; and indicators of changes in level of development and levels of education.

The Case of Bangladesh

As seen in Table 3, uneducated women experienced substantial declines in desired number of children, close to the level of decline for women with some education. The recent DHS survey in Bangladesh is further evidence that large increases in contraception and decreases in fertility can come about without large changes in education or in income per capita. Since the Bangladesh Fertility Survey in 1976, the TFR has declined from 6.1 to 3.4 births and contraceptive use has increased from 8 percent to 45 percent, although the percentage of ever-married women with some education has increased to only 42 percent and income per capita has risen by $50 to $180 a year. Those data signify that the decline noted in the Matlab region was not a fluke caused by extraordinary effort in a small area (as Pritchett and Summers imply) but was indicative of changes going on in the country as a whole.

The report begins with a discussion of an explanation of fertility change. On the basis of this discussion, an analysis of level of and change in fertility preference is undertaken.

The second section describes the sources of data and the organization of the data into cases for analysis. The third section presents the levels and trends of fertility preferences for both countries and cohorts. The fourth section of the report is a cross-sectional analysis of data pooled over time and country, done to identify the factors that influence fertility trends. The fifth section analyzes changes in fertility preferences over time within cohorts of women. The sixth section analyzes differences in initial fertility desires between cohorts. The last sections discuss the results and apply hypothetical changes to the analysis models to illustrate and clarify the roles of family planning and development in determining fertility preferences.

[1] Pritchett and Summers also ignore the effect of the constant term in their regressions, the slopes of which are close to one, meaning that women who desire four children on average will end up with five. This is a clear indication of "unmet need." Moreover, taking results of cross-sectional cross-national analyses as indicators of what will happen over time may be totally misleading.

2 Toward an Explanation of Changes in Fertility

Changes in fertility levels are determined by changes in the proximate determinants elaborated by Davis and Blake (1956) and modeled by Bongaarts (1978, 1982). According to Bongaarts, four determinants account for most of the variation in fertility level: age at marriage (or age of beginning regular sexual activity), contraceptive use, postpartum infecundability (mainly postpartum amenorrhea), and induced abortion. For most countries, the true extent of induced abortion is not known. The impact of development and other factors on fertility turns principally on an increase in both contraceptive use and age at marriage. To a small extent, the increases in both contraceptive use and age at marriage that accompany development are offset by declines in the duration of postpartum infecundability. Within marriage, the principal determinant of completed fertility is contraceptive use. Indeed, in 50 developing countries, contraceptive use accounts for roughly 90 percent of the variation in total fertility (Robey et al. 1992, 9).

2.1 ELEMENTS OF AN EXPLANATION

I. *Contraceptive prevalence* increases in an S-curve in relation to time. That curve can be subdivided into six stages of contraceptive change.

Stage 0: Pre-increase (2% to 5% prevalence). Contraceptive prevalence begins at low levels, with the "hard-core users." Most of them are highly educated and motivated women. Since they are rather isolated from the rest of society, their use has little impact on that of others. This stage can exist for a long time.

Stage 1: Incipient increase (5% to 15%). Some additional women begin to use contraception, usually women with secondary education, but also women with little or no education who would be hard pressed if they were to have another birth (women with many more children than desired, women whose spouses do not provide for the children, etc.). These women *are* connected with the rest of society, and use of contraceptive methods by these women tends to legitimize it for others. At the end of stage 1, most women either know or have heard of someone who uses contraception.

Stage 2: Takeoff (15% to 25%). More women begin to use contraception, and most women know about it and have a number of women in their circle who use it; contraception is spreading among less-educated and uneducated women.

Stage 3: Rapid increase (25% to 50%). Contraceptive use has been legitimized in the minds of most women. Desired number of children decreases, owing to the triggering of women's latent desires.

Stage 4: Leveling off (50% to 60%). Most women are using or have used contraception, and the increase levels off because of market saturation, even if the desired number of children decreases further.

Stage 5: Plateau (60% to 70%). Few if any additional women begin to use contraception. Nonuse is mostly limited to women who have not attained their desired number of children, pregnant and postpartum infecund women, women with restricted sexual activity, and "hard-core nonusers" who are opposed on moral or religious grounds.

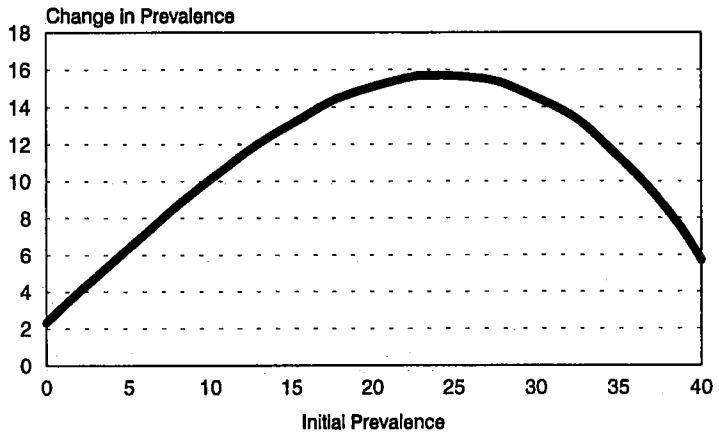
That those kinds of changes occur is somewhat supported by graphing the change in contraceptive prevalence between surveys according to initial values for cohorts drawn from the pooled data set (described below), as shown in Figure 1. At low levels of prevalence, the change is small but rises to a substantial level and then falls again.

II. *Preconditions* for change in contraceptive prevalence include recognized reductions in infant and child mortality, the spread of small-family values, which can be accelerated through media contact (especially television), and the legitimazation of the ideas of fertility control and contraceptive use allowing latent small-family values to become expressed values.

III. *Facilitating conditions* include rising levels of women's education and women's increasing participation in the modern economic sectors (which increase the opportunity costs of rearing children); increasing urbanization and rising school attendance (which increase expectations for children, thus increasing the costs of having children); increases in living standards for most of the population; and the spread of knowledge of contraception. Not all of the preconditions and facilitating conditions are always necessary for an increase in contraceptive use. Nor are they sufficient for triggering a rapid rise in use.

Figure 1
Predicted Change in Modern Contraceptive Prevalence
According to Initial Value

Cohort Data From WFS, DHS-I, and DHS-II Surveys

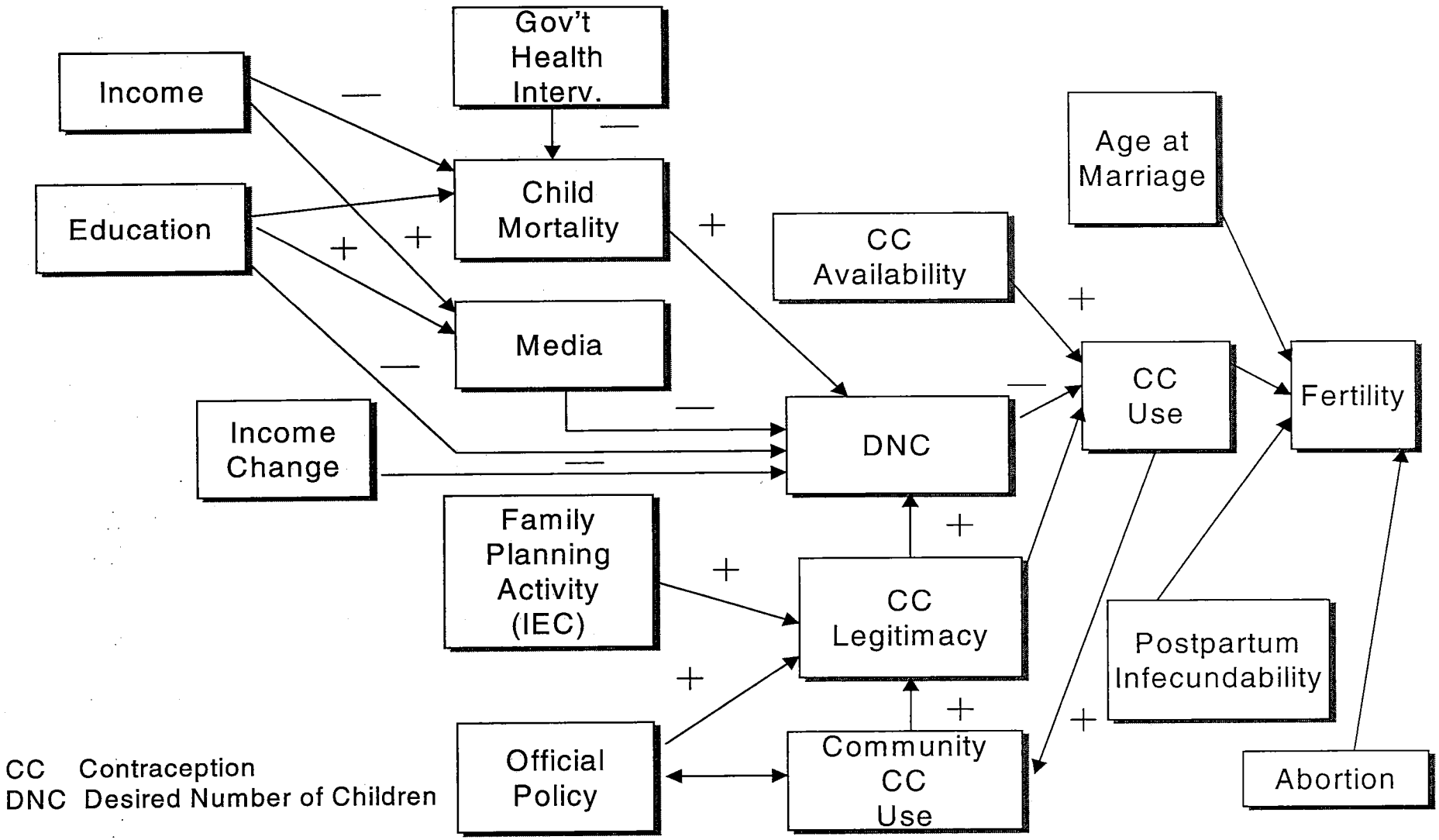


IV. *Triggering the takeoff:* As long as standards of living are rising for most of the population, most families do not feel any pressure to change long-established behavior—even in societies where the preconditions and facilitating conditions obtain. However, there are certain societal changes ("triggers") that can lead to wholesale changes in the desired number of children and to contraceptive use in a short period of time. One such trigger is a decrease in income after a sustained increase: To offset now-falling levels of living, families adjust by adopting legitimized behavioral changes. Another trigger could be strong official support for family planning and smaller families. Note that some of the preconditions must be in place before a trigger can function.

In accordance with the above findings, Figure 2 illustrates how both development and family planning programs can combine in the "reproductive revolution." In order to investigate the hypothesized explanation outlined above, this report will attempt to answer the following questions:

1. What are fertility preferences today?
2. How have fertility preferences changed?
3. What are the determinants of changes in fertility preferences?
4. What has been the role of family planning programs in changing fertility preferences?

Figure 2
Effects of Development and Family Planning
on Fertility



3 Data Sources and Analysis Cases

The data for this study come principally from the World Fertility Survey (WFS) and Demographic and Health Surveys (DHS) programs. Through personal interviews, the programs collected information from households and women of reproductive age (15 to 49 years, mostly) on subjects dealing with fertility, fertility preferences, family planning, infant and child mortality, and maternal and child health. The WFS was conducted by the International Statistical Institute under grants from the United States Agency for International Development (USAID), the United Nations Fund for Population Activities (UNFPA), and the United Kingdom's Overseas Development Agency (ODA). The DHS program, conducted originally by Westinghouse Electric Corporation and now by Macro International Inc., is funded principally by USAID. The DHS is now in its third 5-year phase of activities.

The WFS and DHS data allow a variety of fertility, contraceptive, and fertility preference measures to be tabulated, not only for national totals but also for subnational groups (for example, groupings by education) and—more important for this study—for cohorts of women.[2] The birth history section of the individual woman's questionnaire allows calculation of fertility and of infant and child mortality for the recent past.[3] The reproductive-history section (known as the reproductive calendar) collected by the DHS in some surveys allows contraceptive prevalence rates to be calculated for up to 5 years before the survey date. However, on fertility desires and on most family planning topics, the information available is relevant only for the time of the survey. Fortunately, quite a few countries have had more than one survey, so changes to overall and subgroup levels can indeed be measured. In fact, grouping women by birth date allows cohorts of women to be tracked. When the data set was being developed for this analysis, data from multiple fieldings of the WFS and DHS were available for 24 countries.

Two types of non-survey data are also used in the analyses: family planning effort scores for 1982 and 1989 compiled by Lapham, Mauldin, and Ross (Lapham and Mauldin 1985; Mauldin and Ross 1991) and gross national income per capita compiled by the World Bank (1993, Table 2).

The variables used in this study are shown in Appendix Table 1. In broad, general terms, they are categorized as fertility desires; actual fertility; contraceptive use and knowledge; family planning program effort; family planning information; education and communication; mass media communications; education; income per capita; other development measures; under-five mortality; cohort age; and date, cohort, and country identifiers. Those variables are measured on three levels: national (i.e., over all women in the survey), by no-education and some-education subgroups, and for 5-year birth cohorts of women for both the national and subgroup levels. Thus there are six data sets. The data are categorized as national, no education, and some education—divided into all women and women by cohort. Within each data set, the information has been pooled across surveys and countries, but identifiers for survey, country, and cohort have been retained. Change over time is measured by differencing the variables between the surveys, both for all women and within cohorts. Certain national values are assigned to all cohorts because of a lack of cohort-specific information: income per capita is taken at the year of the survey, and the family planning effort scores are broadly assigned to WFS surveys (1982 scores) and DHS surveys (1989 scores).

[2] Women of all marital statuses are included in the data sets in this report, except for countries where the surveys covered only ever-married women, namely, Egypt, Jordan, Morocco, Pakistan, Sri Lanka, Sudan, Thailand, Tunisia, Turkey, and Yemen. In those countries, the assumption is made that ever-married women represent all the women in the cohort. If marriage tends to be early in those cultures, that assumption is essentially true. Another approach would be to confine the analysis to marriage cohorts as defined by date of marriage.

[3] Because of truncation, cumulative period fertility rates and mortality rates are useful up to 15 years before the survey.

4 Fertility Preferences and Changes in Preferences

4.1 HOW MANY CHILDREN DO WOMEN WANT?

Table 1 gives two types of indicators of the desired number of children[4] for countries from three survey programs. The declared mean desired number of children is based on women's declarations in response to a question about how many children they would have if they could begin their reproductive life anew. Women who did not respond with a numeric answer were excluded from the mean. The synthetic mean and median desired number of children are based on the question as to whether a woman wanted another child. Women who were contraceptively sterilized were classified as not wanting any more children; women who declared themselves to be infecund were excluded from calculation of the percentage who wanted no more children. With those percentages and the achieved parity, a life-table approach was used to calculate the synthetic mean and median (Lightbourne 1985, 165-98).[5]

Figure 3 shows the distribution of mean desired number of children, pooled over time, for the cohorts of women included in this study. There is wide variation in the declared and the synthetic means and medians across countries. At one extreme is a response of around eight children in Cameroon, Nigeria, and Senegal at the time of the WFS; at the other end is the response of about two and a half children, or fewer, in Bolivia, Colombia, Peru, and Turkey at the time of the DHS-II or the DHS-III. Although the declared mean is more of an indication of the ideal or preferred number of children, the synthetic mean appears to be more of an indication of current intentions—and the synthetic means are usually below the declared means. The highest synthetic mean is that of Nigeria during the WFS survey (at more than 10 children); the lowest is that of Northeast Brazil (at just over two children) in a DHS-I survey. Median values are generally lower than mean values for the synthetic measures, a tendency indicating that some women desire a future birth even at high parities.

4.2 HOW HAVE FERTILITY PREFERENCES CHANGED?

Over time, there has been a decline in the average desired number of children in all countries (Table 1). Kenya shows the largest decline (more than three children); Pakistan and Bolivia show the smallest declines. The declared mean and the synthetic measures tend to indicate the same amount of decline.[6] Figures 4a to 4d show the decline between surveys according to region. In Table 2 the same measures of fertility preferences are tabulated for women with no education. Here again there is a large variation in declared mean desired number of children across countries, from more than eight children in Cameroon, Nigeria, and Senegal to slightly more than three children in Egypt, Indonesia, Northeast Brazil, Colombia, and Peru and fewer than three children in Bolivia and NE Brazil for DHS-I. For some countries, the synthetic measures are lower than two children, which is below those measures for all women, perhaps because of economic crises that hit the poor and the uneducated particularly hard. In this table, as well as in the preceding one, there is a widespread—but not universal—decline over time in the mean declared number of preferred children. That there are large differentials and declines in fertility preferences for uneducated women indicates that those preferences are reflections of attitudes current in society that are not uniquely tied to a person's education, as seemed to be implied by Pritchett and Summers.[7]

Because the women in each survey are limited to those of reproductive age, declines in the overall mean desired number of children can come from two sources of change: 1) the incorporation of new cohorts of women with lower desired number replacing the older cohorts with higher desires passing out of the eligible age range and 2) declines caused by changes of opinion within cohorts or among women. The first source can be clearly understood because of the increasing levels of education for women, but declines due to the second source are not usually expected. Cross-sectional studies have indicated fertility preferences rising with age, partly because of educational differences between cohorts but also because of increasing parity—coupled with a reluctance on the part of some women to declare a desired number of children smaller than the number they have already.

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[4] Instead of the term "ideal" number (as used by Pritchett and Summers), the term "desired" number of children is used, because women are not asked how many children they would like to have under ideal conditions. The question used is the same: "If you could return to the time when you didn't have any children and could choose the number of children you would have in your whole life, how many would that be?" An alternative term could be "preferred" number of children.

[5] This estimate is based on combining information on desire for an additional child from women at the various parity levels. R.E. Lightbourne provides a discussion (of estimates of desired number of children) that uses the synthetic cohort approach and considers the biases that may result.

[6] Morocco shows a small increase (0.16) in declared mean between DHS-I and DHS-II, but the synthetic measures declined.

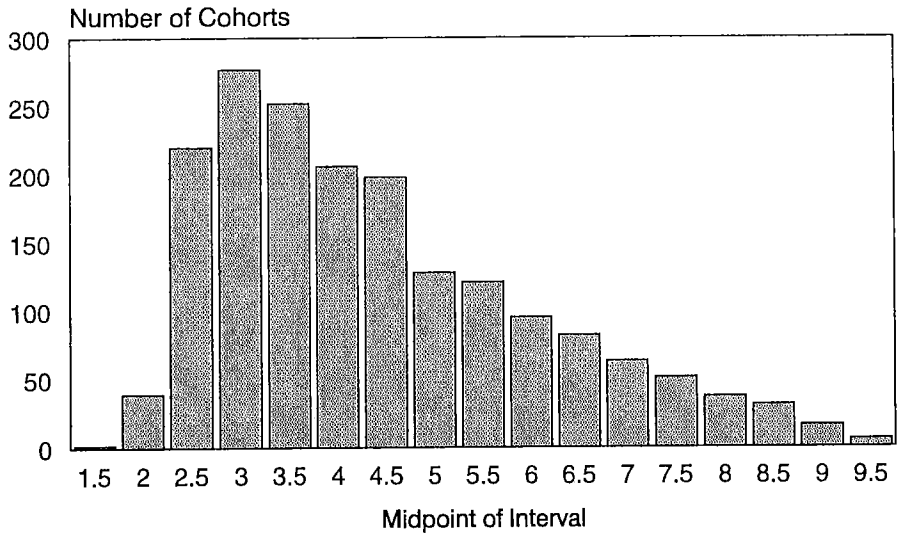
[7] "Although this article has not focused on the determinants of desired fertility, expansion of female education appears to be a key to fertility reductions" (Pritchett and Summers, "Desired Fertility").

Table 1 Desired number of children: declared and synthetic measures, from the World Fertility Survey (WFS) and Demographic and Health Surveys (DHS)

	WFS			DHS-I			DHS-II or III		
	Declared	Synthetic		Declared	Synthetic		Declared	Synthetic	
Region/Country	mean	Mean	Median	mean	Mean	Median	mean	Mean	Median
Sub-Saharan Africa									
Burkina Faso	u	u	u	u	u	u	5.74	6.05	5.62
Cameroon	8.00	9.82	9.71	u	u	u	6.82	7.32	6.70
Ghana	5.74	7.59	7.04	5.26	5.81	5.33	4.41	4.69	4.15
Kenya	6.77	7.66	7.11	4.43	4.45	3.88	3.70	3.98	3.41
Madagascar	u	u	u	u	u	u	5.52	4.56	3.83
Malawi	u	u	u	u	u	u	5.06	5.04	4.58
Namibia	u	u	u	u	u	u	5.01	3.87	2.95
Niger	u	u	u	u	u	u	8.23	7.46	7.25
Nigeria	8.25	10.12	9.90	u	u	u	5.82*	6.71	6.13
Rwanda	6.04	7.03	6.63	u	u	u	4.24	5.08	4.49
Senegal	7.99	9.58	9.39	6.83	6.11	5.78	5.87	6.99	6.57
Sudan (N.)	6.32	6.99	6.35	5.86	5.76	5.19	u	u	u
Zambia	u	u	u	u	u	u	5.79	5.82	5.40
North Africa									
Egypt	4.08	4.06	3.46	2.90	3.27	2.70	2.85	3.19	2.63
Jordan	6.31	5.31	4.81	u	u	u	4.43	4.03	3.46
Morocco	4.93	5.05	4.54	3.66	4.01	3.45	3.82	3.85	3.30
Tunisia	4.13	4.36	3.77	3.48	3.58	3.04	u	u	u
Turkey	3.04	3.76	3.15	u	u	u	2.40	2.89	2.42
Yemen	5.35	6.05	5.49	u	u	u	u	u	u
Asia									
Bangladesh	4.06	2.96	2.31	u	u	u	2.50	3.54	2.90
Indonesia (JB)	4.14	4.40	3.87	3.22	3.39	2.87	2.78	3.16	2.65
Pakistan	4.15	4.79	4.22	u	u	u	4.06*	4.37	3.81
Philippines	4.42	4.16	3.60	u	u	u	3.23	3.29	2.77
Sri Lanka	3.79	3.57	3.04	3.05	3.05	2.56	u	u	u
Thailand	3.71	3.27	2.72	2.80	2.68	2.27	u	u	u
Latin America/Caribbean									
Bolivia	u	u	u	2.60	2.32	1.79	2.49	2.39	1.85
Brazil (NE.)	u	u	u	2.83	2.09	1.45	2.68	2.55	2.09
Colombia	3.53	3.42	2.90	2.72	2.66	2.20	2.58	2.80	2.35
Dominican Republic	4.27	3.82	3.33	3.36	2.88	2.43	3.08	3.46	2.89
Ecuador	3.52	3.81	3.25	3.04	2.96	2.43	u	u	u
Mexico	4.19	3.55	2.96	3.00	3.09	2.59	u	u	u
Paraguay	4.51	4.96	4.17	u	u	u	3.87	3.92	3.29
Peru	3.78	3.61	3.05	2.64	2.52	2.06	2.47	2.54	2.09
Trinidad and Tobago	3.77	3.64	3.09	2.92	3.01	2.51	u	u	u

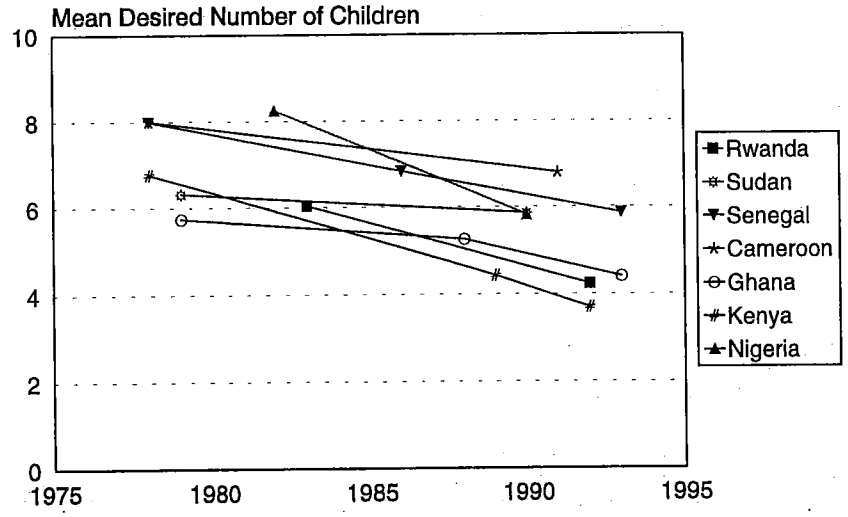
u=Not available; no survey.
N.=North.
JB=Java-Bali.
NE.=Northeast.
* Large proportions with nonnumeric replies.

Figure 3
Distribution of Mean Desired Number of Children
for Cohorts of Women



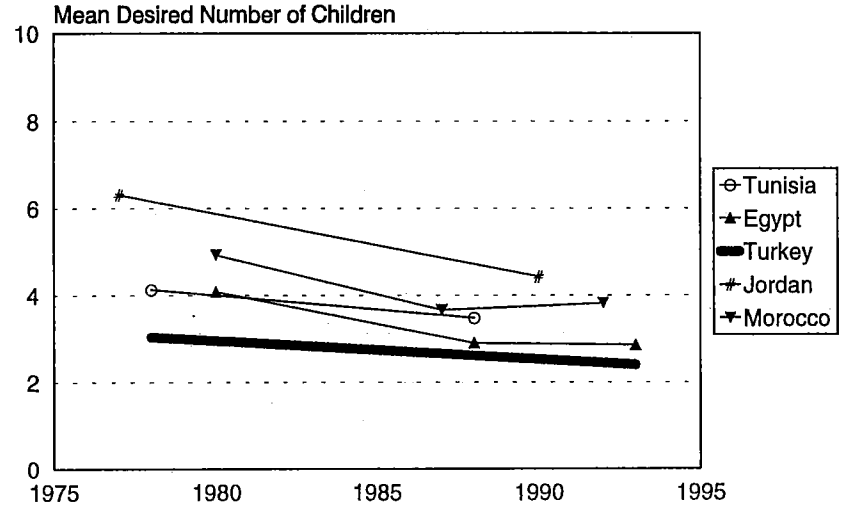
Surveys, WFS and DHS

Figure 4a
Desired Number of Children, in Sub-Saharan Africa



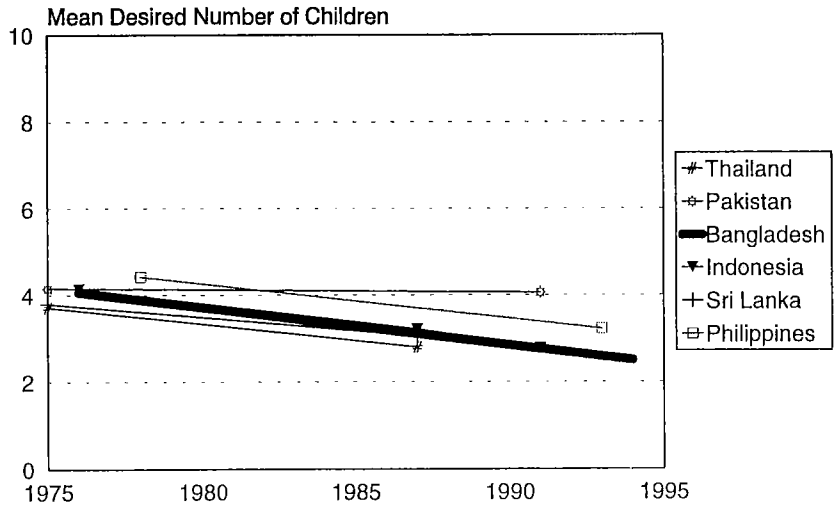
Surveys, WFS and DHS

Figure 4b
Desired Number of Children, in the Near East and North Africa



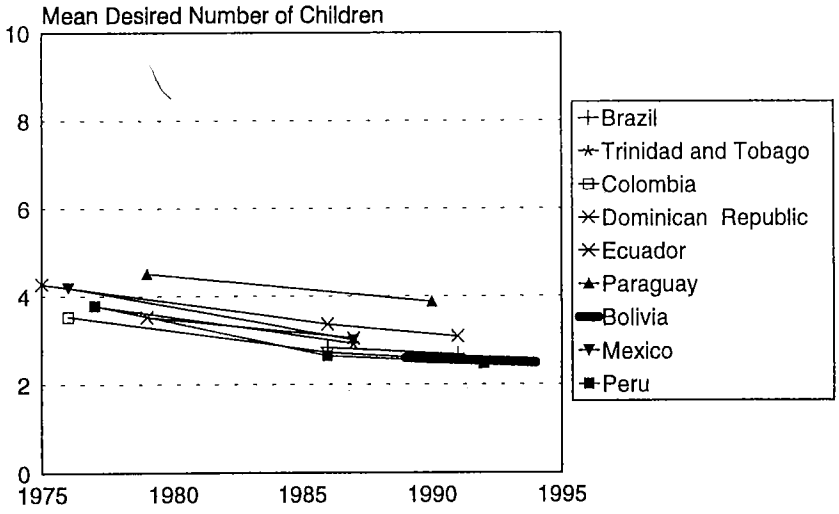
Surveys, WFS and DHS

Figure 4c
Desired Number of Children, in Asia



Surveys, WFS and DHS

Figure 4d
Desired Number of Children, in Latin America/Caribbean



Surveys, WFS and DHS

Table 2 Desired number of children: declared and synthetic measures for women with no education, from the World Fertility Survey (WFS) and Demographic and Health Surveys (DHS)

Region/Country	WFS			DHS-I			DHS-II or III		
	Declared mean	Synthetic		Declared mean	Synthetic		Declared mean	Synthetic	
		Mean	Median		Mean	Median		Mean	Median
Sub-Saharan Africa									
Burkina Faso	u	u	u	u	u	u	6.14	6.17	5.77
Cameroon	8.10	10.16	9.97	u	u	u	8.80	8.31	7.75
Ghana	6.62	8.19	7.72	6.34	6.34	6.02	5.47	5.28	4.82
Kenya	7.63	8.03	7.65	5.41	4.57	3.98	4.85	4.58	4.04
Madagascar	u	u	u	u	u	u	7.23	4.90	4.20
Malawi	u	u	u	u	u	u	5.35	4.99	4.53
Namibia	u	u	u	u	u	u	6.55	4.72	3.84
Niger	u	u	u	u	u	u	8.50	7.47	7.25
Nigeria	8.47	10.17	9.93	u	u	u	6.93*	7.09	6.66
Rwanda	6.43	7.08	6.77	u	u	u	4.56	4.89	4.37
Senegal	8.42	9.63	9.34	7.37	6.21	5.90	6.42	7.36	7.05
Sudan (N.)	6.58	7.42	6.76	6.83	6.09	5.57	u	u	u
Zambia	u	u	u	u	u	u	6.84	5.48	5.04
North Africa									
Egypt	4.54	4.57	3.96	3.14	3.46	2.88	3.08	3.34	2.75
Jordan	7.38	6.08	6.06	u	u	u	5.26	3.94	3.00
Morocco	5.14	5.33	4.87	3.85	4.23	3.69	4.11	4.10	3.54
Tunisia	4.35	4.59	4.11	3.80	3.64	3.16	u	u	u
Turkey	3.45	4.17	3.59	u	u	u	2.78	2.91	2.40
Asia									
Bangladesh	4.12	3.09	2.46	u	u	u	u	u	u
Indonesia (JB)	4.26	4.25	3.66	3.38	2.82	2.30	3.10	2.38	1.87
Pakistan	4.23	4.92	4.36	u	u	u	4.29*	4.58	4.08
Philippines	5.67	4.90	3.87	u	u	u	4.63	3.72	3.08
Sri Lanka	4.43	3.34	2.84	3.54	2.78	2.34	u	u	u
Thailand	4.08	3.16	2.57	3.46	2.63	2.23	u	u	u
Latin America/ Caribbean									
Bolivia	u	u	u	2.77	2.27	1.71	2.72	2.08	1.53
Brazil (NE.)	u	u	u	2.79	**	**	3.14	1.75	1.01
Colombia	4.58	3.41	2.75	3.44	**	**	3.13	2.41	1.74
Dominican Republic	5.06	3.44	3.00	3.70	2.57	2.06	3.43	2.85	2.27
Ecuador	4.74	3.85	2.94	3.60	2.93	2.26	u	u	u
Mexico	5.04	3.63	2.96	4.24	3.08	2.55	u	u	u
Paraguay	5.82	5.04	4.32	u	u	u	4.90	**	**
Peru	4.25	3.74	3.08	3.14	2.38	1.97	3.00	2.18	1.63
Trinidad and Tobago	4.41	**	**	3.45	**	**	u	u	u

u=Not available; no survey.
N.=North.
JB=Java-Bali.
NE.=Northeast.
* Large proportions with nonnumeric replies.
** Base was too small (fewer than 25 women).

Has there been a decline within cohorts over time in desired number of children? How much of the overall decline is due to cohort change? Table 3 answers those questions. All cohorts show a decline between surveys among both educated and uneducated women. The decline is largest among the oldest women. Overall, the decline within cohorts accounts for half of the national declines between surveys,[8] slightly higher for women with education than for women without. As examples of the change in desired number of children that has taken place within cohorts in many countries, Appendix Tables 2 through 5 show the changes for one country in each region—Egypt for the Middle East, Indonesia for Asia, Kenya for sub-Saharan Africa, and Peru for Latin America.

Table 3 Average change in mean desired number of children between surveys for cohorts of women, for all women and for women with no education

Year of birth	All education		No education		Some education	
	Change	Number	Change	Number	Change	Number
1935-39	-.83	15	-.93	15	-.78	15
1940-44	-.53	37	-.54	37	-.54	37
1945-49	-.47	37	-.39	37	-.46	37
1950-54	-.36	37	-.29	37	-.34	37
1955-59	-.28	37	-.10	37	-.32	37
1960-64	-.38	37	-.24	36	-.39	37
1965-69	-.62	18	-.50	17	-.28	16
1970-74	-.34	12	-.25	12	-.21	12
1975-79	.00	1	.00	1	.00	1
Total	-.44	231	-.36	229	-.41	229
National	-.84	37	-.76	37	-.71	37
Percentage from cohort change	52%		47%		58%	

Note: Number indicates cohort contrasts born at each date.

[8] The other half is due to the incorporation of new cohorts into the reproductive age range and to the older cohorts' passing out of the range.

5 What are the Determinants of Fertility Preferences?

5.1 CROSS-SECTIONAL ANALYSIS

An initial look at the correlates of the desired number of children (DNC) can be obtained by using the data in a cross-sectional analysis—that is, using the values of desired number of children and independent values at the specific points in time rather than using changes in those values over time. Descriptive values for the variables included in the regressions are given in Appendix Table 6.

Table 4 presents the results of regressions run on the pooled data set for both desired number of children and percentage of women wanting no more children. All variables shown are significant to at least the 5-percent level. The regressions were run two ways, both excluding and including indicator (dummy) variables to identify countries. The purpose of including the country indicators was to control for outlier countries; however, their inclusion may obscure some real explanation. All regressions are highly significant with F values over 150 and R^2 of 0.70 or above.

Taking mean desired number of children as the dependent variable, we see that the relationships of the family planning variables, knowledge of family planning methods (Know), effort score for family planning programs (FPScore), having heard family planning messages on the radio (FPRadio), and accepting family planning messages on the radio or TV (Accept) to mean desired size (where significant) are inverse. The cohort's experience with infant and child mortality, as shown in the proportion of their children who have died (Dead), is inversely related to mean desired family size. That relationship is not in the expected direction, since as mortality falls the number of children desired rises. However, recent experience with infant and child mortality, that of children born in the last 5 years (U5MR), shows higher levels of desired number of children going along with higher mortality. The strong positive relationship between parity and desires reveals a reluctance to express a number fewer than the actual for some women, as is indicated in the literature. On the other hand, age is negatively related to parity and mutes its effect. The greater their experience in raising children, the fewer offspring women tend to want. Age is not significant after country indicator variables are introduced, possibly because it is not important in some countries and because it is related to date of survey, whose inverse relationship with mean desired number of children does become significant. Two other control variables, cohort of birth (Coh) and whether the survey was from the WFS set rather than DHS, do not have significant effects.

Table 4 Results (beta coefficients) of cross-section regressions on desired number of children and desire for no more children (based on pooled data set) for women of all education levels

Variable	Mean DNC (1)	Mean DNC (2)*	No more (3)	No more (4)*
Adjusted R^2	.702	.939	.823	.912
F	142.27	267.44	314.44	215.27
Dead	-.121	--	--	-.104
U5MR	+.078	--	--	--
FPScore	-.190	-.446	+.181	+.275
Know	-.440	--	+.172	-.115
FPRadio	-.108	--	+.067	--
Accept	--	-.073	--	--
Urb	--	--	+.144	+.188
Water	--	--	--	--
Elec	-.208	--	+.084	--
Income	--	--	--	-.051
Prim	--	--	--	--
Sec	--	-.052	--	+.073
Radio	-.078	-.045	--	--
Print	--	+.106	--	--
Parity	+.637	+.312	--	+.252
Age	-.220	--	-.446	--
Coh	--	--	-1.341	-.701
Date	--	-.124	+.653	+.346
WFS	--	--	--	--

--=Not significant at the 5% level.
*=Includes country indicator variables.
Note: Variables are explicated in Table A.1.

Only one development variable, percentage of respondents with electric supply (Elec), is significantly related to desires. The presence of electricity in a home reduces the mean desired number of children. Not surprisingly, that relationship becomes nonsignificant when the country indicator variables are introduced, since all cohorts in a country are likely to have similar values.

Surprisingly, education (Prim and Sec) is not related to desires (Table 6). Use of mass media (Radio and Print) is also not related.

When indicator variables are added to identify the country, some of the relationships change. As measured by the beta coefficient, FPScore doubles its inverse relationship with mean desired number of children. However, knowledge of methods and FPRadio become nonsignificant. In their place, acceptance of family planning messages on the radio (Accept) becomes significant and is negatively related (to a small extent) to desires. Secondary schooling (Sec) is the only significant development or education variable. The variables for media use have opposing relationships with desired number of children. Radio is negatively related; but surprisingly, Print is positively related. The proportion of children who died is not significant.

Another way of looking at fertility desires is with the percentage of women who want no more children (No More). Using that variable as dependent, we would expect relationships in the opposite direction from that of desired number of children. The family planning variables—FPScore, Know, and FPRadio—are positively related to No More. Those relationships are in the expected direction. Neither the education variable nor the variable for media use is related to No More. Two development variables, Urb (the proportion of the cohort that is urban) and Elec (the percentage of the cohort with electricity) are positively related. Among the control variables, age and cohort are negatively related to the percentage who want no more children, and date of survey is positively related. Those relational directions may indicate secular trends in fertility desires that go beyond those affected by the preceding variables.

Controlling for country not only changes the direction of knowledge of methods but also eliminates the significant effect of FPRadio. However, the slope of FPScore grows steeper. The percentage of dead children becomes negatively related to No More, indicating that parents want to make up for mortality to some extent. With regard to the development variables, national income per capita (Income) becomes significant, but electricity use drops out. The fact that income is inversely associated with the percentage who want no more children is in line with economic theory that children are a "normal good"—that is, that ceteris paribus, parents want more children given higher income.

Secondary schooling becomes significant and positively related to No More. Among the control variables, parity is positively related to the percentage who want no more children. This relationship is in the expected direction. Cohort and date (bottom of Table 4) again show the effects of secular trends.

The same analysis was done for women who had had no education. Since education differences were thereby eliminated, the impact of other factors may be more clearly revealed. As noted earlier, uneducated women are not uniform in their fertility desires, a fact often overlooked by those who hold to the conviction that preferences are primarily determined by education. Indeed, Table 5 shows that most of the factors that affect all women also affect women with no education, and many are somewhat stronger among uneducated women. National income per capita becomes significant for desired number of children in the regression without country indicator variables, indicating that higher income levels are associated with lower desires for children and greater proportions of uneducated women who want no more children. The factor of family planning messages heard on the radio is not significant for uneducated women, but radio listening in general has a stronger negative effect on fertility desires for uneducated women than for all women when country indicator variables are not included.

Table 5 Results (beta coefficients) of cross-section regressions on desired number of children and desire for no more children (based on pooled data set) for women with no education

Variable	Mean DNC (1)	Mean DNC (2)*	No more (3)	No more (4)*
Adjusted R^2	.530	.905	.694	.824
F	76.86	178.32	175.59	111.04
Dead	-.119	--	--	--
U5MR	+.092	--	--	--
FPScore	-.272	-.296	+.209	+.323
Know	-.309	--	+.139	--
FPRadio	--	--	--	--
Accept	--	-.083	--	--
Urb	--	--	+.066	+.064
Water	--	-.046	--	--
Elec	-.237	--	+.136	+.094
Income	-.115	--	+.097	+.257
Radio	-.135	--	--	--
Print	--	--	--	--
Parity	+.402	+.284	+.347	+.430
Age	--	--	+.340	+.295
Coh	--	--	--	--
Date	--	-.148	--	--
WFS	--	--	--	--

--=Not significant at the 5% level.
*=Includes country indicator variables.
Note: Variables are explicated in Table A.1.

6 What are the Determinants of Changes in Fertility Preferences?

6.1 TREND ANALYSIS

Cross-sectional cross-country analysis as usually applied makes a basic—but false—assumption that the relationships found to hold over several or many countries at one point in time will apply to an individual country over time. Since there are many differences between countries, usually unmeasured, that can relate to both dependent and independent variables, such analyses are misleading when their results are meant to guide future policy in relation to a particular country.

The principal reason that such cross-sectional analyses have been used is that up to now there has been very little information available with which to investigate trends in fertility preferences. However, now, with the availability of comparable nationally representative data in multiple surveys, analysis can be performed that studies the dynamic of changes in desired number of children. In this study, the means used to investigate that dynamic is a decomposition of trends into their cohort components. First changes in preferences are examined for women in the same birth cohort, utilizing the differences between surveys for each country with more than one survey. Then differences between cohorts of women are examined.

6.2 TRENDS WITHIN COHORTS

Change in Desired Number of Children Within Cohorts

The results described in this section are based on changes in both the dependent and the explanatory variables. Using changes in variables cancels out persistent country effects. Trend analysis brings its own problems, however, not the least of which is the question of proper formulation of the dependent variable. For instance, the amount of change in desired number of children is not expected to be linear. At an initial value of, say, eight children, a decrease to five children is possible; but at an initial value of two children, a decrease of three children is not possible. Indeed, because very few societies would want to have less than replacement fertility, a practical lower limit to desired number of children would be two. It is postulated that the response to the independent variables will vary according to how far above two children the initial value is, the response being less the lower the initial values.

Four formulations of the dependent variable are used: a) the percentage change (the change in desired number of children, divided by the initial value); b) the modified percentage change (the change in desired number of children, divided by the initial value, less two children); c) the change in desired number of children, with regressions that include the initial values of desired number of children as independent variables; and d) the deviations between the actual the and predicted change, determined on the basis of a power regression of initial values of desired number of children.[9]

The results of the regressions run with the different formulations of the dependent variable are shown in Tables 6 and 7. Table 6 presents the results without country indicator variables; Table 7, with country indicators. The independent variables include those related to preconditions (experience of infant and child mortality, usage of media [radio and print]), legitimization of family planning (family planning program effort, knowledge of contraception, IE&C), facilitating conditions (education [primary and secondary]), urbanization, water and electricity availability, income per capita), triggering factors (change in per capita income) and demographic controls (age, parity, cohort). Appendix Table 7 presents the means, the standard deviations, and the number of valid cases for the regression variables.

In two of the formulations of the regression model without the country indicator variables (Table 6), the change in under-five mortality (represented by the proportion dead of children born in the last 5 years, dU5MR) is both significant and strongly related to changes in desires in the expected direction. The level of mortality, both lifetime (Dead) and of children born in the last 5 years (U5MR), is negatively related to change in desired number of children, which is not as expected (an increase in mortality leads to a decrease in desires). In all models, family planning program effort is strongly negatively related to desires. Changes in the effort scores are also significantly negatively related to desires. The true value of the effect of change in program effort may not be revealed, because data are only available for two points in time, so that changes between the DHS surveys are not measured. Family planning messages heard on the radio, and changes in acceptance of family planning messages on radio or TV, are also significantly negatively related to desires.

[9] The deviations are $a\Delta DNC = \Delta DNC - \Delta DNC^*$, where $a\Delta DNC$ is the deviation of actual change in desired number of children, ΔDNC from the predicted change in desired number of children, ΔDNC^*. Predicted values of change are $\Delta DNC^* = 0.446244 - 0.205431 * oDNC$, where oDNC is the initial value. Higher order terms were not significant.

Table 6 Results (beta coefficients) of intracohort regressions on trends in desired number of children (based on pooled data set) for various formulations of change in desired number of children

Variable	ΔDNC / DNC-2 (1)	ΔDNC / DNC (2)	ΔDNC (3)	aΔDNC (4)
Adjusted R^2	.533	.527	.683	.508
F	13.91	16.98	25.33	13.34
Dead	-.344	-.358	--	-.196
dDead	--	--	--	--
U5MR	-.241	-.275	-.328	-.350
dU5MR	+.462	+.557	+.565	+.667
FPScore	-.502	-.462	-.719	-.656
dScore	-.167	-.200	-.147	-.188
dKnow	+.149	--	+.151	--
FPRadio	-.141	-.108	-.146	-.164
dFPRadio	--	--	--	--
dAccept	-.288	--	--	--
Income	--	--	--	--
dIncome	--	--	+.117	--
dLbForce	-.122	-.175	-.254	-.234
dUrb	--	+.130	--	+.135
dWater	-.283	--	--	--
dElec	+.334	--	-.225	-.126
Prim	--	--	+.480	+.538
dNPrim	-.182	--	-.316	-.355
Sec	+.571	+.517	--	--
dNSec	--	--	+.278	+.282
Radio	-.199	-.308	-.543	-.601
dRadio	--	--	+.244	+.209
dPrint	+.570	+.278	+.377	+.401
dParity	+.484	+.397	+.400	+.364
dAge	-.178	-.250	-.395	-.366
Coh	-.760	-.553	-.486	-.487
dDate	--	--	--	--
oDNC	ni	ni	-.878	ni
oDNC2	ni	ni	--	ni
WFS	-.403	-.366	--	--

aΔDNC=Deviation from predicted change based on initial value.
d (before variable name)=Change between surveys.
oDNC, oDNC2=Initial value of DNC and squared initial value.
--=Not significant.
ni=Not included.
Note: Variables are explicated in Table A.1.

Interestingly, increases in knowledge of contraceptive methods are positively related to increases in DNC in two formulations.

Income level is not significantly related to desires; but change in income, the postulated triggering mechanism for change in contraceptive prevalence, has a significant effect on desired number of children in one of the formulations. The positive sign of the beta coefficient indicates that the larger the increase in per capita income, the less of a decrease there is in desired number of children.

The development variable of change in labor force participation is significantly negatively related to changes in DNC in all formulations, as expected. However, the change in the percentage of the cohort that is urban is positively related to changes in desired number of children. The change in the percentage of the cohort with electricity is negatively related to changes in DNC, as expected, except in formulation (1), where its positive coefficient is almost completely offset by a negative coefficient for changes in the percentage of the cohort with a public water supply.

The relationship of education to cohort change in desired number of children is complex. In three of the formulations, the greater the change in the national level of percentage with 5 or more years of education (dNPrime), the greater the decline in the desired number of children. For absolute decline, a change in the national level of percentage with 9 or more years of education is positively related to changes in DNC (a trend that would reduce the amount of decline). Given the levels of national change in education, the cohort's own level of education offsets the effect of the national level, as shown by the positive beta coefficients for both 5 or more years and 9 or more years. It appears that the combined effect is this: Increases in national levels of primary education set the stage for a large decline in DNC for all cohorts (perhaps due to burgeoning discussion of family size in general); but for individual cohorts, the national level becomes less important if the cohort itself has a higher level of education.

The use of media in the form of radio listening or newspaper reading is related to changes in desired number of children in opposite ways. A higher level of radio listening leads to declines in fertility desires; but increases in the reading of newspapers and increases in radio listening lead to increases in desires over time. However, information on the most effective molder of opinion of the mass media, television, is not available in the WFS and DHS data for most of the countries studied.

As expected (since some women do not want to express a desired number of children smaller than the number that they have), changes in parity are positively related to changes in expressed desires. Age is consistently negatively related with trends in desired number of children.

The control variable identifying cohort is significant in all of the formulations, indicating that there are still unexplained variations in cohort trends. The variable indicating whether the initial value of desired number of children came from a WFS survey is significant in two of the formulations, indicating that the somewhat different form of the question did lead to a different value, and an adjustment was needed.

In Table 7, the same variables are used but now the regressions include indicator variables for each country. Since some of the variables (such as family planning effort, income per capita, and changes in national level of education) equally affect all cohorts in a country, it is expected that there will be reductions in the effects of those variables—and perhaps changes to other independent variables as well. The important differences between the non-country-controlled regressions and those controlled for country are as follows:

Table 7 Results (beta coefficients) of intracohort regressions on trends in desired number of children (based on pooled data set) for various formulations of change in desired number of children, including country indicator variables

Variable	ΔDNC / DNC-2 (1)	ΔDNC / DNC (2)	ΔDNC (3)	aΔDNC (4)
Adjusted R^2	.652	.715	.914	.756
F	17.11	21.01	68.12	23.25
Dead	-.187	-.240	--	--
dDead	--	--	--	--
U5MR	-.140	--	--	-.177
dU5MR	+.409	--	--	+.470
FPScore	-.471	-.383	-.222	-.439
dScore	-.188	-.365	--	--
dKnow	+.157	--	--	--
FPRadio	-.217	--	--	--
dFPRadio	--	--	--	--
dAccept	-.343	--	--	--
Income	--	--	--	--
dIncome	--	--	-.322	--
dLbForce	--	--	-.126	--
dUrb	--	-.100	--	+.137
dWater	-.261	--	--	--
dElec	+.337	--	-.200	-.301
Prim	--	--	--	+.360
dNPrim	--	--	+.375	--
Sec	+.536	+.637	--	--
dNSec	--	--	--	--
Radio	-.234	-.252	-.200	-.444
dRadio	--	--	--	--
dPrint	+.557	+.196	--	+.124
dParity	+.519	+.360	+.120	+.338
dAge	--	--	--	-.362
Coh	-.670	-.544	-.366	-.385
dDate	--	--	--	--
oDNC	ni	ni	-2.051	ni
oDNC2	ni	ni	--	ni
WFS	-.608	-.478	--	-.252

aΔDNC=Deviation from predicted change based on initial value.
d (before variable name)=Change between surveys.
oDNC, oDNC2=Initial value of DNC and squared initial value.

In the first formulation of the dependent variable (the relative decline in DNC to two children), the effects of changes in labor force participation and national levels of percentage with 5 or more years of schooling become nonsignificant, as does the control variable for change in age. The effects of children's mortality level overall and of births in the last 5 years are reduced, but change in children's mortality maintains its strong direct relationship with fertility desires.

In the second formulation (the relative decline in DNC)—the mortality of children born in the last 5 years—hearing family planning messages on the radio or TV, the change in labor force participation, and the control for change in age become not significant, and change in level of cohort urbanization reverses its sign.

In the third formulation (absolute change in desired number of children), there are quite a few changes. Recent mortality and changes in recent mortality are no longer significant, compared with the regression uncontrolled by country indicator variables. Although family planning effort is still significant, the change in the effort score and the change in contraceptive knowledge become not significant, as do the percentage who heard family planning messages, the level of cohort percentage of women with 5 or more years of education, the change in national percentage with 9 or more years of schooling, the change in radio listening, the change in newspaper reading, and the change in age. The change in income per capita becomes inversely related to the absolute change in desired number of children, which is different from effects for all other formulations, both with and without the country indicator variables. National level of percentage with 5 or more years of schooling also switches its sign, becoming positively related to desires.

In the fourth formulation (the deviation from the predicted change in DNC based on previous level), the effects of including the country indicator variables again is fairly large. Six factors no longer show significant relationships: Lifetime children's mortality, changes in family planning effort, labor force participation, national percentage with 5 or more years and 9 or more years of schooling, and changes in radio listening. Family planning effort decreases in the strength of its relationship with DNC, whereas the change in cohort percentage with electricity strengthens its inverse relationship.

Change in Percentage of Women Who Want No More Children

Using the change in percentage of women who want no more children as the dependent variable gives a different perspective from that of using change in desired number of children. It is a much more immediate measure. Since with the passage of time cohorts of women become older and tend to have more children, an increase in the frequency of the response "no more" is expected. Nevertheless, additional changes can be brought about by the variables of interest: family planning activities and development. The results of regressions on the change in the percentage of women who want no more (dNomore), excluding and including indicator variables for identifying countries, are shown in Table 8.

The regression without the country dummy variables (column 1) indicates that greater exposure to family planning information on the radio is associated with an increase in the percentage of women who want no more children. However, increases in knowledge of contraception lead to a decrease in the percentage who want no more. This is the inverse of what should be expected.

Increases in lifetime experience with child mortality are associated with decreases in the percentage who want no more children—as expected, since increased experience of mortality would lead to a higher expectation of risk of future child mortality. Also as expected, an increase in the number of children ever born leads to higher percentages wanting no more children.

Income and the development variables are not associated with a change in the percentage wanting no more children. Changes in national levels of education have opposing effects on "no more." Moreover, cohorts with a higher percentage with 9 or more years of schooling are more likely to have increased their percentage wanting no more children, but an increase in newspaper reading lowers the change in percentage wanting no more children.

The control variables for cohort and change in date are significantly related to the percentage wanting no more and show that there are probably other variables not included in the model that explain changes in the percentage wanting no more children.

Including the country indicator variables (column 2) eliminates the effects of all variables but change in lifetime mortality, education, parity, and control variables. An increase in national percentage with 5 or more years of schooling and having a large cohort percentage with 9 or more years of education leads to a cohort increase in the percentage who want no more children, an expected result.

Table 8 Results (beta coefficients) of intracohort regressions on changes in percentage of women who want no more children (based on pooled data set)

Variable	ΔNomore (1)	ΔNomore* (2)
Adjusted R^2	.731	.886
F	49.62	60.05
Dead	--	--
dDead	-.153	-.063
U5MR	--	--
dU5MR	--	--
FPScore	--	--
dScore	--	--
dKnow	-.199	--
FPRadio	+.176	--
dFPRadio	--	--
dAccept	--	--
Income	--	--
dIncome	--	--
dLbForce	--	--
dUrb	--	--
dWater	--	--
dElec	--	--
Prim	--	--
dNPrim	+.289	+.247
Sec	+.129	+.162
dNSec	-.246	--
Radio	--	--
dRadio	--	--
Print	--	--
dPrint	-.185	--
dParity	+.165	+.414
dAge	--	--
Coh	-.511	-1.123
dDate	+.193	-.512
oNoMore	--	-.458
oNoMore2	-.887	-.823

*=Includes country indicator variables.
--=Not significant.
d (before variable name)=Change between surveys.
Note: Variables are explicated in Table A.1.

Rate of Change in Desired Number of Children

Because the information for countries on the amount of change in desired number of children varied on account of variations in the intervals between surveys, a third set of regressions was run, with two formulations of the rate of change in desired number of children: a) the annual average cohort rate of change in desired number of children (the change in desired number of children, divided by the number of years between

surveys), and b) the adjusted rate of change (the deviation of the actual rate of change from the predicted rate of change, based on the initial level of desired number of children).[10]

Table 9 shows the results of regressions using the two formulations with and without country indicator variables. A positive coefficient indicates a rate of increase in DNC, while a negative coefficient indicates a rate of decline in DNC. There are generally only small differences between the direct and the deviation models without country indicator variables (columns 1 and 3, respectively). In both, an increase in recent infant and child mortality is related to an increase in the rate of change in DNC; similarly, higher parity leads to an increase in DNC. Factors leading to a rate of decline are higher family planning effort, messages heard on the radio and increase in acceptance of such messages (though that effect is lessened by changes in percentage hearing the messages, which has a positive sign for the coefficient), and increases in labor force participation. In the deviation model (column 3), additional factors are significant: change in family planning effort score (which leads to a greater decline in DNC) and higher levels of income and changes in income (which retard the decline or accelerate the rate of increase). Higher levels of radio listening lead to a greater rate of decline as well.

Table 9 Results (beta coefficients) of intracohort regressions on rates of change in desired number of children (based on pooled data set) for various formulations of rates of change in desired number of children, with and without country indicator variables

Variable	r$_{\Delta}$DNC (1)	r$_{\Delta}$DNC* (2)	ar$_{\Delta}$DNC (3)	ar$_{\Delta}$DNC* (4)
Adjusted R^2	.613	.833	.463	.718
F	25.33	43.99	14.24	22.85
Dead	-.268	-.191	--	--
dDead	--	--	--	--
U5MR	--	--	+.172	--
dU5MR	+.268	--	+.448	+.224
FPScore	-.398	-.219	-.569	-.314
dScore	--	--	-.220	-.450
dKnow	+.142	--	--	--
FPRadio	-.203	--	--	--
dFPRadio	+.233	+.11	--	--
dAccept	-.255	-.58	-.235	-.567
Income	--	--	+.218	+.263
dIncome	--	--	+.151	+.249
dLbForce	-.228	--	-.280	--
dUrb	--	--	--	--
dWater	--	--	--	--
dElec	--	--	--	--
Prim	--	--	--	--
dNPrim	--	--	--	--
Sec	+.236	--	+.523	+.289
dNSec	--	--	--	--
Radio	--	--	-.279	-.188
dRadio	--	--	--	--
dPrint	+.247	+.265	+.364	+.440
dParity	+.568	+.377	+.577	+.503
dAge	--	--	--	--
Coh	-.658	-.596	-.553	-.464
dDate	--	--	--	--
oDNC	--	-1.362	ni	ni
oDNC2	-.776	--	ni	ni
WFS	-.423	--	-.399	-.370

Adding indicator variables to the direct and deviation models (columns 2 and 4, respectively) removes the effect of labor force participation in both models. It also removes the effect of changes in contraceptive knowledge, family planning radio messages, and secondary education in the direct rate model; and it removes the effect of level of recent mortality in the deviation rate model. When the country indicator variables are included, the size of the coefficient for family planning effort is reduced by about 40 percent as well.

6.3 DIFFERENCES BETWEEN COHORTS

As time progresses, earlier-born cohorts move out of the reproductive ages and are replaced by later-born cohorts. Since the departing and entering cohorts are likely to have different desires, change in the average desired number of children for women of the reproductive ages taken together is likely to occur even if each cohort of women did not change their initial opinions. The preceding section examined changes that have occurred over time in the desired number of children within the same cohort of women. The purpose of this section is to examine differences between cohorts in desires and to attempt to explain those differences.

The hypothesis on which we base our examination is that certain conditions at the time of entering reproductive life determine a woman's initial desired number of children. Effects of life stage and period then further alter the initial desires to those held at a particular point in time. The initial conditions likely to be important are hypothesized to be the cohort's level of education, level of urbanization, average family size, and child mortality, and the income level when that cohort entered reproductive age (when the cohort was 15 to 19 years old). Except for education, for most cohorts the information necessary for this examination must come from sources external to the Demo-

[10] The deviations in rate of change are ar$_{\Delta}$DNC = r$_{\Delta}$DNC - r$_{\Delta}$DNC*, where ar$_{\Delta}$DNC is the deviation of the actual rate of change in desired number of children, r$_{\Delta}$DNC, from the predicted rate of change in desired number of children, r$_{\Delta}$DNC*. Predicted values of rate of change are r$_{\Delta}$DNC* = 0.005348 - .002455*oDNC, where oDNC is the initial value. Higher order terms were not significant.

graphic and Health Surveys (especially for the older cohorts)[11] and is available only on the national level. The total fertility rate was used as a proxy for average family size. Child mortality was proxied by the infant mortality rate. World Bank tables were used to take or estimate gross national income per capita in constant U.S. dollars.

The examination of differences between cohorts is complicated by the fact that the cohorts are measured at different life stages and at different time periods. To make it possible to compare the true effects of being in one cohort versus another, the life stage and period effects must be removed.[12] Those effects were removed by using the predicted values for desired number of children if the cohort of women would have had zero parity and no child mortality and would have been measured in 1990. The predicted values are based on regressions of a cohort's changes in the average desired number of children as a function of average cohort parity, proportion of children dead, and date of measurement. Using the predicted rather than the actual cohort values effectively sets the cohorts at the same starting point.

Several regression formulations were tried, the first based only on the desired number of children, DNC. That formulation, however, allows the intermingling of period effects and life stage effects with cohort effects. So in the chosen formulation, to zero out cohort-specific effects (i.e., those that do not vary by life stage or time period), the dependent variable was selected to be the difference in desired number of children between two surveys. That dependent variable, ΔDNC, was then regressed against the time between the surveys, the increase in the age of the cohort, and the changes in average parity and average number of dead children between the two surveys. For those variables, a power formulation was used up to the cubic. Indicator variables were used to control the regression for whether the preceding survey was from the World Fertility Survey series and for country-specific variation.

The resulting estimation equation is

DNC*=DNC + (0.028754 + 0.216455*(0-parity) - 0.046748*(20-age) - 0.0002200038*(90.0-date)**3 - 0.630169*WFS),

where DNC* is the predicted value of the average number of desired children when the cohort had no children and were age 20 in 1990, DNC is the measured average desired number of children for the cohort in each survey, parity is the average number of children ever born, age is the average age at time of interview, date is the date of the survey in years and fractions of years, and WFS is a correction factor for the slightly different question wording in the World Fertility Surveys. Note that the date enters as the cubic and that number of dead children is not significant.

To estimate the effects of cohort-specific variables, the estimated desired number of children, DNC*, was used as the dependent variable. Table 10 shows women's estimated desired number of children at ages 15 to 19 for the oldest and youngest cohorts for each region and all regions together. The overall change is about 1.4 children (from 5.04 to 3.66), a 27-percent change and 45 percent of the way to the minimum of two children desired. All regions show substantial drops in estimated desired number of children: 2.2 in sub-Saharan Africa, 1.1 in Asia, 1.6 in the Near East, and 2.3 in Latin America and the Caribbean. Those changes represent 43-percent, 61-percent, 61-percent, and 90-percent drops, respectively, to the minimum of two children. Figure 5 graphically presents the change between cohorts. From

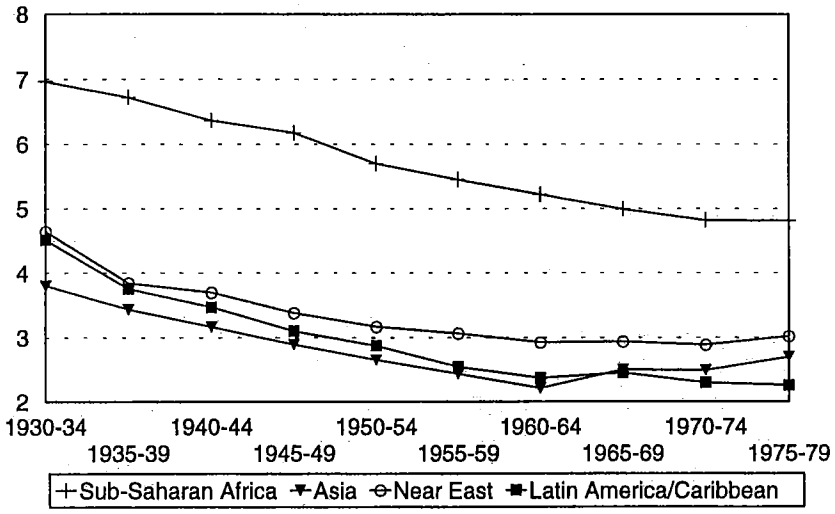
Table 10 Differences between oldest and youngest female cohorts in predicted desired number of children and respondents' level of education

	Estimated desired number of children		Percentage with 5+ years of education		Percentage with 9+ years of education	
Region	1930-34	1975-79	1930-34	1970-74	1930-34	1970-74
Sub-Saharan Africa	6.96	4.81	3.4	50.9	1.3	25.4
Asia	3.80	2.70	19.2	59.4	7.2	38.5
Near East	4.64	3.02	9.3	54.6	2.0	18.3
Latin America/Caribbean	4.51	2.25	29.3	81.5	10.3	46.0
All	**5.04**	**3.66**	**15.4**	**62.6**	**5.2**	**28.7**

[11] An attempt was made to use type of place of residence during childhood, taken from the DHS data, but percentages urban by cohort did not follow a logical progression and were at odds with external data.

[12] Unfortunately, it is beyond the scope of this report to estimate the interactions among cohort, life stage, and period effects.

Figure 5
Estimated Desired Number of Children for Female Cohort Age 15 to 19 Years Old



this figure it is easy to see that sub-Saharan Africa has by far the highest desired number of children, but that there is a substantial decrease for later-born cohorts. The other regions surveyed show a slowing and perhaps a reversal of the decline in desired number of children among more recently born cohorts.

There was a great deal of difference between the world when the younger cohorts entered reproductive age and the world when the older cohorts entered that age. Tables 10 and 11 show differences between the older and the younger cohorts for several characteristics. For all variables but education, comparisons are made between cohorts born in the 1930-34 period and those born in the 1970-74 period. Because of truncation, the latest cohort with complete data is that born between 1970 and 1974. In all regions, there are large changes in every characteristic except gross national income per capita. The proportion of educated women increased from threefold to fivefold regionally, for both the percentage with 5 or more and the percentage with 9 or more years of education (Figures 6 and 7). Conditions at the time of initial preference formation have also changed substantially by cohort over the course of 49 years (ending in 1979) (Figure 8). The total fertility rate overall fell by more than two children in all regions but sub-Saharan Africa, where fertility rose and then fell to a small extent. Fertility fell by between a third in Asia to almost

Table 11 Differences between oldest and youngest female cohorts in national fertility, infant mortality, percentage urban, and income per capita when cohort was 15 to 19 years of age

	Total fertility rate		Infant mortality rate		Percentage urban nationally		Gross national income per capita	
Region	1930-34	1975-79	1930-34	1970-79	1930-34	1970-79	1930-34	1975-79
Sub-Saharan Africa	6.76	6.46	175.0	90.1	11.2	29.4	441	440
Asia	6.38	4.03	142.2	69.0	14.4	33.7	182	413
Near East	7.04	3.68	196.5	45.5	20.5	60.5	387	943
Latin America/Caribbean	6.68	3.58	125.7	51.7	32.1	65.6	690	1043
All	**6.71**	**5.05**	**159.1**	**71.8**	**20.6**	**42.7**	**544**	**640**

Figure 6
Percentage of Women With 5 or More Years of Education

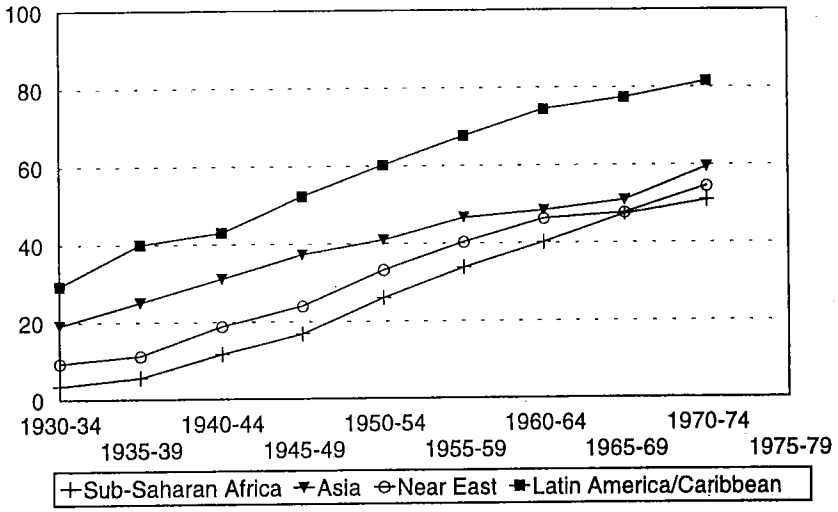


Figure 7
Percentage of Women With 9 or More Years of Education

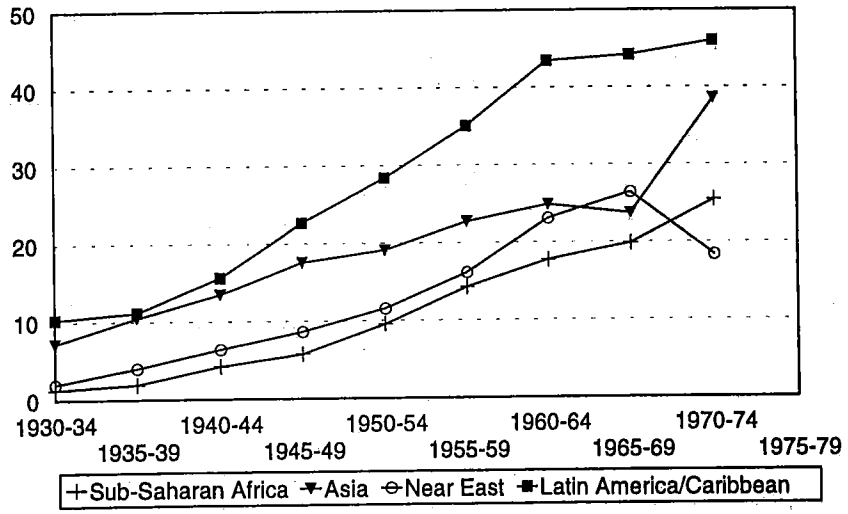
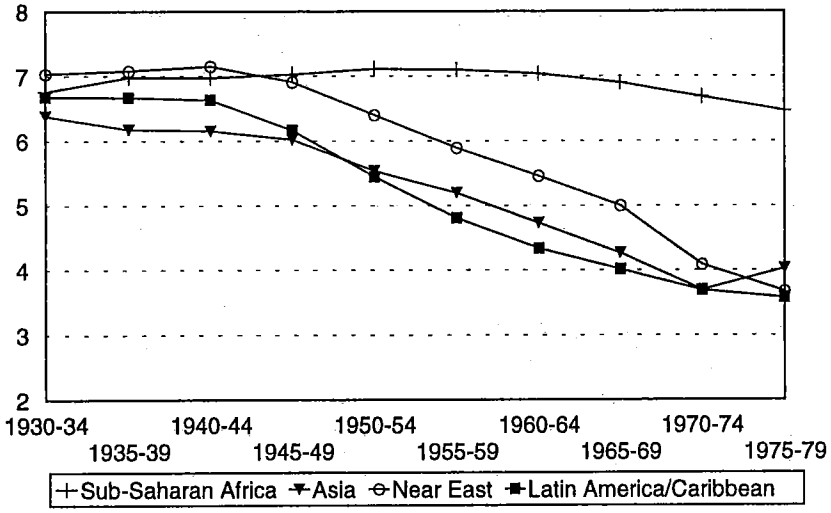


Figure 8
National Total Fertility Rate for Female Cohort Age 15 to 19 Years Old



half in the Near East and Latin America. Infant mortality fell by one-half overall, substantially more than one-half in the Near East and Latin America, about one-half in Asia, and almost one-half in sub-Saharan Africa (Figure 9). The proportion of the population living in urban areas more than doubled in all regions, and the Near East and Latin America went from predominantly rural to predominantly urban (Figure 10). Gross national income per capita (Figure 11) presents a substantially differing picture according to region. In the Near East there has been a steady increase over time, resulting in a doubling of income per capita. Asian cohorts have also experienced a general and substantial increase. The other two regions have not fared as well. While income per capita increased dramatically in Latin America, especially between 1955 and 1965, since 1965 there has been an equally dramatic fall. In sub-Saharan Africa, there has been little change in gross national income per capita from the earliest to the latest cohorts; there was a small rise between 1970 and 1975 and a small decline since 1975.

In line with the changes in those formative conditions, we would expect that education, fertility, mortality, and urbanization would play a strong role in determining initial family size desires; that income per capita may not play a large role (especially in Latin America and sub-Saharan Africa); and that sub-Saharan Africa, because of the small degree of change in fertility and income, would show a very different pattern from those of the other regions. Table 12 gives linear correlation coefficients between the formative characteristics and estimated initial desired number of children for each region and all regions together.

The total fertility rate is positively related to initial desires in all regions except sub-Saharan Africa, in line with the expectations noted above. The infant mortality rate is positively correlated with initial desires in all regions. The proportion urban is significantly negatively related only in the Near East and Latin America. Income per capita is also negatively related to initial desires except in sub-Saharan Africa, also as noted above. In Asia, surprisingly, neither of the education variables is significant, and only in sub-Saharan Africa and for all regions together is the percentage with 9 or more years of education significant. These results may be due to the fact that sub-Saharan African countries are just at the start of the demographic transition, where only more highly educated persons have lower initial desires for children, whereas in the other regions the transition has already progressed so that the distinction between lower and higher desired number of children comes at a lower level of education. Another explanation is that media penetration, especially the visual media of television and movies, has occurred less in sub-Saharan Africa than in the other regions.

Figure 9
National Total Infant Mortality Rate for Female
Cohort Age 15 to 19 Years Old

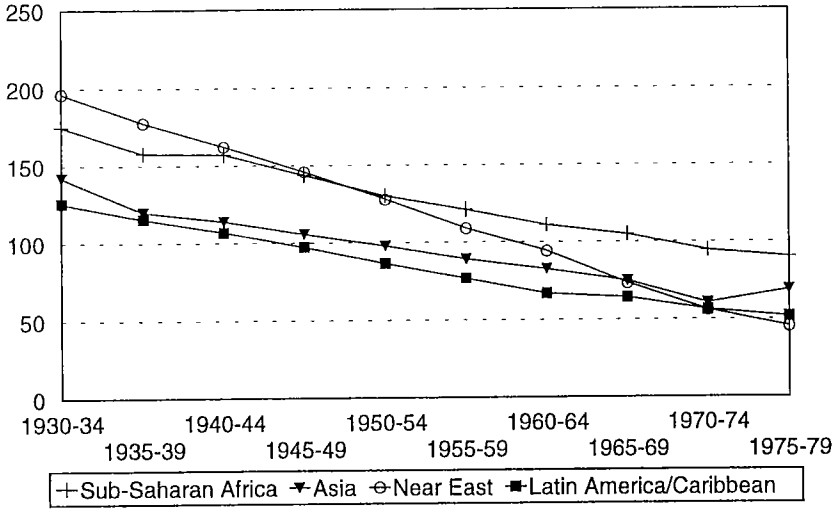


Figure 10
National Total Percentage Urban for Female
Cohort Age 15 to 19 Years Old

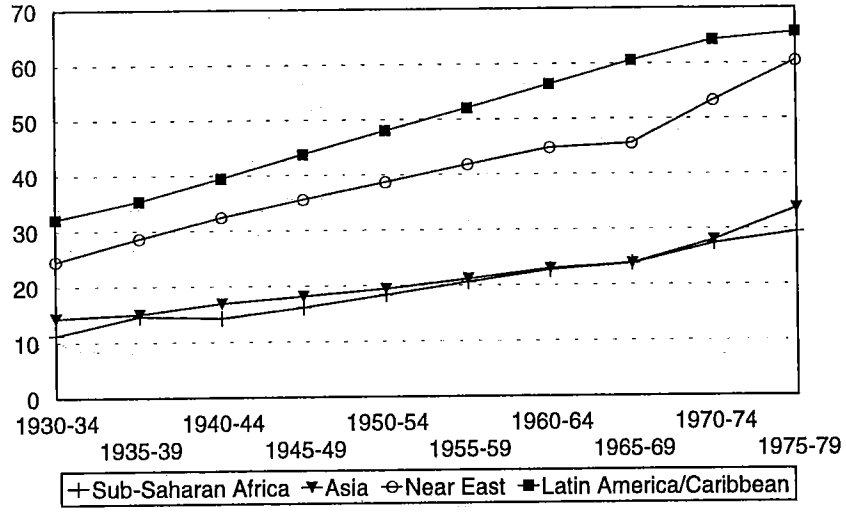


Figure 11
Gross National Income per Capita for Female Cohort Age 15 to 19 Years Old

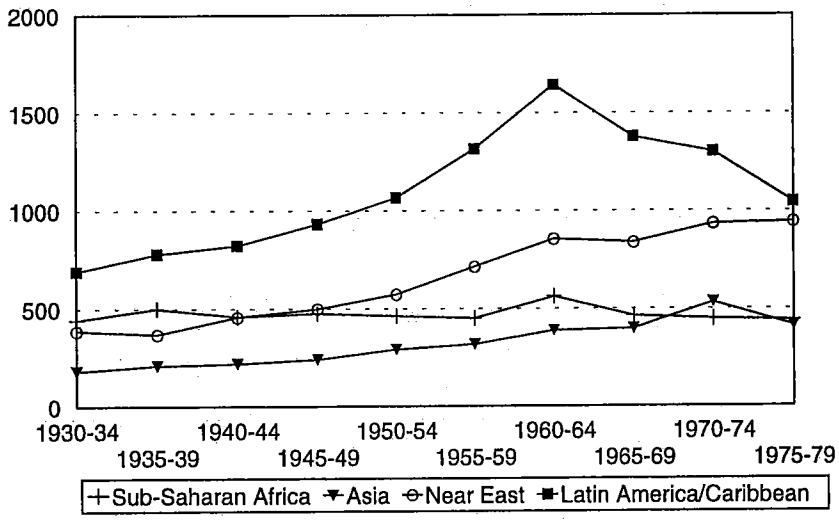


Table 12 Pearson correlation coefficients with estimated initial desired number of children

Variable	Sub-Saharan Africa	Asia	Near East	Latin America/ Caribbean	All regions
TFR	ns	.660	.767	.620	.645
IMR	.496	.455	.319	.280	.530
Percentage urban	ns	ns	-.382	-.677	-.493
Income per capita	ns	-.285	-.637	-.268	-.295
Percentage with 5+ years of education	-.660	ns	-.446	-.508	-.534
Percentage with 9+ years of education	-.285	ns	ns	ns	-.322

ns=Not significant at 5% level.

Regressions for Intercohort Change in Desired Number of Children

As a first step, an OLS regression was run with the estimated initial desired number of children as the dependent variable, on cohort percentages with 5 or more years and 9 or more years of education and cohort-formative levels of total fertility rate, infant mortality rate, percentage urban, and national income per capita (Y/N), along with indicator variables corresponding to world regions. The means, standard deviations, and number of valid cases are presented in Table 13. Mean substitution was used for the 34 cohorts with missing formative income per capita.

Table 13 Means and standard deviations of characteristics used to predict initial desired number of children

Variable	Mean	Standard deviation	Number of valid cases
Predicted DNC	3.87	1.63	541
Percentage with 5+ years of education	41.4	26.7	541
Percentage with 9+ years of education	15.5	15.4	541
Formative TFR	5.99	1.37	541
Formative IMR	107.9	42.5	541
Formative percentage urban	32.4	17.7	541
Formative income per capita	674.28	578.01	507

Note: Variables are explicated in Table A.1.

The regression for which results are shown in Table 14 predicts fairly well, with an adjusted R^2 indicating that almost 40 percent of the variance between cohorts in initial desired number of children is predicted by the variables included. Among the individual variables the greatest predictive power, as indicated by the beta values, is the formative total fertility rate, which acts in the expected direction. This variable stands in for average family size at the time the cohort was forming its fertility preferences, and this experience may be crucial in setting the context in which other factors operate. It is interesting to note that the infant mortality rate is not significant and thus may not play an important role in setting initial desires. For each one-child increase in the total fertility rate, initial preferences rise by almost half a child.

The next most important characteristic is the percentage of the population that was urban during the formative years, which acts in the expected direction. Although the percentage of the cohort that was urban during the formative period should be the variable of interest, data for that variable are inadequate, so national percentages urban had to be substituted, presuming that as the national percentage urban is greater so is the cohort's percentage. No information on other potentially important factors from the cohort's formative periods is available, notably exposure to mass media (such as television, movies, radio, and print), for which the percentage urban is acting as a proxy. For each 10-percent increase in percentage urban, preferences fall by almost 0.2 of a child.

Table 14 Regression predicting initial desired number of children

Variable	Coefficient	Standard error of coefficient	β	t ratio	Significance of the t ratio
Constant	1.796	0.419		4.29	.000
Percentage with 5+ years of education	-.0090	.0033	-.148	-2.73	.006
Percentage with 9+ years of education	-.0137	.0046	-.129	-2.96	.003
TFR	.4862	.0527	.411	9.22	.000
Percentage urban	-.0169	.0043	-.184	-3.97	.001
Y/N	4.340×10^{-4}	1.174×10^{-4}	.154	3.70	.002
Infant mortality rate	ns	ns	ns	ns	ns
Number of cases	541				
Adjusted R^2	.396				
F	71.92	Significance	.000		

Note: Variables are explicated in Table A.1.
ns=Not significant at 5% level.
Y/N=Income per capita.

In order of importance, income per capita follows. Income per capita has a direct rather than an inverse relation with initial fertility desires, indicating that for a $1,000 increase, there would be a 0.4 increase in the initial desired number of children.

The education variables—the percentage of the cohort with 5 or more years and the percentage with 9 or more years of education, representing approximately primary and secondary levels, respectively—have effects on initial desires that are strong, but not as strong as those of the preceding variables (in part owing to distributional characteristics). The coefficients indicate that a 20-percent increase in each percentage would decrease initial desired fertility by about 0.2 and 0.3 children for 5 or more years and 9 or more years, respectively

Applying the regression coefficients to the values of the cohorts born in 1930-34 and 1975-79 (1970-74 for the education variable), gives the following results in terms of predicted initial desired number of children and the amount of decline that can be expected in response to the factors included in the regression (Table 15). For all regions together, the decline due to cohort factors is on the order of two-and-a-half children, or a little over half of the earlier cohort's desires. The Latin American/Caribbean region is predicted to have had the greatest amount of decline (down to one-third of the earliest cohorts' initial desires) and sub-Saharan Africa the least (but still down to three-quarters of the earlier cohorts' initial desires).

Because the data are pooled across surveys, the differences in the cohorts' formative variables may be picking up country differences in those variables as well. To test this idea, indicator variables were added to the above regression that identify the country from which the cohorts came. The results of adding those indicator variables are shown in Table 16. Adding the country indicator variables substantially changes the results of the regression, with the variable indicating the proportion of the cohort with 5 or more years of education becoming much more important and the variable for the proportion with 9 or more years less important. The level of national urbanization also gains substantially in importance. The effects of formative level of income per capita becomes nonsignificant, whereas that of fertility is actually reversed and much less important.

Table 15 Predicted levels and decline in initial desired number of children

Region	1930-34 cohort (maximum)	1975-79 cohort (minimum)	Decline across cohorts	Percentage decline
Sub-Saharan Africa	5.04	3.82	1.21	24%
Asia	4.46	2.30	2.16	48%
Near East	4.93	2.23	2.70	55%
Latin America/Caribbean	4.40	1.52	2.88	66%
All	**4.74**	**2.17**	**2.56**	**54%**

Table 16 Regression on initial desired number of children with country indicator variables

Variable	Coefficient	Standard error of coefficient	β	t ratio	Significance of the t ratio
Constant	6.1171	0.3537		17.29	.000
Percentage with 5+ years of education	-.0260	.0023	-.428	-11.22	.000
Percentage with 9+ years education	-.0051	.0023	-.048	-2.26	.024
TFR	-.0939	.0381	-.079	-2.47	.014
Percentage urban	-.0219	.0034	-.239	-6.46	.000
Y/N	0.899×10^{-4}	0.629×10^{-4}	.032	1.43	.153
Number of cases	541				
Adjusted R^2	.882				
F	127.65	Significance	.000		

Note: Variables are explicated in Table A.1.
Y/N=Income per capita.

One way of strongly controlling for country effects on initial levels of desire is to counteract them, or zero them out, by using differences between the estimated initial values of cohort desires for adjoining cohorts within a country. Similarly, the independent variables should be differenced to zero out country effects. Because the data sets do not each cover all the cohorts under examination, the number of cases for the analysis is reduced when that difference is used as the dependent variable. Duplicate measurements of the same cohort difference have been eliminated.[13]

Three variations of the dependent variable were considered: the simple difference in estimated initial desires between a specific cohort of women and the next oldest cohort; the percentage change in initial desires from the next oldest; and the percentage change from the next oldest value less 1.4 children, the minimum estimated initial desired number of any of the cohorts. Since (logically) fertility desires cannot fall below zero children and they are very unlikely to fall below the minimum value of 1.4 children, the latter two formulations of the dependent variable were used to allow for nonlinear effects.

Table 17 shows the Pearson correlations with the differenced variables and the three formulations of the dependent variable.

Note that there is considerable variation in whether the variables are significantly correlated with the dependent variables according to region. Indeed, in the Asian region, none of the variables correlate significantly, and the change in urbanization is not significantly correlated with the dependent variables, either in any of the regions or for all regions together.

The results of the regressions for the formulations of the dependent variable as absolute and relative differences are shown in Table 18. Since the regression as a whole was nonsignificant, the last formulation, the percentage of the minimum difference, is not shown. For the two formulations shown, results are given for regressions without and with country indicator variables.

Three variables show significant results when the absolute difference in estimated initial desired fertility is used as the dependent variable: the cohort percentage with 5 or more years of education, the cohort percentages with 9 or more years of education, and the formative total fertility rate. The difference in the proportion of the cohort with 5 or more years of education is the strongest predictor of cohort differences in initial fertility, with a beta value of about one-quarter of a standard deviation. The proportion of the cohort with 9 or more years of education is also a significant determinant of initial desires, but to a much smaller degree: the coefficient is about a third the size of that of 5 or more years.

The second-strongest variable is the formative total fertility rate (TFR), which unexpectedly has a negative sign for its coefficient, an indication that the more the formative fertility decreased between cohorts, the less the initial desired number of children decreased. This result is unexpected on two accounts, theory and the results presented in Table 17.

Table 17 Pearson correlation coefficients for cohort differenced variables

Variable	Cohort difference in desired number of children (ΔDNC)	Percentage change in desired number of children (%ΔDNC)	Percentage change to minimum desired number of children (TΔDNC)
Sub-Saharan Africa			
ΔTFR	-.267	-.260	-.261
ΔIMR	ns	ns	ns
ΔUrbanization	ns	ns	ns
ΔY/N	ns	ns	ns
Δ5+ years of education	-.343	-.345	-.330
Δ9+ years of education	-.215	-.205	-.197
Asia			
ΔTFR	ns	ns	ns
ΔIMR	ns	ns	ns
ΔUrbanization	ns	ns	ns
ΔY/N	ns	ns	ns
Δ5+ years of education	ns	ns	ns
Δ9+ years of education	ns	ns	ns
Near East			
ΔTFR	-.329	ns	ns
ΔIMR	ns	ns	ns
ΔUrbanization	ns	ns	ns
ΔY/N	ns	ns	ns
Δ5+ years of education	-.314	-.286	ns
Δ9+ years of education	ns	ns	ns
Latin America/Caribbean			
ΔTFR	ns	ns	ns
ΔIMR	.316	.278	.229
ΔUrbanization	ns	ns	ns
ΔY/N	ns	-.241	-.237
Δ5+ years of education	-.245	ns	ns
Δ9+ years of education	-.324	-.312	ns
All regions			
ΔTFR	-.208	-.118	ns
ΔIMR	ns	ns	ns
ΔUrbanization	ns	ns	ns
ΔY/N	ns	ns	ns
Δ5+ years of education	-.286	-.217	ns
Δ9+ years of education	-.210	-.206	ns

Note: Variables are explicated in Table A.1.

[13] The duplicate measurements arise because of the cohort's being measured in more than one survey. The difference in the estimated initial values and in the formative values will therefore be repeated.

Table 18 Regressions on cohort differences among women in initial desired number of children

Variable	Difference in estimated initial desires		Difference in estimated initial desires with country indicators		Percentage difference		Percentage difference with country indicators	
	Coefficient and t-ratio	β	Coefficient and t-ratio	β	Coefficient and t-ratio	β	Coefficient and t-ratio	β
Constant	-0.1490 (-5.35)		-0.1794 (-6.29)		-1.8605 (-2.51)		-2.0474 (-2.75)	
Percentage with 5+ years of education	-0.0128 (-4.54)	-0.256	-0.0123 (-4.56)	-0.255	-0.2745 (-3.20)	-0.187	-0.2802 (-3.28)	-0.190
Percentage with 9+ years of education	-0.0042 (-2.65)	-0.149	-0.0043 (-2.89)	-0.155	-.1409 (-2.96)	-0.173	-.1412 (-2.98)	-0.173
TFR	-0.2004 (-3.45)	-0.192	-0.2459 (-4.37)	-0.235	ns	ns	ns	
Percentage urban	ns	ns	ns	ns	ns	ns	ns	ns
Y/N	ns	ns	ns	ns	ns	ns	ns	ns
Infant mortality rate	ns	ns	ns	ns	ns	ns	ns	ns
Number of cases	283		283		283		283	
Adjusted R^2	0.135		0.223		0.069		0.079	
F and significance	15.68	0.0000	11.12	0.0000	11.53	0.0000	9.07	0.0000

Note: Variables are explicated in Table A.1.
ns=Not significant at 5% level.

One possible explanation for the relative strength of the formative total fertility rate may be that the increase noted in the sub-Saharan African countries and some countries of Asia is due to a reduction in primary sterility. There is ample evidence for this reasoning in the case of central sub-Saharan African countries, where high levels of sexually transmitted diseases are thought to have been the culprit (Larsen 1994; Evina 1994; Cordell 1993). In this case, families with children would be large families, which influence the children's initial desires. Of course, there would be no children in families with primary sterility. The total fertility rate would increase because of a decrease in the proportion of families with no children, so that the fertility environment of the children would not be increasing. Moreover, primary sterility is usually thought to be a tragedy, not something to be chosen, and so it would be unlikely to influence fertility desires in the downward direction.

Addition of the country indicator variables does not substantially alter the results of the regression on absolute difference in desires, but it somewhat strengthens the effect of the total fertility rate.

With either the F-test value or the adjusted R^2, the formulation of cohort difference as a relative change is less well predicted by the formative variables than the absolute difference is, perhaps indicating that the relationship is fairly close to linear. In the relative formulation, the effect of the change in formative total fertility rate is not significant, with only the education variables left to explain differences between cohorts.

As was done above, the coefficients from the difference regressions can be used to predict cohort differences in initial fertility. The results are presented in Table 19 for the regressions that included the country indicator variables.

Neither regression does very well in predicting the estimated decline in initial desired number of children for all the regions. For the regions taken together, however, the absolute-difference regression performs adequately, being about a tenth of a child off. The relative-difference regression predicts nearly the same relative decline in all regions; it comes closer to the "true" value for sub-Saharan Africa and Asia yet goes farther from it in the Near East and Latin America than the absolute-difference regression does.

Table 19 Predicted initial desired number of children for the 1975-79 cohort from absolute and relative difference regressions, including country indicator variables

Region	Estimated initial desired number of children	Difference regressions: 1975-79 cohort predicted by		Across cohorts		Percentage decline	
		Absolute	Relative	Absolute	Relative	Absolute	Relative
Sub-Saharan Africa	4.81	6.17	5.69	0.79	1.27	11%	18%
Asia	2.70	3.57	3.14	0.23	0.66	6%	17%
Near East	3.02	3.01	3.87	1.63	0.77	35%	17%
Latin America/Caribbean	2.25	2.77	3.56	1.74	0.95	39%	21%
All	**3.66**	**3.77**	**4.13**	**3.19**	**0.91**	**63%**	**18%**

7 Summary and Discussion

Time is perhaps the most fundamental parameter in demography. In the study of fertility preferences, changes over time should be viewed by distinguishing initial values from changes in those values that are caused by aging and by life course and period-specific conditions. By means of combining information from repeated surveys in countries, cohorts of women can be followed over time. The results presented in this report indicate that about half of the change that countries undergo in the average desired number of children occurs because individual women change their preferences. This change is not due to any increase in schooling but rather due to either the adoption of new attitudes or the expression of latent attitudes. The other half is due to the changing cohort composition of the reproductive-age population of countries as earlier-born women pass out of the childbearing ages and later-born women move into those ages.

Around the time of the WFS surveys (1974-83), women in less developed countries desired from three-and-a-half children to about eight children on average, as declared in questions that asked how many they would want if they were to start over again.[14] By the time of the DHS-II and DHS-III surveys included in this report (1993-95), declared desired number ranged from two-and-a-half to between five and six children.[15] Synthetic measures of desired number of children, which presumably reflect period conditions to a greater extent than the declared measure does, show generally the same result. Uneducated women generally have somewhat higher fertility preferences than all women, but they still show a large decline over time within cohorts. Interestingly, synthetic measures among uneducated women show lower levels of fertility desires, similar to and sometimes lower than those of all women, perhaps indicating a greater impact of period economic conditions on the uneducated.

In studies that rely on cohort data pooled for a number of countries, the important correlates of desired number of children and the percentage of women who want no more children are the level of infant and child mortality, family planning effort, knowledge of family planning, radio messages on family planning, and the number of children women have borne. Per capita income, education level, and other development variables are somewhat less strongly related to differences in fertility preferences. For uneducated women, most of the same family planning and media factors are important (radio listening remains, while radio messages on family planning drops out), but the income and development indicators become somewhat more important for them than for all women.

The study of how contraception and fertility desires have changed within cohorts over time gives an insight into the dynamics of the fertility transition that cross-sectional studies cannot provide. As educed from the trend regressions presented above, the leading correlates of decline in fertility preferences within cohorts are the level of family planning effort, decrease in per capita income, and increase in national levels of schooling. In two of the formulations of the dependent variable, lower levels of income are also related to decreases in fertility preferences. Countries with higher income levels had smaller declines in desires, as did cohorts that became more urbanized (one formulation). Those results are not altogether unexpected, from the theoretical discussion above, since improvements in economic status tend to relieve the burden of having children.

Both the rate of change in fertility desires and the change in the proportions of women who want no more children show results similar to those in the different formulations of amount of change in desires: that both family planning effort and development affect individual women over time. Also interesting is the confirmation that for desired number of children, higher parity reduces the apparent change in declared desires, a "misreporting" effect hypothesized in cross-sectional studies. Without this form of misreporting, average cohort decline in desired number of children would be substantially higher.

Cohort levels of desired number of children are measured at given points in time and have changed by varying amounts because of longer or shorter periods of exposure and life course. Those intracohort changes must be taken into account in order to study the factors leading to differences between cohorts. The procedure used in this study is to predict the initial desired number of children that cohorts would state by adjusting currently expressed desires for general trends related to parity, age, and time (with an adjustment for whether the survey data pertained to the WFS or a DHS). The predicted initial values (i.e., for women age 20, with no children, in 1990) are then tested against conditions extant—that is, formative levels of education, urbanization, income, fertility, and mortality. The analysis indicates that greater formative urbanization and education reduce initial desires, whereas greater formative income per capita along with increase initial desires. Formative infant mortality was not found to be a significant predictor of initial fertility desires.

Let us then review the findings in terms of the initial discussion on explanation of fertility change: preconditions, legitimization factors, facilitating factors, and triggering changes.The variables in this study that are related to *preconditions* are media

[14] Turkey reported three children.

[15] Niger reported eight children and Cameroon almost seven.

exposure and infant and child mortality. The former affects intercohort changes in desires but not initial formation of desires. The latter shows mixed results, perhaps because of lack of sufficient data to study the effect adequately. In the cross-sectional analysis, radio listening negatively affects fertility desires; in one formulation, increases in radio listening lead to declines in fertility desires when country indicator variables are included. Print readership and increases in readership lead to increases in desires, the reason for which is not readily understandable but may be reflecting the effects of greater wealth. However, because no data are available for time periods preceding the surveys, media exposure cannot be included in the regressions on initial intercohort differences in desires. Moreover, data on exposure to television—arguably the most powerful of the media for forming opinions—are not available for most of the countries.

The variables associated with *legitimization* of lower fertility and family planning in this study are family planning effort, knowledge of contraception, and family planning messages in the media. Data on all three of those factors are available only for the analysis of intracohort trends, since they are not available (generally) for periods during which cohorts were forming their initial fertility preferences. However, the total fertility rate during the formative period was used as a substitute, to attempt to proxy the effects of reigning fertility and family planning conditions. In the cross-sectional analysis (pooled time and country), family planning effort, contraceptive knowledge, exposure to radio messages on family planning, and acceptance of such messages were all related to lowered fertility desires and increased proportions who wanted no more children, for all women and for women with no education (except hearing family planning messages for the latter). For changes in attitude on the part of the same women (intracohort trends), family planning effort decreases fertility desires and increases both the percentage who want no more children and the rate of decline in desired number of children. Increase in knowledge of contraceptive methods is also associated with a greater rate of decline in desired number of children after country effects are controlled. Higher formative-period fertility rates are associated with greater initial desired number of children by the cohorts of women.

Facilitating factors in this study include education levels (percentage with 5 or more and percentage with 9 or more years completed), urbanization, water and electricity supply, labor force participation, and income per capita. Education has its main effect in establishing initial fertility desires—the percentage with 5 or more years having a slightly greater effect than the percentage with 9 or more years when country effects are uncontrolled, but much greater when country effects are controlled. In the cross-sectional analysis, however, it is the latter variable only that is significant. It should be noted also that uneducated women show large changes in fertility preference, so that education is certainly not the only—nor perhaps the principal—determinant of preference changes. Moreover, intracohort changes in fertility preferences cannot (by definition) be due directly to changes in education. Indirectly, national-level increases in education lead to declines in desired number of children, but the declines are tempered by higher cohort levels of education, perhaps because educated women are more likely to have an extended time horizon and therefore think more about future consequences, or perhaps because their situation has changed less over time.

The development factors—percentage urban, percentage with water and electricity, and percentage participating in the labor force—perform better as correlates for lower fertility desires for uneducated women than for all women in the cross-sectional analyses. The formative proportion urban is important in determining the initial levels of desires, even after country effects are controlled. For intracohort changes, increases in the proportion of the cohort that is urban raise the level of the cohort's fertility desires if country effects are not controlled but reduce desires if they are, a result difficult to understand. Increases in the electric supply, however, decrease fertility desires. Increases in labor force participation rates lead to a greater rate of decline in fertility desires, but only if country indicators are not in the analysis. The other development variable—the change in proportion with a public water supply—does not have a significant effect.

As seen from the cross-sectional analysis, the level of per capita income affects all women and uneducated women differentially, having little effect on the former group's fertility preferences but decreasing preferences for the latter group. However, greater period income per capita is associated both with higher levels of initial fertility desires (as predicted by economists) and with intracohort increases in desires in the formulations where it is significant (one formulation controlled for country effects shows a decrease).

The postulated *trigger* for declines in fertility desires and increased use of contraception—and thus declines in fertility—is a decline in per capita income. The intracohort trend analysis of desired number of children confirms that hypothesis. However, the change in income effect is not a significant predictor of increases in the rate of decline in desired number of children, nor of increases in the percentage of women who want no more children. Since a trigger would be postulated to occur only when income per capita declined (perhaps by a threshold amount), it is possible that significant results for the dependent variables would occur if only negative deviations in income were to be taken into account. However, investigating the necessary length of time and steepness of the income decline to obtain an effect on preferences and whether the effect is permanent or temporary is beyond the scope of the current report.

The analyses in this report can be summarized as follows: there has been a general decline in fertility desires, on account of both intercohort and intracohort changes. That is, women with lower initial desires have replaced women with higher desires in the reproductive age range, and also individual women have lowered their own desires. Those changes are due to

general development and education as well as to family planning program efforts.

Family planning programs can be seen to have two roles in fertility decline, passive and active. In their passive role, they supply the demand for contraceptives by which couples attempt not to exceed their desired number of children. In their active role, they legitimize the use of contraception, along with reductions in manifest fertility preferences, by legitimizing latent preferences and by actively promoting small-family values. Pritchett and Summers's study considers only the passive role of family planning programs. Their claim—that because the slope of the relationship between average ideal number of children (here, desired number of children) and the total fertility rate of countries is close to unity, family planning programs do not contribute to fertility decline—is flawed, because they do not consider the effects of family planning programs on those desires.

A simulated change in desired number of children that combines both inter- and intracohort changes over time can be produced by using the results of the regressions. In this simulation, it is assumed that the 1930-34 and 1975-79 birth cohorts vary from one to another in their initial desires as predicted by the results in Table 18. A linear trend is used to estimate the initial levels of cohorts between the extremes. The values are taken as being representative of fertility in the year 1974. For the year 1994, a two-standard deviation change is applied to the trend beta values (from the relative change down to two children) to estimate the amount of change. The results of that simulation are shown in Table 20. It can be seen that the initial desired number of children would decline from 4.2 to 3.0 owing to the shift of cohorts into and out of the reproductive ages, and that a further decline to 2.6 children is caused by women changing their minds under the influence of the trend factors.[16] Interestingly, if the same cohorts had been present in the reproductive ages in 1994, time trends would have reduced their desired number of children to 3.0.

The amount of change attributable to the different groups of factors can be determined by summing the beta values of the individual factors in each group. The results are shown in Table 21. Overall, it can be seen that although family planning progress decreases the desired number of children by means of both inter- and intracohort changes, declines due to development effects between cohorts are offset by increases within cohorts.

Table 20 Simulated change in desired number of children attributable to inter- and intra-cohort changes over time

Cohort		Year 1974		Year 1994		
Number	Date of birth	Age	Initial DNC	Age	Initial DNC	Trend DNC
1	1925-29	45-49	5.03			
2	1930-34	40-44	4.74			
3	1935-39	35-39	4.45			
4	1940-44	30-34	4.17			
5	1945-49	25-29	3.88	45-49	3.88	3.05
6	1950-54	20-24	3.60	40-44	3.60	2.89
7	1955-59	15-19	3.31	35-39	3.31	2.73
8	1960-64			30-34	3.03	2.57
9	1965-69			25-29	2.74	2.41
10	1970-74			20-24	2.46	2.25
11	1975-79			15-19	2.17	2.09
Average			**4.17**		**3.03**	**2.57**

Table 21 Compared effects of a one-standard deviation progress in health, family planning, development, and life course on desired number of children

		Intracohort		Overall	
Influence	Inter-cohort	Without CI	With CI	Without CI	With CI
Health changes	0.0	+0.12	-0.08	+0.12	-0.08
Family planning	-0.41	-0.95	-1.06	-1.36	-1.47
Development	-0.31	+0.13	+0.40	-0.18	+0.09
Life course	0.0	+0.31	+0.52	+0.31	+0.52

CI=Country indicator variables.

[16] The estimate is controlled for country effects. Excluding those effects, the decline is to 2.5 children.

8 Conclusions

One of the fundamental differences between the developed and the developing worlds is the mindset of the majority of the population with regard to childbearing. In the developed countries, the "default mode" of the fertility decision is not to get pregnant, and couples normally consciously decide whether and when to procreate. In the developing countries, the mindset is the opposite: it is assumed that children will be forthcoming unless a deliberate decision is made to avoid or delay births. Does a shift to the former mindset coincide automatically and irrevocably with development at a set pace, or can the shift be accelerated through active programs?

The above analysis shows that family planning programs do more than just act as passive providers of access to contraception. The data do not support the notion that fertility desires are affected *only* by education, income, and long-term development factors. Family planning programs do actively affect the fertility desires of couples, by means of increased contacts with people using contraception; gains in knowledge about contraception; and legitimization of the expression of small-family values and the use of contraception, via the mass media, cohort experience, and official policy. About half the change in fertility desires over time comes from women who had in the past voiced a desire for higher numbers of children, women whose educational situation was already determined by the time they entered into childbearing. Those results are very encouraging. They show that countries do not have to wait to become developed before reducing their population growth. The need for contraception, however, will still probably outpace actual contraceptive use (unmet need) for many countries, because programs are shooting at a moving target that they themselves are helping to move.

8.1 FURTHER ANALYSIS

The results presented here are the findings of an exploratory study. The limited scope of this report has not allowed investigation of the full theoretical model outlined above. In particular, it was decided not to include actual contraceptive use in the regression equations, because of its endogeneity with respect to fertility desires. It is hoped to be able to do more in upcoming work. Other formulations of the dependent variables than those used here should be tried, to ascertain the most useful functional form. Also, different functional forms and lags should be tried for the independent change variables, such as income and mortality. As more data become available—both from repeated surveys of other countries and the countries used here and from other outside data sources—the analysis should be updated to take the richer data set into account.

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Appendix

Table A.1 Variables used in analysis

Cross-sectional analysis	
Dependent variables:	
DNC	Mean desired number of children
NOMORE	Percentage who want no more children
Primary explanatory variables:	
FPSCORE	Family-planning-program-effort score
KNOW	Percentage who know a contraceptive method
ACCEPT	Percentage who accept f/p on radio
FPRADIO	Percentage who had heard about f/p on radio
RADIO	Percentage who listen to radio
PRINT	Percentage who read newspaper
Control variables:	
DATE	Date of interview
PRIM	Percentage with 5+ years of education
SEC	Percentage with 9+ years of education
INCOME	Gross national income per capita
URB	Percentage urban
ELEC	Percentage with electricity
WATER	Percentage with water supply
LBFRCE	Percentage in labor force
AGE	Mean age of cohort
ASFR	Age-specific fertility rate
PARITY	Mean number of children ever born
U5MR	Mean percentage dead of births in previous 5 years
Trend analysis	
Dependent variables:	
ΔDNC	Change in mean preferred number of children
ΔNOMORE	Change in percentage wanting no more children
Explanatory variables:	
FPSCORE	Family-planning-program-effort score
dKNOW	Change in percentage who know a contraceptive method
dACCEPT	Change in percentage who accept f/p on radio
dRADIO	Change in percentage who listen to radio
dPRINT	Change in percentage who read newspaper
dFPRAD	Change in percentage who had heard about f/p on radio
Control variables:	
dDATE	Time between surveys
PRIMARY	Percentage with 5+ years of education
SECONDARY	Percentage with 9+ years of education
INCOME	Gross national income per capita
dINC	Change in national income per capita
dURB	Change in percentage urban
dELEC	Change in percentage with electricity
dWATER	Change in percentage with water supply
dLBFRCE	Change in percentage in labor force
dAGE	Change in mean age of cohort
dASFR	Change in age-specific fertility rate
dPARITY	Change in mean number of children ever born
dU5MR	Change in percentage dead of births in previous 5 years

Continued...

Table A.1—*Continued*

Trend analysis				
Identification variables:				
CNTY	Country			
CM	Cameroon		GH	Ghana
KE	Kenya		NG	Nigeria
RW	Rwanda		SN	Senegal
SD	Sudan		EG	Egypt
JO	Jordan		MA	Morocco
PK	Pakistan		TN	Tunisia
YE	Yemen		ID	Indonesia
LK	Sri Lanka		PH	Philippines
TH	Thailand		TR	Turkey
BD	Bangladesh		BO	Bolivia
BR	Brazil		CO	Colombia
DR	Dominican Republic		EC	Ecuador
MX	Mexico		PE	Peru
PY	Paraguay		TT	Trinidad and Tobago
SRVY	Survey			
0	WFS			
1	DHS I			
2	DHS II			
COH	Cohort of birth			
0	All cohorts	1	1930-34	
2	1935-39	3	1940-44	
4	1945-49	5	1950-54	
6	1955-59	7	1960-64	
8	1965-69	9	1970-74	
10	1975-79	11	1980-84	

Continued . . .

Table A.1—*Continued*

Construction of Score for Family Planning Program Effort

Scale of 0 to 120 was based on rating from 0 to 4 on each of the following measures:

Policy and state-setting activities

1 Policy on fertility reduction and family planning
2 Statements by leaders
3 Level of program leadership
4 Policy on age at marriage
5 Import laws and legal regulations
6 Advertising of contraceptives allowed
7 Involvement of other ministries and public agencies
8 Percentage of in-country funding of family planning budget

Service and service-related activities

9 Involvement of private-sector agencies and groups
10 Civil bureaucracy involved
11 Community-based distribution
12 Social marketing
13 Postpartum program
14 Home-visiting workers
15 Administrative structure
16 Training program
17 Personnel carry out assigned tasks
18 Logistics and transport
19 Supervision system
20 Mass media for IE&C
21 Incentives and disincentives

Record keeping and evaluation

22 Record keeping
23 Evaluation
24 Management's use of evaluation findings

Availability and accessibility of fertility-control supplies and services

25 Male sterilization
26 Female sterilization
27 Pills and injectables
28 Condoms, spermicides, foam, diaphragms
29 IUDs
30 Abortion

Table A.2 Desired number of children for cohorts of women in three national surveys: Egypt

Birth cohort	All women			Uneducated women			Educated women		
	WFS	DHS-I	DHS-II	WFS	DHS-I	DHS-II	WFS	DHS-I	DHS-II
National	4.08	2.90	2.85	4.54	3.14	3.08	3.40	2.67	2.68
1930-34	4.57	--	--	4.87	--	--	4.12	--	--
1935-39	4.41	3.22	--	4.80	3.65	--	3.79	2.60	--
1940-44	4.43	3.25	3.21	4.82	3.47	3.49	3.68	2.93	2.87
1945-49	4.00	3.04	3.17	4.53	3.28	3.42	3.29	2.78	2.89
1950-54	3.67	2.86	3.00	4.23	3.11	3.16	2.98	2.65	2.87
1955-59	3.79	2.75	2.92	4.26	2.96	3.24	3.16	2.62	2.71
1960-64	4.15	2.78	2.82	4.51	3.02	3.06	3.49	2.62	2.67
1965-69	4.24	2.78	2.67	4.72	2.92	2.87	3.00	2.63	2.54
1970-74	--	3.13	2.57	--	3.36	2.70	--	2.73	2.45
1975-79	--	--	2.54	--	--	2.45	--	--	2.68

Table A.3 Desired number of children for cohorts of women in three national surveys: Indonesia

Birth cohort	All women			Uneducated women			Educated women		
	WFS	DHS-I	DHS-II	WFS	DHS-I	DHS-II	WFS	DHS-I	DHS-II
National	4.14	3.22	2.78	4.26	3.38	3.10	3.94	3.18	2.71
1930-34	4.81	--	--	4.74	--	--	5.15	--	--
1935-39	4.64	3.77	--	4.61	3.72	--	4.73	3.83	--
1940-44	4.42	3.74	3.31	4.39	3.64	3.32	4.48	3.80	3.31
1945-49	4.00	3.48	3.23	3.96	3.52	3.45	4.04	3.47	3.13
1950-54	3.70	3.35	3.03	3.78	3.33	3.31	3.63	3.35	2.96
1955-59	3.30	3.21	2.93	3.37	3.26	3.13	3.25	3.20	2.89
1960-64	3.05	3.01	2.72	3.17	3.13	2.83	2.96	2.99	2.70
1965-69	--	2.75	2.49	--	2.82	2.68	--	2.74	2.47
1970-74	--	2.50	2.35	--	2.45	2.63	--	2.50	2.34
1975-79	--	--	2.48	--	--	3.00	--	--	2.44

Table A.4 Desired number of children for cohorts of women in three national surveys: Kenya

Birth cohort	All women			Uneducated women			Educated women		
	WFS	DHS-I	DHS-II	WFS	DHS-I	DHS-II	WFS	DHS-I	DHS-II
National	6.77	4.43	3.70	7.63	5.41	4.85	6.15	4.12	3.47
1930-34	8.65	--	--	8.91	--	--	7.97	--	--
1935-39	8.07	5.74	--	8.28	5.73	--	7.67	5.77	--
1940-44	7.77	5.29	4.61	7.85	5.32	4.52	7.65	5.23	4.75
1945-49	7.01	5.38	4.27	7.51	5.62	4.84	6.58	5.14	3.70
1950-54	6.24	4.89	4.14	6.80	5.40	4.49	5.90	4.55	3.93
1955-59	6.00	4.70	4.05	6.88	5.37	4.78	5.69	4.36	3.73
1960-64	5.65	4.36	3.81	6.38	5.36	5.26	5.54	4.16	3.53
1965-69	--	3.88	3.49	--	5.15	5.03	--	3.78	3.36
1970-74	--	3.74	3.38	--	5.40	5.19	--	3.66	3.28
1975-79	--	--	3.48	--	--	4.78	--	--	3.44

Table A.5 Desired number of children for cohorts of women in three national surveys: Peru

Birth cohort	All women			Uneducated women			Educated women		
	WFS	DHS-I	DHS-II	WFS	DHS-I	DHS-II	WFS	DHS-I	DHS-II
National	3.78	2.64	2.47	4.25	3.14	3.00	3.59	2.59	2.44
1930-34	4.50	--	--	4.78	--	--	4.29	--	--
1935-39	4.23	3.51	--	4.75	3.77	--	3.87	3.43	--
1940-44	3.87	3.22	3.13	4.25	3.09	3.33	3.68	3.27	3.09
1945-49	3.62	2.98	2.97	3.54	3.24	3.25	3.65	2.91	2.92
1950-54	3.36	2.94	2.83	3.51	3.63	3.19	3.33	2.86	2.79
1955-59	2.97	2.66	2.60	3.30	3.33	2.88	2.91	2.61	2.58
1960-64	3.06	2.37	2.40	3.31	2.29	2.79	3.02	2.37	2.39
1965-69	--	2.27	2.26	--	2.41	2.63	--	2.27	2.25
1970-74	--	2.20	2.19	--	2.38	1.98	--	2.20	2.19
1975-79	--	--	2.23	--	--	2.08	--	--	2.23

Table A.6 Descriptive values of cross-section regression variables

Variable	Mean	Standard deviation	Cases	Label
DNC	4.413	1.572	541	Mean desired number of children
NOMORE	46.743	31.778	541	Percentage wanting no more children
FPSCORE	54.105	23.582	541	Family-planning-program effort Score
KNOW	80.557	21.678	540	Percentage who know a contraceptive method
FPRADIO	30.769	13.233	281	Percentage who had heard about f/p on radio
ACCEPT	78.250	13.317	256	Percentage who accept f/p on radio
INCOME	806.412	666.636	510	Gross national income per capita
URB	39.718	20.548	531	Percentage urban
ELEC	50.411	24.704	336	Percentage with electricity
WATER	33.894	19.310	339	Percentage with water supply
LBFRCE	37.627	23.701	531	Percentage in labor force
PRIM	38.782	26.235	541	Percentage with 5+ years of education
SEC	15.545	14.815	541	Percentage with 9+ years of education
RADIO	61.426	14.312	336	Percentage who listen to radio weekly
PRINT	47.207	17.417	280	Percentage who read newspaper weekly
AGE	30.911	11.048	541	Mean age of cohort
PARITY	3.613	2.468	541	Mean number of children ever born
ASFR	150.255	98.307	541	Age-specific fertility rate
DEAD	14.303	12.358	538	Percentage of children who died
U5MR	11.243	12.358	538	Percentage dead of births in last 5 years
DATE	86.270	6.276	541	Date of interview (year)
COH	5.444	2.458	541	Cohort of birth

Table A.7 Descriptive values of intracohort trend regression variables

Variable	Mean	Standard deviation	Cases	Label
oDNC	4.369	1.630	216	Previous desired number of children
oDNC2	21.732	17.159	216	oDNC squared
DNC	3.915	1.398	216	Mean desired number of children
ΔDNC	-0.454	0.632	216	Change in desired number of children
tΔDNC	-16.679	24.373	216	ΔDNC/(DNC-2)
pΔDNC	-8.986	11.638	216	ΔDNC/DNC
aΔDNC	0.003	0.534	216	ΔDNC adjusted for old DNC
rΔDNC	-0.005	0.007	216	Rate of change in DNC
arΔDNC	0.000	0.006	216	rΔDNC adjusted for old rΔDNC
NOMORE	65.051	26.911	216	Percentage wanting no more children
dNOMORE	24.912	16.497	216	Change in percentage wanting no more
oNOMORE	40.139	29.250	216	Previous percentage wanting no more
oNOMO2	2462.741	2620.934	216	oNOMORE squared
Dead	13.074	5.983	216	Percentage of children who died
dDead	-0.498	3.461	215	Change in percentage dead, of children
U5MR	8.171	6.202	216	Percentage dead of children born in last 5 yrs
dU5MR	-3.656	15.771	215	Change in U5MR
FPSCORE	64.606	18.293	216	Family-planning-program-effort score
dSCORE	17.558	14.928	216	Change in f/p effort scores
dKNOW	11.758	15.571	216	Change in percentage who know contraceptive method
FPRadio	33.776	17.021	174	Percentage who had heard about f/p on radio
dFPRAD	3.143	11.607	56	Change in percentage hearing f/p on radio
dACCEPT	36.457	14.864	35	Change in percentage accepting f/p on radio
INCOME	855.268	624.336	205	Gross national income per capita
dINC	7.073	139.395	205	Change in national income per capita
dURB	4.444	10.115	216	Change in percentage urban
dELEC	19.257	15.634	70	Change in percentage with electricity
dWATER	6.400	5.019	70	Change in percentage with water supply
dLBFRCE	8.042	18.857	216	Change in percentage in labor force
PRIM	42.153	24.649	216	Percentage with 5+ years of education
SEC	19.023	14.537	216	Percentage with 9+ years of education
dNPrim	14.551	9.236	216	Change in national percentage with 5+ yrs of education
dNSec	8.727	7.620	216	Change in national percentage with 9+ yrs of education
Radio	62.995	17.597	204	Percentage who listen to radio/TV weekly
dRADIO	-3.643	11.131	70	Change in percentage who listen to radio
Print	52.246	19.353	167	Percentage who read newpaper weekly
dPRINT	12.086	7.622	70	Change in percentage who read a newspaper
dPARITY	1.350	1.031	216	Change in mean parity
dAGE	8.809	4.248	216	Change in mean age
dDATE	8.918	3.705	216	Change in mean date of interview
COH	5.199	1.905	216	Cohort of birth
WFS	0.676	0.469	216	If preceding survey was WFS

Table A.8 Descriptive values of intercohort regression variables

Variable	Mean	Standard deviation	Cases	Label
DNCADJ4	3.868	1.626	541	Predicted initial desired number of children
Y/N	674.282	578.013	507	Formative gross national income per capita
URBCOH	32.410	17.718	541	Formative percentage urban
PRIMCOH	41.364	26.722	541	Percentage with 5+ years of education
SECCOH	15.484	15.353	541	Percentage with 9+ years of education
TFRCOH	5.989	1.374	541	Formative total fertility rate
IMRCOH	107.908	42.538	541	Formative infant mortality rate

Table A.9 Descriptive values of intercohort change regression variables

Variable	Mean	Standard deviation	Cases	Label
da4DNC	-0.163	0.358	283	Difference in predicted initial desired number of children
tda4DNC	-1.085	43.883	283	da4DNC/(previous cohort DNCadj4 - 1.4)
pa4DNC	-3.112	10.506	283	da4DNC/previous cohort DNCadj4
dY/N	50.319	201.133	260	Difference in formative gross national income per capita
dURBCOH	2.805	1.771	283	Difference in formative percentage urban
dPRIMCO	4.958	7.139	283	Difference in percentage with 5+ years of education
dSECCOH	-0.777	12.872	283	Difference in percentage with 9+ years of education
dTFRCOH	-0.233	0.342	283	Difference in formative total fertility rate
dIMRCOH	-11.413	6.398	283	Difference in formative infant mortality rate

Appendix B

Summary of DHS-I, DHS-II, and DHS-III Surveys, 1985-1997

Region and Country	Date of Fieldwork	Implementing Organization	Respondents	Sample Size	Male/Husband Survey	Supplemental Studies, Modules, and Additional Questions
SUB-SAHARAN AFRICA						
DHS-I						
Botswana	Aug-Dec 1988	Central Statistics Office	AW 15-49	4,368		AIDS, PC, adolescent fertility
Burundi	Apr-Jul 1987	Département de la Population, Ministère de l'Intérieur	AW 15-49	3,970	542 Husbands	CA, SAI, adult mortality
Ghana	Feb-May 1988	Ghana Statistical Service	AW 15-49	4,488	943 Husbands	CA, SM, WE
Kenya	Dec-May 1988/89	National Council for Population and Development	AW 15-49	7,150	1,133 Husbands	
Liberia	Feb-Jul 1986	Bureau of Statistics, Ministry of Planning and Economic Affairs	AW 15-49	5,239		TBH, employment status
Mali	Mar-Aug 1987	Institut du Sahel, USED/CERPOD	AW 15-49	3,200	970 Men 20-55	CA, VC, childhood physical handicaps
Ondo State, Nigeria	Sep-Jan 1986/87	Ministry of Health, Ondo State	AW 15-49	4,213		CA, TBH
Senegal	Apr-Jul 1986	Direction de la Statistique, Ministère de l'Economie et des Finances	AW 15-49	4,415		CA, CD
Sudan	Nov-May 1989/90	Department of Statistics, Ministry of Economic and National Planning	EMW 15-49	5,860		FC, M, MM
Togo	Jun-Nov 1988	Unité de Recherche Démographique, Université du Benin	AW 15-49	3,360		CA, SAI, marriage history
Uganda	Sep-Feb 1988/89	Ministry of Health	AW 15-49	4,730		CA, SAI
Zimbabwe	Sep-Jan 1988/89	Central Statistical Office	AW 15-49	4,201		AIDS, CA, PC, SAI, WE
DHS-II						
Burkina Faso	Dec-Mar 1992/93	Institut National de la Statistique et de la Démographie	AW 15-49	6,354	1,845 Men 18+	AIDS, CA, MA, SAI
Cameroon	Apr-Sep 1991	Direction Nationale du Deuxième Recensement Général de la Population et de l'Habitat	AW 15-49	3,871	814 Husbands	CA, CD, SAI
Madagascar	May-Nov 1992	Centre National de Recherches sur l'Environement	AW 15-49	6,260		CA, MM, SAI
Malawi	Sep-Nov 1992	National Statistical Office	AW 15-49	4,850	1,151 Men 20-54	AIDS, CA, MA, MM, SAI
Namibia	Jul-Nov 1992	Ministry of Health and Social Services, Central Statistical Office	AW 15-49	5,421		CA, CD, MA, MM
Niger	Mar-Jun 1992	Direction de la Statistique et des Comtes Nationaux	AW 15-49	6,503	1,570 Husbands	CA, MA, MM, SAI
Nigeria	Apr-Oct 1990	Federal Office of Statistics	AW 15-49	8,781		CA, SAI
Rwanda	Jun-Oct 1992	Office National de la Population	AW 15-49	6,551	598 Husbands	CA
Senegal	Nov-Aug 1992/93	Direction de la Prévision et de la Statistique	AW 15-49	6,310	1,436 Men 20+	AIDS, CA, MA, MM, SAI
Tanzania	Oct-Mar 1991/92	Bureau of Statistics, Planning Commission	AW 15-49	9,238	2,114 Men 15-60	AIDS, CA, MA, SAI
Zambia	Jan-May 1992	University of Zambia	AW 15-49	7,060		AIDS, CA, MA

DHS-III						
Benin	Jun-Aug 1996	Institut National de la Statistique	AW 15-49	5,491	1,535 Men 20-64	AIDS, CA, MA, MM, SAI
Central African Republic	Sep-Mar 1994/95	Direction des Statistiques Démographiques et Sociales	AW 15-49	5,884	1,729 Men 15-59	AIDS, CA, CD, MA, MM, SAI
Comoros	Mar-May 1996	Centre National de Documentation et de la Recherche Scientifique	AW 15-49	3,050	795 Men 15-64	CA, MA
Côte d'Ivoire	Jun-Nov 1994	Institut National de la Statistique	AW 15-49	8,099	2,552 Men 12-49	CA, MA, SAI
Eritrea	Sep-Jan 1995/96	National Statistics Office	AW 15-49	5,054	1,114 Men 15-59	AIDS, CA, MA, MM, SAI
Ghana	Sep-Dec 1993	Ghana Statistical Service	AW 15-49	4,562	1,302 Men 15-59	CA, MA
Kenya	Feb-Aug 1993	National Council for Population and Development	AW 15-49	7,540	2,336 Men 15-54	AIDS, CA, MA, SAI
Madagascar	Sep-Dec 1997	Institut National de la Statistique, Direction de la Démographie et des Statistiques Sociales	AW 15-49	7,060		AIDS, CA, MA
Malawi (KAP)[a]	Jun-Oct 1996	National Statistical Office	AW 15-49	2,683	2,658 Men 15-54	AIDS
Mali	Nov-Apr 1995/96	CPS/MSSPA et DNSI	AW 15-49	9,704	2,474 Men 15-59	AIDS, CA, MA, MM, SAI
Mozambique	Mar-Jul 1997	Instituto Nacional de Estatístical Ministéro de Saúde	AW 15-49	8,779	2,335 Men 15-64	CA, MA, MM, SAI
Senegal (Interim)	Jan-Apr 1997	Division de Statistiques Démographiques, Direction de la Prévision et de la Statistique	AW 15-49	8,593	4,306 Men 20+	AIDS
Tanzania (KAP)[a]	Jul-Sep 1994	Bureau of Statistics, Planning Commission	AW 15-49	4,225	2,097 Men 15-59	AIDS, PC
Tanzania (In-depth)	Jun-Oct 1995	Bureau of Statistics, Planning Commission	AW 15-49	2,130		Adult and childhood mortality estimation
Tanzania	Jul-Nov 1996	Bureau of Statistics, Planning Commission	AW 15-49	8,120	2,256 Men 15-59	AIDS, CA, MA, MM
Uganda	Mar-Aug 1995	Statistics Department, Ministry of Finance and Economic Planning	AW 15-49	7,070	1,996 Men 15-59	AIDS, CA, MA, MM, SAI
Uganda (In-depth)	Oct-Jan 1995/96	Institute of Statistics and Applied Economics, Makerere University	AW 20-44	1,750	1,356 Partners	Negotiating reproductive outcomes
Zambia	Jul-Jan 1996/97	Central Statistics Office	AW 15-49	8,021	1,849 Men 15-59	AIDS, CA, MA, MM
Zimbabwe	Jul-Nov 1994	Central Statistical Office	AW 15-49	6,128	2,141 Men 15-54	AIDS, CA, MA, MM, PC, SAI
NEAR EAST/NORTH AFRICA						
DHS-I						
Egypt	Oct-Jan 1988/89	National Population Council	EMW 15-49	8,911		CA, CD, MM, PC, SAI, WE, WS
Morocco	May-Jul 1987	Ministère de la Santé Publique	EMW 15-49	5,982		CA, CD, S
Tunisia	Jun-Oct 1988	Office National de la Famille et de la Population	EMW 15-49	4,184		CA, S, SAI
DHS-II						
Egypt	Nov-Dec 1992	National Population Council	EMW 15-49	9,864	2,466 Husbands	CA, MA, PC, SM
Jordan	Oct-Dec 1990	Department of Statistics, Ministry of Health	EMW 15-49	6,461		CA, SAI
Morocco	Jan-Apr 1992	Ministère de la Santé Publique	AW 15-49	9,256	1,336 Men 20-70	CA, MA, MM, SAI
Yemen	Nov-Jan 1991/92	Central Statistical Organization	EMW 15-49	5,687		CA, CD, SAI

DHS-III						
Egypt	Nov-Jan 1995/96	National Population Council	EMW 15-49	14,779		CA, FC, MA, WS
Jordan	Jun-Oct 1997	Department of Statistics	EMW 15-49	5,548		AIDS, CA, MA, MM
Morocco (Panel)	Apr-May 1995	Ministère de la Santé Publique	AW 15-49	4,753		
ASIA						
DHS-I						
Indonesia	Sep-Dec 1987	Central Bureau of Statistics, National Family Planning Coordinating Board	EMW 15-49	11,884		PC, SM
Nepal (In-depth)	Feb-Apr 1987	New Era	CMW 15-49	1,623		KAP-gap survey
Sri Lanka	Jan-Mar 1987	Department of Census and Statistics, Ministry of Plan Implementation	EMW 15-49	5,865		CA, NFP
Thailand	Mar-Jun 1987	Institute of Population Studies Chulalongkorn University	EMW 15-49	6,775		CA, S, SAI
DHS-II						
Indonesia	May-Jul 1991	Central Bureau of Statistics, NFPCB/MOH	EMW 15-49	22,909		PC, SM
Pakistan	Dec-May 1990/91	National Institute of Population Studies	EMW 15-49	6,611	1,354 Husbands	CA
DHS-III						
Bangladesh	Nov-Mar 1993/94	Mitra & Associates/NIPORT	EMW 10-49	9,640	3,284 Husbands	PC, SAI, SM
Bangladesh	Nov-Mar 1996/97	Mitra & Associates/NIPORT	EMW 10-49	9,127	3,346 EMM	CA, MA, SM
Indonesia	Jul-Nov 1994	Central Bureau of Statistics/ NFPCB/MOH	EMW 15-49	28,168		MM, PC, SAI, SM
Kazakstan	May-Aug 1995	Institute of Nutrition, National Academy of Sciences	AW 15-49	3,771		CA, MA
Kyrgyz Republic	Aug-Nov 1997	Institue of Obstetrics and Pediatrics	AW 15-49	3,848		CA, MA, anemia testing
Nepal	Jan-Jun 1996	Ministry of Health/New ERA	EMW 15-49	8,429		CA, MA, MM
Philippines	Apr-Jun 1993	National Statistics Office	AW 15-49	15,029		MM, SAI
Turkey	Aug-Oct 1993	General Directorate of MCH/FP Ministry of Health	EMW <50	6,519		CA, MA
Uzbekistan	Jun-Oct 1996	Research Institute of Obstetrics and Gynecology	AW 15-49	4,415		CA, MA
LATIN AMERICA/CARIBBEAN						
DHS-I						
Bolivia	Feb-Jul 1989	Instituto Nacional de Estadística	AW 15-49	7,923		CA, CD, MM, PC, S, WE
Bolivia (In-depth)	Feb-Jul 1989	Instituto Nacional de Estadística	AW 15-49	7,923		Health
Brazil	May-Aug 1986	Sociedade Civil Bem-Estar Familiar no Brasil	AW 15-44	5,892		CA, S, SM, abortion, young adult use of contraception
Colombia	Oct-Dec 1986	Corporación Centro Regional de Población, Ministerio de Salud	AW 15-49	5,329		CA, PC, S, SAI, SM
Dominican Republic	Sep-Dec 1986	Consejo Nacional de Población y Familia	AW 15-49	7,649		CA, NFP, S, SAI, family planning communication

Dominican Republic (Experimental)	Sep-Dec 1986	Consejo Nacional de Población y Familia	AW 15-49	3,885		S, SAI
Ecuador	Jan-Mar 1987	Centro de Estudios de Población y Paternidad Responsable	AW 15-49	4,713		CD, SAI, employment
El Salvador	May-Jun 1985	Asociación Demográfica Salvadoreña	AW 15-49	5,207		CA, S, TBH
Guatemala	Oct-Dec 1987	Instituto de Nutrición de Centro América y Panamá	AW 15-44	5,160		CA, S, SAI
Mexico	Feb-May 1987	Dirección General de Planificación Familiar, Secretaría de Salud	AW 15-49	9,310		NFP, S, employment
Peru	Sep-Dec 1986	Instituto Nacional de Estadística	AW 15-49	4,999		NFP, employment,
Peru (Experimental)	Sep-Dec 1986	Instituto Nacional de Estadística	AW 15-49	2,534		
Trinidad and Tobago	May-Aug 1987	Family Planning Association of Trinidad and Tobago	AW 15-49	3,806		CA, NFP, breastfeeding
DHS-II						
Brazil (NE)	Sep-Dec 1991	Sociedade Civil Bem-Estar Familiar no Brasil	AW 15-49	6,222	1,266 Husbands	AIDS, PC
Colombia	May-Aug 1990	PROFAMILIA	AW 15-49	8,644		AIDS
Dominican Republic	Jul-Nov 1991	Instituto de Estudios de Población y Desarrollo (PROFAMILIA), Oficina Nacional de Planificación	AW 15-49	7,320		CA, MA, S, SAI
Paraguay	May-Aug 1990	Centro Paraguayo de Estudios de Población	AW 15-49	5,827		CA, SAI
Peru	Oct-Mar 1991/92	Instituto Nacional de Estadística e Informática	AW 15-49	15,882		CA, MA, MM, SAI
DHS-III						
Bolivia	Nov-May 1993/94	Instituto Nacional de Estadística	AW 15-49	8,603[b]		AIDS, CA, CD, MA, MM, S, SAI
Brazil	Mar-Jun 1996	Sociedade Civil Bem-Estar Familiar no Brasil	AW 15-49	12,612	2,949 Men 15-59	AIDS, CA, MA, MM, PC, S
Colombia	Mar-Jun 1995	PROFAMILIA	AW 15-49	11,140		AIDS, CA, MA, PC
Dominican Republic	Aug-Dec 1996	CESDEM/PROFAMILIA	AW 15-49	8,422	2,279 Men 15-64	CA, MA
Guatemala	Jun-Dec 1995	Instituto Nacional de Estadística	AW 15-49	12,403		AIDS, CA, MA, MM, S
Haiti	Jul-Jan 1994/95	Institut Haitien de l'Enfance	AW 15-49	5,356	1,610 Men 15-59	AIDS, CA, CD, MA, SAI
Peru	Aug-Nov 1996	Instituto Nacional de Estadística e Informática	AW 15-49	28,951	2,487 Men 15-59	CA, MA, MM

[a] No health or birth history section in questionnaire.
[b] Household questionnaire was administered in 26,144 households.

AIDS acquired immune deficiency syndrome
AW all women
CA child anthropometry
CD causes of death (verbal reports of symptoms)
CMW currently married women
EMW ever-married women
FC female circumcision
M migration
MA maternal anthropometry
MM maternal mortality
NFP natural family planning
PC pill compliance
S sterilization
SAI service availability information
SM social marketing
TBH truncated birth history
VC value of children
WE women's employment
WS women's status

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