THE PROXIMATE DETERMINANTS DURING THE FERTILITY TRANSITION

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INTRODUCTION

Fertility has declined very markedly in the majority of developing countries over the past thirty to forty years, and it continues to decline almost everywhere. As a result, fertility has reached very low levels in many countries. In addition, currently more than 40 per cent of the world's population lives in countries with total fertility levels lower than 2.1 children per woman, the level that, under conditions of low mortality, assures the long-term replacement of the population. The increasing number of countries with below-replacement fertility raised the question as to what are the prospects for the future fertility levels of countries with "intermediate" fertility today, that is, those where fertility is still above replacement level but is below five children per woman. Will their fertility, which continues to decline, inevitably reach levels below replacement, leading the whole world to below-replacement fertility? Or will their fertility follow sufficiently diverse paths determined by factors which remain to be identified?

Since the transition from high to low fertility is now virtually universal, it is clear that its onset does not depend on the level of development and that the path it will follow is not necessarily determined by socio-economic factors such as levels of education, female employment, or urbanization. However, there is no doubt that the so-called "proximate" determinants of fertility continue to be relevant since they represent the mechanisms through which the reduction of fertility is effected. Consequently, to assess the likelihood that countries with intermediate-fertility levels today will reach levels below replacement in the medium-term future, it is useful if not essential to consider what reaching such a goal implies in terms of changes in the proximate determinants of fertility.

This paper focuses on the implications of future below-replacement fertility levels for the evolution of the proximate determinants of fertility in the geographical regions used by the United Nations Population Division. By focusing on future levels and trends of contraceptive prevalence, abortion and marriage patterns consistent with the expectation that fertility will decline to low levels by 2050, this paper concludes that not all regions and countries with intermediate-fertility levels today are likely to reach fertility levels below replacement by mid-century. Examination of trends in the proximate determinants of fertility is made by using the FAMPLAN model. The paper also discusses different options for the formulation of assumptions on future fertility trends for the elaboration of population projections.

A. THE RECENT FERTILITY DECLINE AND ITS INTERMEDIATE DETERMINANTS

Contrary to common wisdom, the worldwide fertility decline which occurred over the past forty years was anticipated by demographers and population forecasters, as evidenced by the United Nations population projections made in the 1950s and 1960s. What was not really anticipated was its magnitude,

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the fact that developed regions would also experience sustained fertility declines after the baby booms of the 1950s ad 1960s, and that several less developed countries could reach and maintain below-replacement fertility levels by 2000.

Until the early 1960s, the world was divided into two distinct demographic groups: (*a*) the less developed countries and regions with total fertility rates above five children per woman, and (*b*) the less developed regions with an average fertility rates below 3.5 children per woman (see table 1). Forty years later (in 1995-2000), the picture is much more varied. First, out of the five regions of Africa, three still have a total fertility of about 6 children per woman or higher. In contrast, in Asia, Eastern Asia had already reached below-replacement fertility. In addition, the three regions of Latin America and South-Eastern Asia had total fertility levels ranging from 2.5 to 3 children per women; and Western and South-central Asia, Northern and Southern Africa, and Polynesia had a total fertility ranging from 3 to 4 children per woman.

In the 1960s, Eastern Asia, the Caribbean, South America, and to a certain extent South-eastern Asia, already had lower fertility levels (6 children per woman and less) than the other less developed regions. This certainly accounts for their present lower fertility (less than 3 children per woman). But their present lower fertility is also the result of the large fertility declines (at about 3 children or higher) that these regions experienced between 1960-1965 and 1995-2000. For the other regions that had similar large fertility declines, namely, Northern Africa, Southern Africa and Central America, but higher fertility in

TABLE 1. ESTIMATED TOTAL FERTILITY RATES FROM 1950-1955 TO 1995-2000, AND DECLINES BY VARIOUS PERIODS, BY SUB-REGION *

	Total fertility rate						*Variations in total fertility rate*		
Sub-region	*1950-1955*	*1960-1965*	*1970-1975*	*1980-1985*	*1990-1995*	*1995-2000*	*1950-55 1995-2000*	*1960-65 1995-2000*	*1980-85 1995-2000*
World	5.0	5.0	4.5	3.6	3.0	2.8	-2.2	-2.2	-0.7
More developed regions	2.8	2.7	2.1	1.8	1.7	1.6	-1.3	-1.1	-0.3
Less developed regions	6.2	6.0	5.4	4.1	3.4	3.1	-3.1	-2.9	-1.0
Eastern Africa	6.9	7.0	7.0	6.9	6.3	6.1	-0.8	-0.9	-0.8
Central Africa	5.9	6.0	6.3	6.6	6.5	6.4	0.5	0.4	-0.2
Northern Africa	6.8	7.1	6.3	5.5	4.1	3.6	-3.2	-3.5	-2.0
Southern Africa	6.4	6.5	5.5	4.7	3.5	3.3	-3.2	-3.2	-1.4
Western Africa	6.8	7.0	7.0	7.0	6.4	5.9	-0.9	-1.0	-1.0
Eastern Asia	5.7	5.2	4.5	2.5	1.9	1.8	-3.9	-3.4	-0.7
South-central Asia	6.1	6.0	5.6	4.8	4.0	3.6	-2.5	-2.4	-1.2
South-eastern Asia	6.0	6.1	5.5	4.2	3.2	2.8	-3.1	-3.3	-1.4
Western Asia	6.4	6.2	5.6	5.0	4.2	3.9	-2.5	-2.4	-1.1
Caribbean	5.2	5.5	4.4	3.4	2.7	2.5	-2.7	-3.0	-0.9
Central America	6.9	6.8	6.4	4.5	3.4	3.0	-3.8	-3.8	-1.5
South America	5.7	5.8	4.7	3.7	2.8	2.6	-3.1	-3.2	-1.1
Melanesia	6.3	6.2	5.8	5.1	4.8	4.4	-1.9	-1.8	-0.7
Micronesia	6.2	6.4	4.8	3.8	4.1	4.3	-1.9	-2.1	0.4
Polynesia	6.8	7.0	5.5	4.3	3.7	3.2	-3.5	-3.7	-1.1
Eastern Europe	2.9	2.4	2.2	2.1	1.6	1.3	-1.6	-1.1	-0.8
Northern Europe	2.3	2.7	2.1	1.8	1.8	1.7	-0.7	-1.1	-0.1
Southern Europe	2.7	2.7	2.5	1.8	1.4	1.3	-1.3	-1.4	-0.5
Western Europe	2.4	2.7	1.9	1.6	1.6	1.5	-0.9	-1.2	-0.1
North America	3.5	3.3	2.0	1.8	2.0	2.0	-1.5	-1.3	0.2
Australia/New Zealand	3.3	3.4	2.6	1.9	1.9	1.8	-1.5	-1.6	-0.1

Source: United Nations, 2001a: Word Population Prospects, The 2000 Revision.
*Decades during which maximum total fertility rates were observed

the 1960s, their 1995-2000 total fertility was higher at between 3.3 and 4 children per women. Western Asia and South-central Asia had a different experience. In fact, their higher 1995-2000 average fertility rates: 3.9 children per woman in Western Asia, and 3.6 in South-central Asia, are the result of both moderately high fertility in the 1960s – 6.2 and 6.1 children per women in 1960-1965 respectively, and more modest fertility declines: minus 2.4 children per woman for both regions.

To go beyond this sub-regional analysis, one has to take into consideration the diversity of the countries within each sub-region, and the varying degree of socio-economic development between countries. Using the data of the United Nations *2000 Revision* of *World Population Prospects*, (United Nations, 2001a), we can sort out according to various criteria the 187 countries (143 less developed and 44 developed countries) for which age-specific population estimates and projections are available. During 1950-1955, only five countries, all developed, had total fertility rates at or below replacement level, 128 countries had high fertility (5 children and more) and all except two were less developed (Albania and TFYR Macedonia were the exceptions), and only 54 countries were at intermediate fertility levels. Among the latter, 17 were less developed countries: five in the Caribbean (Bahamas, Cuba, Jamaica, Barbados, Puerto Rico), two in Eastern Asia (Democratic People's Republic of Korea, China, Hong Kong SAR), one in Middle Africa (Gabon), three in South America (Uruguay, Argentina, Chile), two in South-central Asia (Kazakhstan, Kyrgyzstan), and four in Western Asia (Georgia, Cyprus, Israel, Armenia). During 1960-1965, when many developing countries recorded their highest fertility levels since 1950, the number of countries with fertility levels at or below replacement level, above 5 children per woman and at intermediate levels was exactly the same, although the countries within each group had changed since some countries moved from one group to another. Three less developed countries joined the intermediate fertility group, two in the Caribbean (the Netherlands Antilles and Trinidad and Tobago) and one in South-eastern Asia (Singapore).

By 1995-2000, the situation had changed dramatically. The group of intermediate fertility countries comprised 73 developing countries plus Albania. That is, half of the less developed countries had moved from the high-fertility group to the intermediate-fertility one. Only a third of all less developed countries (49) were still experiencing high fertility[1]. In addition, one of every six less developed countries (21) was already in the group with fertility at or below replacement level, the same group that include all the developed countries with the sole exception of Albania. These developments confirm the view that reductions in fertility since 1950 are global and irreversible, tending to lead to below-replacement fertility that could eventually result in what Chesnais (2001) called a "world population implosion". Interestingly, the less developed countries with fertility at or below replacement level are located primarily in the Caribbean and Eastern Asia, although they also include other countries in Asia, such as Armenia, Cyprus, Georgia, Kazakhstan, Singapore, Sri Lanka and Thailand, and one in Africa (Mauritius). However, only 12 of the 20 less developed countries which were in the intermediate fertility group during 1960-1965 had reached a fertility at or below replacement level by 1995-2000. The eight other countries that had reached intermediate levels of fertility in 1960-1965 and had not seen their fertility drop below replacement level by 1995-2000 were Argentina, Bahamas, Chile, Israel, Jamaica, Kyrgyzstan and Uruguay, all of which had started the transition to low fertility earlier than most developing countries. Gabon, the eighth country, constitutes a special case, since its relatively moderate level of fertility in the 1960s was the result of high prevalence of sub-fecundity and sterility caused by sexually transmitted diseases which, once controlled, made way for increases in fertility. The evidence available indicates, therefore, that rapid fertility decline leading to replacement or below replacement fertility levels occurred mostly in countries of East Asia and the Caribbean. The latter and Mauritius are mainly countries with "creole-type societies" built up by immigration from Africa and Asia and experiencing in recent times significant emigration to

[1] Of the 49 countries in this "high fertility" group, 37 were in sub-Saharan Africa, four in South-Central Asia and five in Western Asia. Note also that about 20 countries of this group may be considered as predominantly Muslim countries. However, about 30 other predominantly Muslim countries belong to the other groups, mainly the "intermediate" fertility group.

North America and Europe. In addition, contrary to what one might have expected, countries such as Argentina, Chile and Uruguay, despite experiencing an early transition to low fertility and being countries of European settlement have not seen their fertility levels drop below replacement.

Let us turn now to the magnitude of the fertility decline between 1960-1965 and 1995-2000, for those less developed countries with "intermediate" fertility during the 1995-2000 period (see Annex, table 1 A). Surprisingly enough, the higher fertility decline: minus 4 children and more, is observed in very different countries, such as Tunisia -4.9, Viet Nam -4.7, Bahrain -4.5, Dominican Republic -4.4, … Algeria -4.1, Mexico -4.1, Colombia and Uzbekistan -4.0, all countries which had in the early 1960s, total fertility rates around or above 7 children per woman. It should be noted that among the countries which had similarly large fertility declines, five: China, Hong Kong SAR, Macao SAR, the Republic of Korea, and Thailand were very close to or below replacement fertility during the 1995-2000 period. At the other extreme, the more modest fertility declines within the intermediate fertility group, are observed first in South America : Argentina -0.5, Uruguay -0.5, and next, again in very different countries such as Israel -0.9, Lesotho -1.1, Nepal -1.2, … Papua New Guinea -1.7, Sudan -1.8, Haiti -1.9, Guatemala -1.9. As has already been pointed out, high declines are observed for many countries which had high fertility in the 1960s (7 children and more, such as Tunisia, Viet Nam, Bahrain, Dominican Republic, Kuwait and Algeria). However, similar large fertility declines are also observed for countries like Brazil which had a lower fertility rate in the 1960s. Some of these countries had strong population and family planning programmes, but others did not. In fact, high fertility in the 1960s did not systematically lead to large fertility declines. At the sub-regional level (see Annex, table 1 A) fertility declines appear more homogeneous in certain sub-regions than in others. For example, almost all countries experienced fertility declines above three children per woman in Northern Africa (except in Sudan), in Western Asia (except in Israel), and in Central America (except in Guatemala). By contrast, in Southern Africa, South-central Asia, South-eastern Asia, and South America, fertility declines vary greatly from one country to another (i.e. between Iran -3.8 and India -2.5, between Viet Nam -4.7 and Indonesia -2.8, between Colombia -4.0 and Argentina -0.5). Sub-regional approaches certainly remain useful in interpreting fertility levels and trends, but obviously it is not a panacea given the heterogeneity of each sub-region, and the particular history and socio-economic development of each country.

Concerning the intermediate variables, our analysis was limited to the most recent period, using on one hand the human development index and its components for 1997 (PNUD, 1999), and the 1995-2000 total fertility rates estimated by the Population Division of the United Nations on the other (United Nations, 2001a). As one would expect, the human development index for 1997 appears fairly well correlated with the 1995-2000 fertility rates. For the 167 countries for which both data were available, the linear regression yields to a R^2 of 0.75 (see table 2). Similar results are obtained when making simple regressions between the 1995-2000 fertility rates, life expectancy at birth and the adult literacy rate, two of the three components of the human development index. The correlation between the total 1995-2000 fertility rates and life expectancy at birth yields a R^2 of 0.71, and a R^2 of 0.68 with adult literacy rate. However, the correlation between the total fertility rates and the third component of the human development index, i.e. the real per capita GDP is much lower, with a R^2 of "only" 0.31. Turning now to the gender-related development index which measures the disparity in achieving human development between women and men (calculated for 143 countries), the correlation between the 1995-2000 total fertility rates and this index also appears to be high: 0.77, reflecting the fact that, at given levels of human development, the higher the disparity between men and women, the higher the total fertility rate.

However, all these associations appear much weaker when dealing separately with each of the three fertility groups: high fertility (45 countries), intermediate fertility (67 countries) and at, or below replacement fertility (55 countries). In fact, the linear regression between the total fertility rates and the human development index yields a R^2 of 0.22 for the high fertility group, a R^2 of 0.40 for the intermediate fertility group and a R^2 close to zero for the at or below replacement group. Similar results are obtained

TABLE 2. SINGLE REGRESSION RESULTS FOR TOTAL FERTILITY RATE, 1995-2000, AND HUMAN DEVELOPMENT INDEX, LIFE EXPECTANCY AT BIRTH, ADULT LITERACY RATE, REAL GDP PER CAPITA AND GENDER RELATED DEVELOPMENT INDEX, 1997, BY FERTILITY GROUP

	R² values				
Total fertility rate 1995-2000	*Human development index*	*Life expectancy At birth*	*Adult literacy rate*	*Real GDP per capita*	*Gender related development index*
All countries	0.75 (N=167)	0.71 (N=167)	0.68 (N=167)	0.31 (N=167)	0.77 (N=143)
Countries with total fertility rate equal or above 5 children per woman	0.22 (N=45)	0.08 (N=45)	0.15 (N=45)	0.06 (N=45)	0.21 (N=33)
Countries with total fertility rate above 2.1 and less than 5 children per woman	0.40 (N=67)	0.35 (N=67)	0.23 (N=67)	0.12 (N=67)	0.46 (N=58)
Countries with total fertility rate equal or less than 2.1 children per woman	0.00 (N=55)	0,01 (N=55)	0.09 (N=55)	0.01 (N=55)	0,00 (N=52)

Sources: 1) United Nations, 2001a: Word Population Prospects, The 2000 Revision; 2) PNUD, Programme des Nations Unies pour le Développement (1999). Rapport mondial sur le développement humain

when making regressions between the total fertility rates and the three components of the human development index and the gender related development index. For the group of high fertility countries andthe at or below replacement group, the R^2 obtained are quite low. Those obtained for the intermediate fertility group are a bit higher, but they suggest, at best, a weak relationship between fertility levels and each of the variables considered.

In our opinion, these results suggest that the well established and accepted relationship between socio-economic development and fertility levels can still be used to explain a country's fertility differentials and the overall fertility transition. However this framework is not really appropriate to explain what is happening after the onset of the fertility transition and before the post-transition period, and it appears inappropriate to explain post transitional fertility differentials. An illustration of these statements is provided by figures 1 and 2 which present the relationships between total fertility rates in one hand and life expectancy at birth and adult literacy rate for each of the three fertility groups: high, intermediate, and at or below replacement, on the other.

Figure 1. Relationship between total fertility rate and life expectancy at birth by fertility group

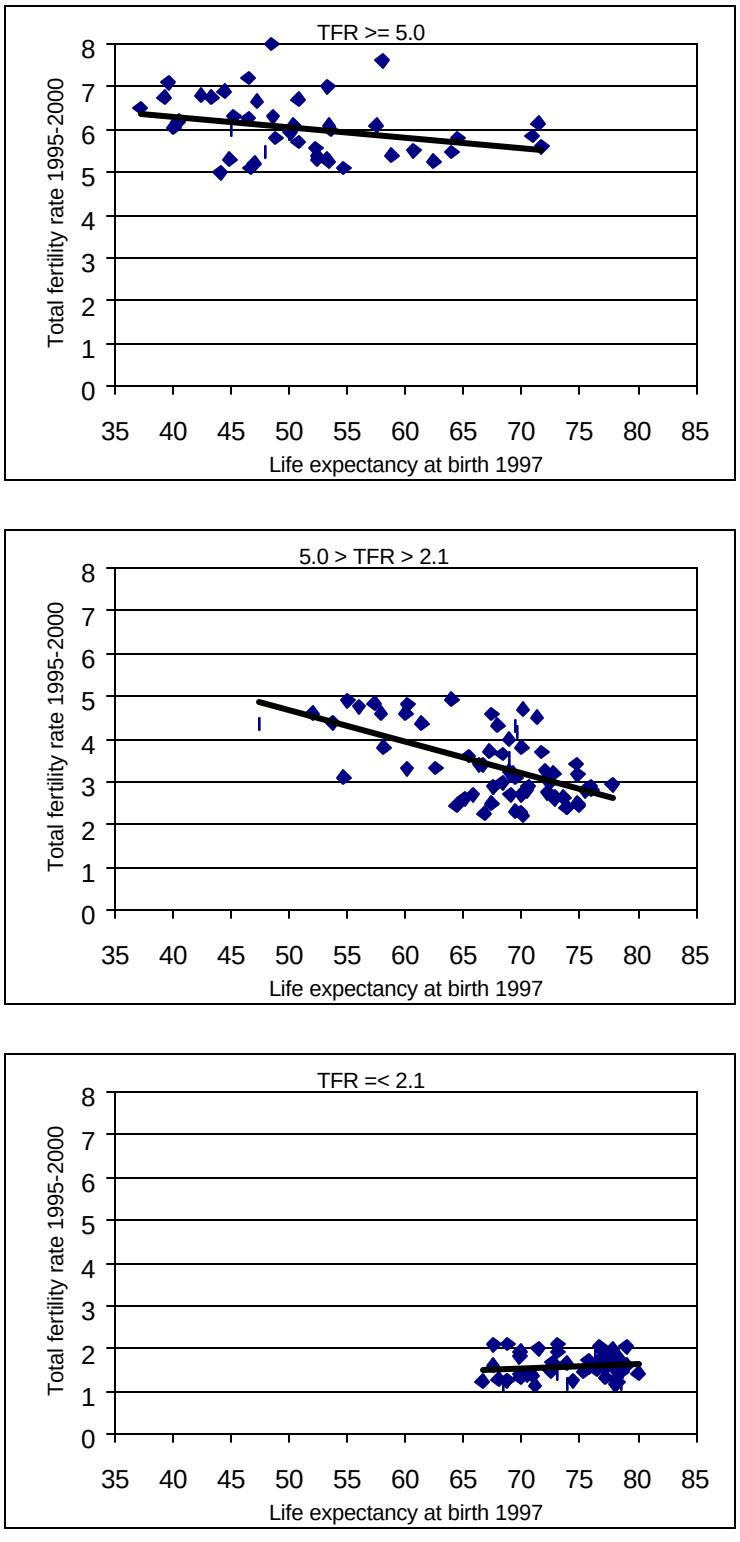
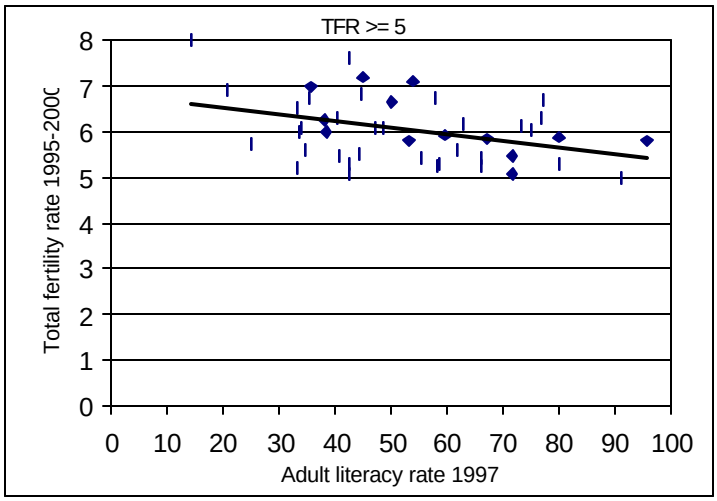
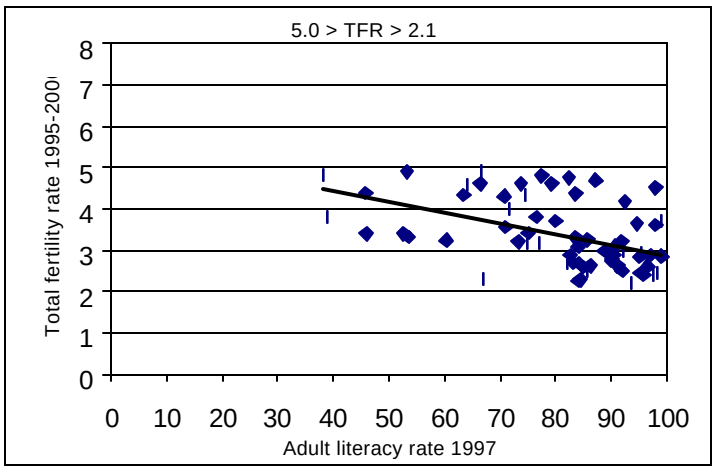
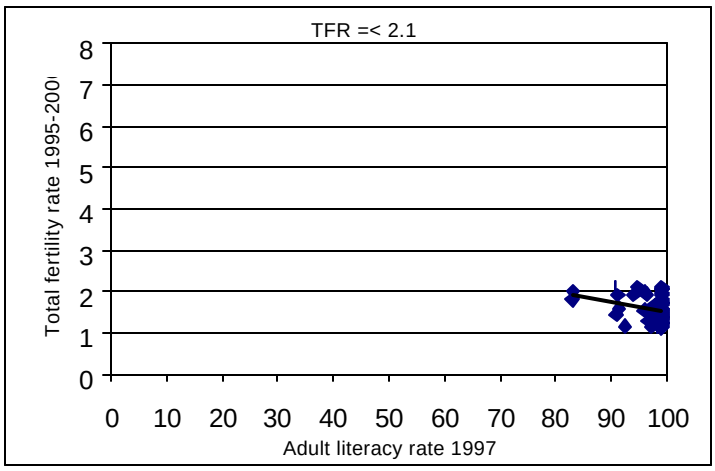


Figure 2. Relationship between total fertility rate and adult literacy rate by fertility group







Concerning first life expectancy at birth (figure 1), among the high fertility group, life expectancy at birth varies from less than 40 years (three countries: Sierra Leone, Malawi, and Uganda) to more than 70 years (three countries: Oman, Saudi Arabia, and Solomon Islands). Among the intermediate fertility group, only one country, Botswana, had in 1997 an estimated life expectancy at birth of less than 50 years, and 40 countries (almost two out three in this group) had a life expectancy at birth of between 50 and less than 70 years. Last, among the at or below replacement fertility group, only 12 countries had life expectancy at birth estimated of between 65 and 70 years and the 43 remaining countries (four out of five in this group) had life expectancy at birth of above 70 years. This indicates that, if it is difficult to envision a fertility decline for those countries with a life expectancy at birth of below 50 years, higher life expectancy at birth is not a sufficient condition to trigger fertility decline. Also, life expectancy at birth above 65 or 70 years can be associated with fertility levels above 3 children per woman.

Turning to the adult literacy rate (figure 2) among the group with high fertility, the adult literacy rate varies from less than 50 per cent in 22 countries (one out of two in this group) to more than 90 per cent in two countries (Zimbabwe and Maldives). Among the intermediate fertility group, four countries had adult literacy rates of less than 50 per cent (Nepal, Bangladesh, Haiti and Morocco), and 42 countries (two out three in this group) had an adult literacy rate of above 80 per cent (and 24 countries had an adult literacy rate of above 90 per cent). Last, among the at or below replacement fertility group, only 2 countries had adult literacy rates of below 90 per cent (China and Mauritius). This indicates that, if it is difficult to envision a fertility decline for those countries with an adult literacy rate of below 50 per cent, a higher adult literacy rate is not a sufficient condition to trigger fertility decline. Also, an adult literacy rate of above 80 or 90 per cent can be associated with fertility levels of above 3 children per woman.

Overall, the relationships between fertility levels and intermediate determinants seem to become weaker, as countries and sub-regions approach the end of their fertility transition (i.e. with total fertility rates of less than 3 children per woman). In fact, the relationship between fertility and the human development index for those countries with 1995-2000 total fertility rates below 3.5 children per woman appears quite loose ($R^2 = 0.27$), and for the countries with 1995-2000 total fertility rates below 3.0 children per woman, this relationship is even weaker ($R^2 = 0.11$).

B. THE ROLE OF THE PROXIMATE DETERMINANTS IN THE COMPLETION OF THE FERTILITY TRANSITION

Future fertility levels, especially for those countries and sub-regions with intermediate fertility and approaching the end of their fertility transition, are likely to be increasingly, the result of the interplay of the proximate determinants of fertility according to the initial values and the future evolution of these determinants (contraceptive prevalence, marriage patterns, duration of breastfeeding associated with the length of post partum insusceptibility, and the level of abortions).

Since the early 1980s, the United Nations Organization makes periodic assessments of the levels and trends of contraceptive use in the world and they also calculate the contraceptive prevalence needed to reach their fertility assumptions. The latest assessment was done in 1998 and refers to the levels and trends of contraceptive use around 1993 (United Nations, 2000). Future contraceptive prevalence was calculated according to the 1998 fertility assumptions up to year 2025. In this exercise, the dependent variable is the level of contraceptive use, and it was assumed that the combined influence of marriage, postpartum insusceptibility and abortion remains constant over the projection period. This work needs to be reviewed for at least three reasons. First, given the importance of the changes made in the fertility assumptions of the 2000 Revision of the World Population Prospects, the level of contraceptive use needed to match the new assumptions has changed and should be updated. Second, contrary to what was assumed in the past, the combined impacts of marriage, postpartum insusceptibility and abortion do not necessarily compensate each

other at all stages of the fertility transition, especially at the end of the transition. Third, given the number of countries now at or below replacement fertility, the time may have come to consider fertility as a dependent variable of the proximate determinants, and to make assumptions on future contraceptive use, and on future values of the other proximate determinants, not only in terms of evaluating the commodities needed by family planning programs, but also to evaluate possible future levels of fertility.

We have tried to evaluate the impact of the proximate determinants on future levels of fertility for those sub-regions with intermediate fertility by using the FAMPLAN computer program developed by The Futures Group International (Stover & Heaton, 1999) based on the "Bongaarts model" (Bongaarts, 1978). Starting from a classic cohort-component demographic projection, FAMPLAN enables one to evaluate the relationships between total fertility rates, on one hand and the proximate determinants of fertility, as well as the average effectiveness of contraceptive use resulting from the method mix (i.e. the percentage of all users according to the method they use), on the other. For each method, effectiveness is measured by the proportion of users who do not become pregnant during one year of method use.

The projections and the analysis of the proximate determinants of fertility were run for each of the eight sub-regions with intermediate fertility, under various assumptions. Given the heterogeneity of these sub-regions, this exercise has serious limitations. However, its objective was not to produce a range of fertility assumptions for each sub-region, but simply to get a better idea of the individual and combined impacts of the various determinants, as these regions approach the end of their fertility transition. The values, by year 2000, of the various parameters used in the projections are presented in table 3. The limitations both in terms of definition and of quality of data of these parameters must be kept in mind.

In all the eight intermediate fertility sub-regions considered here, contraceptive prevalence by the year 2000 is high, i.e. at least of 50 per cent of women in union. The average effectiveness of the methods used is also high, 90 per cent at least, except in one sub-region, Western Asia. This said, the sub-regions can be divided in two groups. The first one, includes the four sub-regions with contraceptive prevalence around 50 per cent and total fertility rates above 3 children per woman. It comprises Northern Africa, Southern Africa, South-central Asia and Western Asia. The second one, comprises the four sub-regions with contraceptive prevalence around or above 60 per cent and total fertility rates between 2.5 and less than 3 children per woman: South-eastern Asia, the Caribbean, Central America and South America. Many countries belonging to the sub-regions of this second group have had strong family planning and population programmes over the past decades.

The percentage of women in union for each sub-region by the year 2000 was taken from United Nations estimates (United Nations, 1999). These data generally refer to women in union, i.e. married women, and women in consensual or common-law unions, since virtually all surveys provide data on contraceptive use among women in union. However, in societies where many unions are without cohabitation ("visiting unions" type, as they are called in the Caribbean), estimates of the women in union might not be accurate. For instance, in most countries in the Caribbean, between a quarter to about half of the unions are "visiting unions". Because of the instability or the irregularity of the relationship between the two partners, these unions are less fertile than the unions with cohabitation, in the absence of contraception. For this reason, it has been suggested that when calculating the value of the index of marriage in the Bongaarts model, these unstable unions be counted as half of a stable union (see examples in Guengant, 1996). It remains that if available data do not include all unstable unions, the lowering impact of marriage on fertility is overestimated (with a Cm Bongaarts index lower than it should be). If all unstable unions are well accounted for, but considered as stable unions, the lowering impact of marriage on fertility is underestimated (with a Cm Bongaarts index higher than it should be). Beyond the accuracy of the data, it should be clear that a high proportion of unstable unions may have an important negative effect on fertility, as demonstrated by previous analyses on Caribbean countries (Guengant, 1996). For instance, the Cm index found in the 1980s for the Dominican Republic, Trinidad and Tobago, Jamaica and Barbados, were quite low (between 0.50 and 0.56)

TABLE 3. PARAMETERS USED FOR RUNNING THE FAMPLAN MODEL

Sub-region	*Northern Africa*	*Southern Africa*	*South-central Asia*	*South-eastern Asia*	*Western Asia*	*Caribbean*	*Central America*	*South America*
Total fertility rate, 2000	3.35	3.16	3.41	2.67	3.71	2.45	2.90	2.49
Contraceptive prevalence rate, 2000								
Any Method	51	53	51	60	50	59	67	72
- Modern method	47	51	44	52	30	54	58	62
Method mix, 2000, Effectiveness								
- Sterilization (female) ……(1.00)	5	16	53	13	6	39	40	43
- Sterilization (male)……(1.00)	0	3	7	2	0	1	2	3
- Pill……..(0.92)	44	27	9	26	13	19	14	24
- Injectable..…… (1.00)	3	38	2	21	1	3	5	3
- I U D…… (0.96)	37	11	8	21	29	22	20	6
- Condom..……..… (0.81)	2	2	7	3	9	7	6	6
- Vaginal barrier method……. (0.81)	0	0	0	0	2	1	0	1
- Traditional and folk method (0.50)	9	3	14	14	40	8	13	14
Total……...	100	100	100	100	100	100	100	100
Average effectiveness ……	0.90	0.96	0.90	0.90	0.76	0.92	0.90	0.90
Other proximate determinants								
- Percent of women in union……	60	45	75	63	65	60	62	60
- Estimate of Postpartum insusceptibility (in months)	8	12	12	9	9	6	9	7
- Total abortion rate..	0	0	0	0	0	0	0	0
- Sterility (percent).	3	3	3	3	3	3	3	3

Sources (adapted from): 1) United Nations, Word Population Prospects: The 2000 Revision, 2001; 2) United Nations, Levels and Trends of Contraceptive Use As Assessed in 1998, ESA/P/WP.155, New York: United Nations, 1999 ; and 3) Stover, John and Laura Heaton (1999). FAMPLAN: Version 4. A Computer Program for Projecting Family Planning Requirements. Spectrum System of Policy Models. Washington, DC: The Futures Group International, The POLICY Project.

and this explains to a large extent the intermediate fertility of these countries (ranging from 3.8 in the Dominican Republic for the 1981-1986 period, to 2.2 in Barbados for 1980-1981). The same is true for Southern African countries. In Botswana, for example, an other extreme case, the Cm index, when adjusted for births occurring outside unions (corresponding to unstable unions) stands at a low 0.46, against 0.87 when just using married women data (Foote and others, 1993). Overall, this means that, the use of published percentages of women in union for the Caribbean and Southern Africa when running FAMPLAN may lead to results that are difficult to interpret. This also means that for the other sub-regions, any evolution from stable unions to less stable ones is likely to have a negative impact on fertility.

Concerning postpartum insusceptibility, the initial values adopted were drawn from a recent review of available data (Ross and others, 1999). According to this source which presents data from 51 surveys undertaken mainly in the 1990s, postpartum insusceptibility remains "high" : 20 months and more in sub-Saharan African countries with total fertility rates still above 5 children per woman. However, high values are also found in some countries with intermediate fertility during the 1995-2000 period: 18 months in Ghana (4,6 children per woman), and Mexico ("only" 2.8 children per woman), and 16 months in Botswana (4,4 children). Low values: 6 months, are found in countries as different as Dominican Republic (2.9 children per woman), Morocco (3.4 children per woman), Jordan (4.7children per woman) Turkey (2.7 children per woman), Brazil (2.3 children per woman). The lowest value: 5 months is given for Trinidad and Tobago, already below replacement fertility. In fact, in other Caribbean countries such as Barbados, also below replacement fertility, postpartum insusceptibility is as low as 4 months, which corresponds to a mean

duration of breastfeeding of 6 months. Finally, at the sub-regional level, the highest values: 12 months, was adopted according to available data for Southern Africa and South-central Asia. The lowest values were adopted for the Caribbean: 6 months, and South America: 7 months. These data, mean that future potential increases of fertility, due to a reduction of postpartum insusceptibility is already quite limited in certain sub-regions, whereas in others this factor can still play a role.

The same source (Ross and others, 1999) provides data on abortion for 46 countries, referring mainly to the 1990s. According to these data, total abortion rates vary from about 3 abortions per woman for Romania, Vietnam and Russia, to between two abortions and one abortion per woman in: by decreasing order, Peru, Kazakhstan, Cuba, Chile, Dominican Republic, Kyrgyzstan, Brazil, Tajikistan, Colombia, Turkmenistan, South Korea, China, and India, and last, to less than one abortion per woman in Mexico, Turkey, Singapore, Uzbekistan, Israel, Tunisia, Hong Kong and Bangladesh. Several of the less developed countries in this list had already reached below replacement fertility (Cuba, China, Singapore, Hong Kong)in 1995-2000, or had a total fertility rate of 2.5 children per woman or less (Viet Nam, Brazil, Chile and Tunisia). It should be noted, that in the former Republics of the USSR abortion is still widely used as a means of contraception. All that points out, as noted by the United Nations (United Nations, 2000), is the importance of the trade-off between abortion and contraception to control fertility during the course of the fertility transition and also in post transitional situations. In that respect it should noted that, according to the same source, total abortion rates vary in European countries roughly from 0.2 to 0.4 in Northern, Southern and Western Europe, to between one to two in Eastern European countries. In fact, it can be easily demonstrated using the Bongaarts model that, with a Cm of about 0.50, a total fertility rate of 2.1 children per woman can be achieved either with a contraceptive prevalence rate of 70 per cent, and no abortion, or with a contraceptive prevalence of 50 per cent and a total abortion rate of 2 abortion per woman. In fact, the latter scenario corresponds to the situation of Barbados in the early 1980s. According to the data from the Barbados 1980-1981 CPS survey, the total fertility rate of 2.16 children per woman, corresponded to a Cm of 0.55, a Cc of 0.5 as a result of a contraceptive prevalence rate of 52 per cent among women in union (and an average effectiveness of the methods used of 0.90), a Ca of 0.66, corresponding to an abortion rate of 1.8 abortion per woman (abortion is legal in Barbados), and a Ci of 0.86, corresponding to a mean duration of breastfeeding of about 6 months and a duration of postpartum insusceptibility of 4 months (Guengant, 1996). For all these reasons, and also because of the limitations of the data on abortion, we have chosen to set the abortion rate at zero in all sub-regions. This means that the contraceptive prevalence rate corresponding to the fertility assumptions of the 2000 Revision of the United Nations World Population Prospects, will correspond more to a combined index of contraception and abortion indices (Cc and Ca), or to situations where widespread use of family planning method limits the use of abortion to low levels (as presently occurring in Northern, Southern and Western Europe).

Last, available data on sterility (Ross and others, 1999), measured by the percentage of women who remain childless at age 45-49, appear at sub-regional level, close to what is generally observed in non pathological settings. Therefore the percentage of sterile women was set at 3 per cent, in all sub-regions.

Using these data, and keeping in mind all the limitations just described, we first attempted to evaluate the contraceptive prevalence required to reach the 2025 and the 2050 fertility levels as proposed by the 2000 revision of the United Nations World Population Prospects (medium variant) (United Nations, 2001), **provided** that all the other factors remain constant. In this case, the dependent variable is the level of contraceptive use, according to the initial method mix and the default effectiveness rates for each method, as well as the values of the other proximate determinants, which are kept constant over the entire 2000-2050 projection span.

Under these assumptions and to reach 2.3 children per woman by year 2050 in Western Asia and more or less replacement fertility in the other seven sub-regions, contraceptive use should reach a “low” 66 per cent of the women in union in the Caribbean and 68 per cent in Southern Africa, and a “high” 77

per cent of the women in union in Western Asia, Central America and South America (see table 4). The lower contraceptive rates of use obtained for Southern Africa and the Caribbean are the result of several factors: the initial high proportion of unstable unions, the higher efficiency of the method mix, and possibly use of abortion higher than in the other sub-regions. The higher levels of contraceptive use needed to reach 2.3 children per woman by 2050 for Western Asia is primarily the result of the low average efficiency of the initial method mix, and of a relatively high percentage of women in union. For Central America and South America, the high level of contraceptive use needed in 2050 to reach replacement fertility, is certainly the result of the initial association of high contraceptive use with relatively low fertility levels (less than three children per woman). This scenario is a likely reflection of a more stable union pattern and a less important use of abortion than in the Caribbean. It should be noted that according to the 2000 United Nations fertility assumptions, most of the move towards replacement fertility, and to the associated levels of contraceptive use, is supposed to take place before year 2025. As a result, average annual percentage point increases of contraceptive use between 2000 and 2025, remains relatively high for most sub-regions, given their initial high levels of contraceptive use. For these sub-regions, annual percentage point increases between 0.4 and 0.7 point within the next 25 years, are not unlikely, but it is not excluded either, that reaching replacement fertility takes longer, than what is currently forecast.

Let us consider now, the total fertility rate as a dependant variable of the various proximate determinants. In this exercise, we tried basically to replace the norm of replacement fertility, by the norm of universal use of contraceptive methods (primarily modern methods), set at 75 per cent of women in union for all sub-regions. As we have just seen, such a level of contraceptive use is close to the 77 per cent of women in union using a method, needed to reach in 2050 the medium fertility assumption of the 2000 Revision of the United Nations World Population Prospects, adopted for Western Asia, Central America and South America. It is also, the level of contraceptive use projected by the United Nations by year 2025 for Southern Europe, Western Europe, and North America. Starting from this basic assumption, additional

TABLE 4. RESULTS OF THE FAMPLAN MODEL: CONTRACEPTIVE PREVALENCE REQUIRED FOR EACH SUB-REGION TO REACH THE TOTAL FERTILITY RATES PROJECTED BY THE UNITED NATIONS UNDER THE MEDIUM VARIANT OF THE 2000 REVISION (THE METHOD MIX, THE EFFECTIVENESS RATE PER METHOD, AND THE OTHER PROXIMATE DETERMINANTS FOR EACH SUB-REGION ARE KEPT CONSTANT)

Sub-region	*Northern Africa*	*Southern Africa*	*South-central Asia*	*South-eastern Asia*	*Western Asia*	*Caribbean*	*Central America*	*South America*
Total fertility rate, 2000	3.35	3.16	3.41	2.67	3.71	2.45	2.90	2.49
Total fertility rate, 2025	2.19	2.20	2.29	2.10	2.90	2.16	2.18	2.13
Total fertility rate, 2050 UN projections 2000	2.10	2.10	2.12	2.08	2.30	2.02	2.10	2.10
Contraceptive prevalence rate, 2000 - any method	51	53	51	60	50	59	67	72
Implied contraceptive prevalence by								
2025	69	66	68	69	66	64	76	76
2050	70	68	70	70	77	66	77	77
Annual percentage point increase in contraceptive use								
2000-2025	0.7	0.5	0.7	0.4	0.6	0.2	0.4	0.2
2025-2050	0.1	0.1	0.1	0.0	0.5	0.1	0.0	0.0

assumptions were made on the other proximate determinants to produce various scenarios. The initial values entered in FAMPLAN are the same than those presented in table 3, and for the future, the various assumptions adopted are presented below (see table 5). These assumptions might be deemed somewhat simplistic or arbitrary. However, the speculative nature of the exercise must be kept in mind.

1. Contraceptive prevalence assumption

a) Increase up to "universal use" of contraceptive methods

For each sub-region, the contraceptive prevalence rate is increased gradually from the level estimated by year 2000 (see table 3), to 75 per cent of the women in union by year 2050.

In addition, for each sub-region, the initial method mix was maintained constant over the 2000-2050 period, with the same "default" effectiveness rates for each method (see table 3). This choice was made because of the already relatively high average effectiveness of the methods used, and because the method mix is the result of the particular history of the diffusion of the various contraceptive methods in each country and sub-region. For these reasons, it was deemed no necessary to change the 2000 initial method mix.

2. Postpartum insusceptibility assumptions

a) Constant duration of postpartum insusceptibility assumption:

For each sub-region, the initial mean duration of postpartum insusceptibility (see table 3) is maintained constant over the 2000-2050 period.

b) Reduced duration of postpartum insusceptibility assumption:

For each sub-region, the initial mean duration of postpartum insusceptibility is shifted gradually to 4 months by 2050, corresponding to the lowest values observed in less developed countries.

3. Percentage of women in union assumptions

a) Constant percentage of women in union assumption:

For each sub-region, the initial percentage of women in union (see table 3) is maintained constant over the 2000-2050 period.

b) Reduced percentage of women in union assumption:

For each sub-region, the initial percentage of women in union (see table 3) is shifted gradually to 50 per cent by 2050 (a percentage slightly above the 45 per cent estimated by 2000 for Southern Africa, and close to those estimated for North America, Northern Europe, Western Europe and Australia and New Zealand).

No specific assumptions were made concerning abortion. In fact was assumed that either the present level of abortion in sub-regions will remain constant and will not affect the FAMPLAN results. One can assume also, that in sub-regions where the recourse to abortion is important (and possibly growing), there will be over time, parallel to the move toward universal use of efficient contraceptive

method a reduction of the number of abortions. The assumption of an increase to contraceptive use by 75 per cent of the women in union by year 2050, is supposed to reflect this phenomenon.

The three scenarios combining these assumptions, are presented in table 5.

TABLE 5. PROJECTION VARIANTS IN TERMS OF CONTRACEPTIVE PREVALENCE, POSTPARTUM INSUSCEPTIBILITY, AND MARRIAGE

	Projections variants: variables		
Contraceptive prevalence in 2050	*Contraceptive prevalence*	*Contraceptive prevalence, and postpartum insusceptibility*	*Contraceptive prevalence, postpartum insusceptibility and marriage*
75 per cent of the women in union use a contraceptive method in 2050, according to the initial method mix	A. Impact of increase to 75 per cent in contraceptive prevalence only	B. Impact of increase to 75 per cent in contraceptive prevalence **and** reduced duration of postpartum insusceptibility to 4 months by year 2050	C. Impact of, by year 2050: **i)** increase to 75 per cent in contraceptive prevalence, **ii)** reduced duration of postpartum insusceptibility to 4 months, and **iii)** reduced percentage to 50 per cent of women in union

In this exercise, one can consider variant A, which measures only the impact of increased contraceptive prevalence to 75 per cent by 2050, as the medium variant at the 2050 horizon. Concerning the two other determinants, the reduced duration of postpartum insusceptibility to 4 months envisaged here will have a positive, although modest, impact on fertility, since the initial durations of postpartum insusceptibility for each sub-region are not really high, whereas on the contrary, the reduced percentage of women in union to 50 per cent, is likely to have an important negative impact on fertility, since the initial proportions of women in union are relatively high (except for Southern Africa where the initial value:45 per cent, is lower). For these reasons, variant B, which combines the impact of increased contraceptive prevalence to 75 per cent and the positive impact of a universal reduced duration of postpartum insusceptibility to 4 months, can be considered as the high variant, and variant C, which adds the negative impact of reduced percentage of women in union, can be considered as the low variant (except for Southern Africa).

The results obtained are presented in table 6.

Let us examine first the results obtained for year 2025. The objective of 75 per cent of the women in union by 2050, achieved trough a gradual increase from the level of contraceptive use estimated for each sub-regions in year 2000, to 75 per cent by 2050, implies a slower move to universal use of contraception than the contraceptive use needed to reach the fertility assumptions of the 2000 Revision of the United Nations World Population Prospects. As a result, the total fertility rates obtained under variant A (which only measures the impact of increased contraceptive prevalence to 75 per cent by 2050) are higher than the fertility assumptions adopted by United Nations for year 2025, for all sub-regions, except for the Caribbean. Under this scenario, the Caribbean is the only sub-region having a total fertility rate below replacement by 2025, and South-eastern Asia is the only one close to replacement fertility, with 2.2 children per woman. The other sub-regions remain above replacement fertility, especially Western Asia, South-central Asia, Northern Africa and Central America. Under variant B, which combines the impact of increased contraceptive prevalence to 75 per cent and the impact of a universal reduced duration of postpartum insusceptibility to 4 months by 2050, total fertility rates by 2025 are logically higher than under variant A, since no sub-region had such a low initial value. When the initial value of duration of postpartum insusceptibility is low, as in the case of the Caribbean and South America, the difference between the total fertility rates obtained under variant A, and variant B is slim. For the other sub-regions, the difference between the total fertility rates obtained under variant B and variant A, varies from +0.2 to

+0.5 children per woman. Under variant C, which combines the three impacts of increased contraceptive prevalence to 75 per cent, reduced duration of postpartum insusceptibility to 4 months and, reduced

TABLE 6. ESTIMATED IMPACT OF INCREASE IN CONTRACEPTIVE PREVALENCE TO 75 PER CENT BY 2050, REDUCED DURATION OF POSTPARTUM INSUSCEPTIBILITY TO 4 MONTHS BY 2050 AND REDUCED PERCENTAGE OF WOMEN IN UNION TO 50 PER CENT BY 2050, ON TOTAL FERTILITY RATES IN 2025 AND 2050, BY SUB-REGIONS

Sub-region	*Northern Africa*	*Southern Africa*	*South-central Asia*	*South-eastern Asia*	*Western Asia*	*Caribbean*	*Central America*	*South America*
Total fertility rate 2000	3.35	3.16	3.41	2.67	3.71	2.45	2.90	2.49
Contraceptive prevalence 2000	51	53	51	60	50	59	67	72
	A. Impact of increase in contraceptive prevalence to 75 per cent by 2050							
Contraceptive prevalence								
2025	63	64	63	68	63	67	71	74
2050	75	75	75	75	75	75	75	75
Total fertility rate								
2025	2.57	2.37	2.61	2.21	3.07	1.98	2.57	2.37
2050	1.80	1.58	1.81	1.75	2.43	1.51	2.24	2.25
	B. Impact of increase in contraceptive prevalence to 75 per cent by 2050 and Reduced duration of postpartum insusceptibility to 4 months by 2050							
Total fertility rate								
2025	3.03	2.73	3.00	2.43	3.38	2.06	2.83	2.52
2050	2.12	2.14	2.45	2.14	2.97	1.64	2.74	2.55
	C. Impact of increase in contraceptive prevalence to 75 per cent by 2050, Reduced duration of postpartum insusceptibility to 4 months by 2050 and, reduced percentage of women in union to 50 per cent by 2050							
Total fertility rate								
2025	2.78	2.88	2.50	2.18	2.99	1.89	2.56	2.31
2050	1.76	2.38	1.64	1.70	2.28	1.37	2.21	2.13

percentage of women in union to 50 per cent by 2050, the total fertility rates obtained for year 2025 appear quite close to those obtained under variant A (which only measures the impact of increased contraceptive prevalence) for six of the eight sub-regions. For Southern Africa and Northern Africa, total fertility rates under variant C are higher than those obtained under variant A. These results seem to confirm the hypothesis according to which the impact of reduced postpartum insusceptibility on one hand, and the impact of reduced percentage of women in union on the other, compensate each other. However, it should be pointed out that the various assumptions adopted under variant C converge at the same values for contraceptive prevalence, mean duration of postpartum insusceptibility and proportion of women in union. This is not the case in the work done by the United Nations, which uses a different methodology (United Nations, 2000). In this work, only the assumptions made for the total fertility rates are spelled out and converge at replacement fertility by year 2050, and the only dependant variable is the contraceptive prevalence rate. Also, the fact that the total fertility rates obtained under variant C are different than those obtained under variant A, for Southern and Northern Africa, points out that the compensation of the impact of reduced postpartum insusceptibility in one hand and the impact of reduced percentage of women in union on the other, should not be taken for granted any time in all contexts.

By the year 2050, variant A, yields below replacement fertility in five of the eight sub-regions considered, and results close to replacement fertility: 2.2 children par woman for Central America and South America, and to 2.4 children par woman for Western Asia. Under variant B, which reflects the potential increase of reduced postpartum insusceptibility on fertility (thus, which can be considered as a high variant), only one sub-region: the Caribbean falls below replacement fertility by 2050. Three sub-regions have at replacement fertility: Northern Africa, Southern Africa, and South-eastern Asia, and the four remaining sub-regions still have above replacement fertility: Western Asia,: 3 children par woman, Central America: 2.7, South America 2.6, and South-central Asia 2.5. Last, under variant C (which can be considered as a low variant), by year 2050, four sub-regions have below replacement fertility: Northern Africa, South-central Asia, South-eastern Asia, and the Caribbean. The other four sub-regions have at, or slightly above replacement fertility: Southern Africa 2.4 children par woman, Western Asia : 2.3, Central America 2.2, and South America 2.1. Of course if we have had made an additional assumption on an increase of total abortion rates to the three assumptions made under variant C, all sub-regions would have fallen below replacement fertility. However, the combination of an assumption of increased abortion, and the assumption of 75 per cent of the women in union using a contraceptive method, is probably not a valid one, since, as pointed out before, such a high level of contraceptive use is generally associated with low total abortion rates.

Despite the limitation of this exercise, the results obtained point out at least one important thing: the future is not yet written, and it is far from granted that all countries and sub-regions of the world presently with intermediate fertility, will reach rapidly below replacement fertility in the coming decades. What could be the implications of these findings for making future population projections?

C. PROJECTING TOTAL FERTILITY RATES OR THE PROXIMATE DETERMINANTS

Up to now, when preparing their population projections, the United Nations, as all population forecasters, set up their fertility assumptions without looking at the associated values of the proximate determinants. The correspondence, rather than the consistency, between the fertility assumptions and the proximate determinants, it looked at, but afterwards, and only for the implied values of the contraceptive use. It is fortunate that, with the 2000 Revision of the United Nations World Population Prospects, the "paradigm" of the 2.1 children per woman, accepted for so many decades, as the implicit ultimate childbearing goal relevant for all people of the world, has been abandoned. Yet, there is no replacement to the lost "replacement fertility" paradigm. Now, in the 2000 Revision, the medium assumption for the high fertility countries is that fertility will decline at an average pace of nearly 1 child per decade starting in 2005 or latter, which means that some of these countries will not reach replacement level by 2050. In intermediate fertility countries, fertility is assumed to reach replacement level before 2050, and last, in below replacement fertility countries, fertility is generally assumed to remain below the replacement level. All this means that if, all countries of the world are no longer supposed to converge to replacement fertility, for those countries with intermediate fertility, forecasters are still stuck with replacement fertility, because of lack of data, lack of in depth analysis, or lack of imagination.

Parallel to classic population projections, projections of contraceptive prevalence and method mix have been made on various occasions at national and international levels (Ross, Stover, and Willard, 1999). These projections, however are made primarily to estimate future numbers of contraceptive users of modern methods and the corresponding supplies. These two sets of projections have obvious different objectives and fulfill different needs of information. But is not it the time to look carefully at the proximate determinants before setting fertility assumptions ? And vice versa, that is looking at existing range of fertility assumptions when setting assumptions on future contraceptive needs ?. This does not necessarily mean that fertility assumptions in population projections, should be built on assumptions on future values of the proximate determinants, although this is not impossible. Recent population projections made for Chad, have built the high, low and medium fertility hypothesis on various assumptions on the proximate determinants,

and interestingly enough the total fertility rate arrived at for year 2025: 4.62 is quasi identical to the one of the 2000 United Nations medium fertility assumption. However, for year 2050, it differs: 3.15 children per woman with the "proximate determinants" method, against 2.23 for the United Nations (Ningam, Nodjimbatem and Guengant, 2002). In our opinion, at least the value of the proximate determinants associated with given total fertility assumptions, should be checked before setting fertility assumptions and running the population projections. Also, these values (of the proximate determinants) should be clearly spelled out, in presenting the fertility assumptions and the results of the population projections. This will help a lot to clarify what has been done, and what, we demographers, are doing.

Such an exercise, i.e. verifying the consistency of the values of the proximate determinants with given fertility assumptions should be done, not at the sub-regional level as we did in this paper, but at the country level. Hopefully, this will help to define some "typical" associations between total fertility rates and the values of the proximate determinants according to various fertility levels, using an approach similar to the one used to associate average method mix by levels of contraceptive prevalence (Stover and Heaton, 1999). Fertility levels, especially those close to, or below replacement fertility, can be associated with several combinations of values of the various proximate determinants. For example, reaching replacement fertility can be achieved through several combinations of values of the proximate determinants. In that respect, the case of Barbados, where replacement fertility was achieved through a combination of moderately high contraceptive use, large recourse to abortion, minimum length of postpartum insusceptibility, and important marriage inhibiting effect (resulting from a moderately high proportion of women in union, but with a large proportion of unstable union) is certainly only one among several other possible combinations, to reach 2.1 children per woman. This particular "proximate determinants mix", may also explain why Barbados fell afterwards below replacement fertility, probably through an increase in contraceptive prevalence and unabated recourse to abortion. Whether, in depth analysis of the variations of the values of proximate determinant during the fertility transition, but as importantly, when fertility is at, or below replacement level, will help to define models which can be used to project future fertility levels remains to be seen, but, such a work need to be done.

D. DISCUSSION

Previous assumed convergence before year 2050, of all countries of the world to 2.1 children per woman was a simple, easy to understand, assumption. However, so many countries are now below replacement fertility, and at the other extreme the fact that fertility has not started yet to decline in a number of least developed countries has forced forecasters to abandon this too simple assumption (Guengant and May, 2001). Now, the world has been divided into high, intermediate and below replacement fertility. However, the United Nations and other population projections continue to be based upon assumptions of total fertility rate, considered as an independent variable, whereas fertility is anything but a dependent variable. Is not that also too simple? To be sure, nobody knows what to do once a country has reached replacement fertility, or is below replacement fertility, as so many less developed countries did in recent years. The proximate determinants framework can help to a certain extent, to explain why, fertility levels among below replacement fertility countries, varies as much as from 1.1 to 2.1 children per woman.

Nonetheless, the difficulties associated with the use of the proximate determinants framework to explain fertility differentials between countries at intermediate or at, or below replacement levels, and to build fertility assumptions, should not be overlooked. The first difficulty is the question of convergence. Are convergence hypotheses, as a result of globalization, universal education, large access to mass media and global messages anywhere in the world, realistic ones? The previous convergence assumption to 2.1 children in all countries of the world has proven to be wrong. Are convergence assumptions towards universal use of contraception, set up at 75 per cent of the women in union, reduced duration of postpartum insusceptibility to 4 months, reduced percentage of women in union, set up at 50 per cent, and

marginal recourse to abortion by 2050, more realistic assumptions? Probably not. But using these assumptions has the advantage of identifying some of the well-known determinants of fertility. Also, so far, the proximate determinants framework has proven to be robust enough, to be used in large variety of contexts.

The other difficulties associated with the use of the proximate determinants framework relate to each determinant. Let us start with union patterns. Union patterns are the result of complex social processes and the difficulty here relates to the evolution of both the proportion of women in union, and of the type of unions. Proportion of women in union varies greatly from one country to another and over time, and is very difficult to project. Making assumptions on future types of union will certainly prove to be even more difficult, although the proportion of unstable unions is likely to have important effect on fertility, as important as the total proportion of women in union. In many societies of different cultural backgrounds (in Europe, in sub-Saharan Africa) informal types of unions (common law and visiting union types) seem to have gained importance recently. As explained before, growing importance of unstable type of unions, will have - provided that all the other factors remain constant - a depressing effect on fertility. But such an evolution, is also likely to affect the timing of childbearing, and the number of desired children. In societies, where these types of union are traditionally well accepted, this will not necessarily affect further negatively the number of desired children. By contrast in societies where a stigma is attached to these informal types of relationships, any increase of the number and proportion of unstable unions is likely to affect fertility negatively.

Concerning the use of modern contraceptive methods, future contraceptive use of various methods, will depend in part on the availability of the methods. Lack or severe limitation to certain groups (for unmarried teenagers for instance) is likely to increase the will to recourse to abortion. However, in the majority of less developed countries with intermediate fertility, abortion is illegal, and the costs and conditions under which illegal abortions are performed are serious limitations to this option. As a result, the trade-off between contraception and abortion will work differently depending on the countries, and the impact on fertility will vary accordingly. Last, the method mix, should not be a major problem for most of the intermediate fertility countries. High levels of contraceptive use have been achieved in several countries through high proportion of sterilization. The shift to reversible methods will not necessarily affect the average method mix effectiveness, in particular if the newly adopted reversible methods are highly efficient, such as the injectables.

Last, one may accept that the mean duration of postpartum insusceptibility is likely to decrease. It remains that it is difficult to predict the extent and the pace of this decrease. The assumption made in this paper of a mean duration of postpartum insusceptibility decreasing to 4 months in all countries, will not necessarily materialize. However, one may assume that as countries will approach replacement fertility, this factor is likely to have less importance. This means that when countries approach replacement fertility, for those countries where contraceptive prevalence is already high, the main proximate determinant of fertility is likely to be marriage (proportion of women in union, and types of unions). If replacement fertility has been achieved with a relatively modest contraceptive prevalence, the main proximate determinant of fertility might be abortion, associated with various impact of marriage patterns.

E. CONCLUSION

Recent opinions on the rapid fertility declines observed in most countries of the world and future prospects fall into three categories. The first envisions the continuation of those declines everywhere and a global and irreversible trend toward below-replacement fertility (Chesnais, 2001). According to this view, after the population explosion of the twentieth century, mankind could progressively experience population implosion. A second view, presents the world as divided into two groups. The first group consists of the countries, both developed and developing, with below-replacement fertility or likely to

attain it in the medium-term future, and the second consists of the least developed countries, most of them in sub-Saharan Africa, whose fertility remains high (Caldwell, 2002). According to this view, tomorrow's challenges will be to cope with ageing and possible population declines in most countries of the world, and at the same time to maintain favourable attitudes, policies and assistance to programmes aimed at reducing fertility in countries where population growth continues to be high. Lastly, one can consider the 2000 *Revision* of the *World Population Prospects* of the United Nations, as a third and more pragmatic approach to future fertility trends. According to the medium fertility assumptions made in the *Revision*, by 2050 the world could still be divided into three groups. First, the group of countries where fertility could be around or above 2.5 children per women (Eastern Africa, Middle Africa, Western Africa and Western Asia). Second, the group of countries where fertility could be at replacement level (South-central and South-eastern Asia, Northern and Southern Africa, Central and South America, Melanesia, Micronesia, and Northern America). Thirds, the group of countries where fertility could be below replacement (Australia/New Zealand, the Caribbean, Eastern Asia, and all regions of Europe).

"Visions" about mankind's future and population dynamics can be stimulating and remain welcome. However, the future is not yet written and its realization depends on many factors, some of which are not even envisioned today. Populations projections are needed to have some sense of the challenges ahead. Pragmatically, the provide some sense of how many children will need to be immunised or educated, how many people will need food or employment, etc. As more and more countries progress to the later stages of the transition to low fertility, demographers seem reluctant to abandon the stationary population and replacement-level fertility as the goal. They also seem not to be ready to admit that populations projections are not as robust as they had appeared and that, as fertility increasingly falls in the realm of control and choice by couples and individuals, it will become considerably more volatile than in the past. The time has come to recognize all these changes and to address the challenges posed by them.

At the global level, population projections and the corresponding assumptions on fertility, mortality (and on the impact of AIDS on mortality) and on international migration, should be presented and explained more thoroughly than at present. In particular, the implications of assumed future fertility trends in terms of the proximate determinants of fertility could be explored and documented. All in all, demographers should be more modest in expressing views on the future of population and should reinforce the work of analysis and monitoring. They should also learn to think about a more diverse world, where at any given time countries will be at quite different stages of the demographic transition.

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ANNEXE

TABLE 1 A. DECREASES OF TOTAL FERTILITY RATES BETWEEN 1960-1965 AND 1995-2000, AND TOTAL FERTILITY RATES 1960-1965 AND 1995-2000, BY COUNTRY AND SUB-REGION

Country	*Variations in total fertility rate 1960-1965 1995-2000*	*Total fertility rate*	
		1960-1965	*1995-2000*
Tunisia	-4.9	7.3	2.3
Viet Nam	-4.7	7.2	2.5
Bahrain	-4.5	7.2	2.6
Dominican Republic	-4.4	7.3	2.9
Kuwait	-4.4	7.3	2.9
Suriname	-4.4	6.6	2.2
Algeria	-4.1	7.4	3.3
Costa Rica	-4.1	7.0	2.8
Saint Lucia	-4.1	6.8	2.7
Mexico	-4.1	6.8	2.8
Lebanon	-4.1	6.4	2.3
Colombia	-4.0	6.8	2.8
Uzbekistan	-4.0	6.8	2.9
Brunei Darussalam	-3.9	6.7	2.8
French Polynesia	-3.9	6.5	2.6
Brazil	-3.9	6.2	2.3
Peru	-3.9	6.9	3.0
Iran (Islamic Republic of)	-3.8	7.0	3.2
Morocco	-3.8	7.2	3.4
Guyana	-3.7	6.2	2.5
United Arab Emirates	-3.7	6.9	3.2
El Salvador	-3.7	6.9	3.2
Venezuela	-3.7	6.7	3.0
Egypt	-3.7	7.1	3.4
Ecuador	-3.6	6.7	3.1
Kenya	-3.5	8.1	4.6
Turkey	-3.5	6.2	2.7
Malaysia	-3.5	6.7	3.3
Syrian Arab Republic	-3.5	7.5	4.0
Cape Verde	-3.4	7.0	3.6
South Africa	-3.4	6.5	3.1
Libyan Arab Jamahiriya	-3.4	7.2	3.8
Reunion	-3.4	5.7	2.3
Jordan	-3.3	8.0	4.7
Mongolia	-3.3	6.0	2.7
Bangladesh	-3.3	7.1	3.8
Panama	-3.3	5.9	2.6
Qatar	-3.3	7.0	3.7
Philippines	-3.2	6.9	3.6
Turkmenistan	-3.2	6.8	3.6
Jamaica	-3.1	5.6	2.5
Honduras	-3.1	7.4	4.3
Belize	-3.0	6.5	3.4
Nicaragua	-3.0	7.3	4.3
Chile	-2.8	5.3	2.4
Indonesia	-2.8	5.4	2.6
Samoa	-2.8	7.3	4.5

Sub-region and country	*Variations in total fertility rate 1960-1965 1995-2000*	*Total fertility rate*	
		1960-1965	*1995-2000*
EASTERN AFRICA			
Kenya	-3.5	8.1	4.6
Reunion	-3.4	5.7	2.3
NORTHERN AFRICA			
Tunisia	-4.9	7.3	2.3
Algeria	-4.1	7.4	3.3
Morocco	-3.8	7.2	3.4
Egypt	-3.7	7.1	3.4
Libyan Arab Jamahiriya	-3.4	7.2	3.8
Western Sahara	-2.1	6.5	4.4
Sudan	-1.8	6.7	4.9
SOUTHERN AFRICA			
South Africa	-3.4	6.5	3.1
Botswana	-2.6	6.9	4.4
Swaziland	-1.7	6.5	4.8
Lesotho	-1.1	5.8	4.8
WESTERN AFRICA			
Cape Verde	-3.4	7.0	3.6
Ghana	-2.3	6.9	4.6
EASTERN ASIA			
Mongolia	-3.3	6.0	2.7
SOUTH-CENTRAL ASIA			
Uzbekistan	-4.0	6.8	2.9
Iran (Islamic Rep. of)	-3.8	7.0	3.2
Bangladesh	-3.3	7.1	3.8
Turkmenistan	-3.2	6.8	3.6
Tajikistan	-2.6	6.3	3.7
Kyrgyzstan	-2.5	5.4	2.9
India	-2.5	5.8	3.3
Nepal	-1.2	6.1	4.8
SOUTH-EASTERN ASIA			
Viet Nam	-4.7	7.2	2.5
Brunei Darussalam	-3.9	6.7	2.8
Malaysia	-3.5	6.7	3.3
Philippines	-3.2	6.9	3.6
Indonesia	-2.8	5.4	2.6
Myanmar	-2.7	6.0	3.3
East Timor	-2.0	6.4	4.4
WESTERN ASIA			
Bahrain	-4.5	7.2	2.6
Kuwait	-4.4	7.3	2.9
Lebanon	-4.1	6.4	2.3
United Arab Emirates	-3.7	6.9	3.2
Turkey	-3.5	6.2	2.7
Syrian Arab Republic	-3.5	7.5	4.0
Jordan	-3.3	8.0	4.7
Qatar	-3.3	7.0	3.7
Israel	-0.9	3.9	2.9

TABLE 1 A. (*continued*)

Country	*Variations in total fertility rate 1960-1965 1995-2000*	*Total fertility rate*	
		1960-1965	*1995-2000*
Fiji	-2.8	6.0	3.2
New Caledonia	-2.7	5.3	2.6
Myanmar	-2.7	6.0	3.3
Tajikistan	-2.6	6.3	3.7
Botswana	-2.6	6.9	4.4
Kyrgyzstan	-2.5	5.4	2.9
India	-2.5	5.8	3.3
Vanuatu	-2.4	7.0	4.6
Paraguay	-2.4	6.6	4.2
Ghana	-2.3	6.9	4.6
Bolivia	-2.3	6.6	4.4
Western Sahara	-2.1	6.5	4.4
Bahamas	-2.1	4.5	2.4
Guam	-2.1	6.0	4.0
East Timor	-2.0	6.4	4.4
Guatemala	-1.9	6.8	4.9
Haiti	-1.9	6.3	4.4
Sudan	-1.8	6.7	4.9
Swaziland	-1.7	6.5	4.8
Papua New Guinea	-1.7	6.3	4.6
Nepal	-1.2	6.1	4.8
Lesotho	-1.1	5.8	4.8
French Guiana	-1.0	5.0	4.1
Israel	-0.9	3.9	2.9
Uruguay	-0.5	2.9	2.4
Argentina	-0.5	3.1	2.6

Sub-region and country	*Variations in total fertility rate 1960-1965 1995-2000*	*Total fertility rate*	
		1960-1965	*1995-2000*
CARIBBEAN			
Dominican Republic	-4.4	7.3	2.9
Saint Lucia	-4.1	6.8	2.7
Jamaica	-3.1	5.6	2.5
Bahamas	-2.1	4.5	2.4
Haiti	-1.9	6.3	4.4
CENTRAL AMERICA			
Costa Rica	-4.1	7.0	2.8
Mexico	-4.1	6.8	2.8
El Salvador	-3.7	6.9	3.2
Panama	-3.3	5.9	2.6
Honduras	-3.1	7.4	4.3
Belize	-3.0	6.5	3.4
Nicaragua	-3.0	7.3	4.3
Guatemala	-1.9	6.8	4.9
SOUTH AMERICA			
Suriname	-4.4	6.6	2.2
Colombia	-4.0	6.8	2.8
Brazil	-3.9	6.2	2.3
Peru	-3.9	6.9	3.0
Guyana	-3.7	6.2	2.5
Venezuela	-3.7	6.7	3.0
Ecuador	-3.6	6.7	3.1
Chile	-2.8	5.3	2.4
Paraguay	-2.4	6.6	4.2
Bolivia	-2.3	6.6	4.4
French Guiana	-1.0	5.0	4.1
Uruguay	-0.5	2.9	2.4
Argentina	-0.5	3.1	2.6
MELANESIA/MICRONESIA/POLYNESIA			
French Polynesia	-3.9	6.5	2.6
Samoa	-2.8	7.3	4.5
Fiji	-2.8	6.0	3.2
New Caledonia	-2.7	5.3	2.6
Vanuatu	-2.4	7.0	4.6
Guam	-2.1	6.0	4.0
Papua New Guinea	-1.7	6.3	4.6

Source: United Nations, 2001a: World Population Prospects, The 2000 Revision.

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