

Completing the fertility transition in the developing world: The role of educational differences and fertility preferences

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This study summarizes patterns of educational differentials in wanted and unwanted fertility at different stages of the fertility transition. The data are from Demographic and Health Surveys in 57 less developed countries. As the transition proceeds, educational differentials in wanted fertility tend to decline and differentials in unwanted fertility tend to rise. An assessment of fertility patterns in developed and less developed countries with low fertility concludes that these differentials are likely to remain substantial when less developed countries reach the end of their transitions. This conclusion implies that the educational composition of the population remains a key predictor of overall fertility in late transitional countries and that low levels of schooling can be a cause of stalling fertility.

Keywords: fertility; preferences; transition; fertility differentials; developing world

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Many less developed countries have experienced large fertility declines in recent decades. The average total fertility for the developing world in 1995–2000 is estimated at 3.1 births per woman, half the level observed in the 1950s (United Nations 2001). Fertility differences among countries are now larger than ever because transitions to replacement fertility have not yet started in some countries (e.g., in parts of West Africa) and have already been completed in others (e.g., in the economically most advanced countries of Southeast Asia). As a result, the observed total fertilities of less developed countries in 1995–2000 range from a high of 8 in Niger to a low of 1.2 in Macao. Past experience suggests that once fertility declines are underway they tend to continue, and the United Nations therefore projects that most countries will complete their fertility transitions before 2050.

Country-level fertility statistics conceal considerable differences in reproductive behaviour among socio-economic groups within countries. Fertility is usually higher in rural than in urban areas, higher among uneducated women than among their better-educated counterparts, and higher in households with low incomes (United Nations 1987; Merrick 2001). Educational differentials are among the best established and most widely studied socio-economic

differentials (Cochrane 1979; Caldwell 1982; United Nations 1987, 1995; Cleland and Rodríguez 1988; Jejeebhoy 1995; Jeffery and Basu 1996; National Research Council 1999). Much of the empirical evidence on socio-economic differentials in the developing world is based on survey data collected in programmes such as the World Fertility Survey (WFS) in the 1970s and early 1980s and the Demographic and Health Surveys (DHS) since the mid-1980s. These surveys provide extensive documentation of fertility differentials for countries in the early and mid-transitional stages, but they provide little information about how the pattern of differentials evolves toward the end of the transition. The conventional wisdom about the importance of education levels leads one to expect that educational differences in fertility will remain at the end of the transition. Some analysts, however (e.g., Jeffery and Basu 1996; Lutz and Goujon 2001; Cleland 2002), suggest that the link between schooling and fertility is a transient phenomenon that could disappear when countries approach replacement-level fertility.

This study has three objectives. The first is to summarize the pattern of fertility differentials by level of education at various stages of the transition based on data from DHS surveys in 57 less developed countries. Next, the analysis of differentials in overall

fertility is extended to differentials in the wanted and unwanted components of fertility. The final objective is to assess evidence on fertility differentials and on the wanted status of births at the end of the transition. The expectation is that the detailed description of the various dimensions of the fertility transition will be helpful in explaining the nature of the transition, in projecting future trends, and in identifying population policy options.

Data

The primary sources of data for this study are DHS surveys conducted in 57 less developed countries since 1985. In a number of countries more than one DHS survey is available. All surveys with nationally representative samples were included (except former Soviet republics, Pakistan, 1990–91, India, 1998–99, and Sri Lanka, 1987—for which estimates of wanted and unwanted fertility for standard categories of education level were not available). The surveys are as follows:

Asia: Bangladesh, Cambodia, India, Indonesia, Nepal, Philippines, Thailand, Vietnam.

Latin America: Bolivia, Brazil, Colombia, Dominican Republic, Ecuador, Guatemala, Haiti, Mexico, Nicaragua, Paraguay, Peru, Trinidad and Tobago.

Near East/North Africa: Egypt, Jordan, Morocco, Tunisia, Turkey, Yemen.

Sub-Saharan Africa: Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Comoros, Côte d'Ivoire, Eritrea, Ethiopia, Gabon, Ghana, Guinea, Kenya, Liberia, Madagascar, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sudan, Tanzania, Togo, Uganda, Zambia, Zimbabwe.

From each survey a custom tabulation with estimates of overall total fertility, wanted total fertility, and unwanted total fertility by level of education was obtained with the STAT compiler program available at the DHS website www.measuredhs.com. This source provides fertility data for three education categories—no schooling, primary (complete and incomplete), and secondary or higher—using country-specific definitions of primary and secondary schooling. Because these education categories are broad, the average years of schooling within each level varies among countries and over time. For example, women with secondary-plus education can be expected to have, on average, more schooling at the end of the fertility transition than at the beginning.

However, fertility differentials within these education groups are typically small compared with fertility differences between groups. As a result, the broadness of the educational categories is unlikely to have a significant effect on the main conclusions of this study.

The large volume of information in these tabulations is condensed in the tables and figures of this study by grouping countries by their transition stage. As summarized in Table 1, seven transition stages are defined according to the level of total fertility observed at the time of the survey. Countries with multiple surveys contribute only one observation per stage. Although there are no post-transitional countries, at least four country estimates are available for each of the other transition stages, and for the mid-transition stage 21 country estimates are available (see last column in Table 1).

Fertility by level of education

Although the relationship between fertility and level of education varies among countries and is not always linear or monotonic, women with more than primary education have substantially lower fertility than women with no education in virtually all DHS and WFS surveys (Jejeebhoy 1995; Rutstein 2003). This relationship is in part attributable to other factors such as family income, rural–urban residence, and husband's education. After controlling for such factors in multivariate analyses, the effect of wife's education remains statistically significant and it is more powerful than the effect of husband's education or the family's economic status (Jejeebhoy 1995).

The well-established cross-sectional relationship between women's education and fertility in mid-

Table 1 Ranges of total fertility assigned to stages of the fertility transition

Transition stage	Total fertility range	Number of DHS surveys
Pre	7+	4
Early	6–6.9	19
Early/mid	5–5.9	16
Mid	4–4.9	21
Mid/late	3–3.9	12
Late	2.1–2.9	7
Post	0–2.0	0

Note: Countries with multiple surveys contribute only one observation per stage.

transitional countries is consistent with different perspectives regarding the permanence of educational differentials at the end of the transition. This issue is illustrated in Figure 1, which plots two alternative model patterns for the transition of fertility by

level of education. In Model A, called the 'leader-follower' model, the decline from high to low fertility follows the same trajectory over time in each education group, with the most educated women making this transition earlier than the least educated. The less

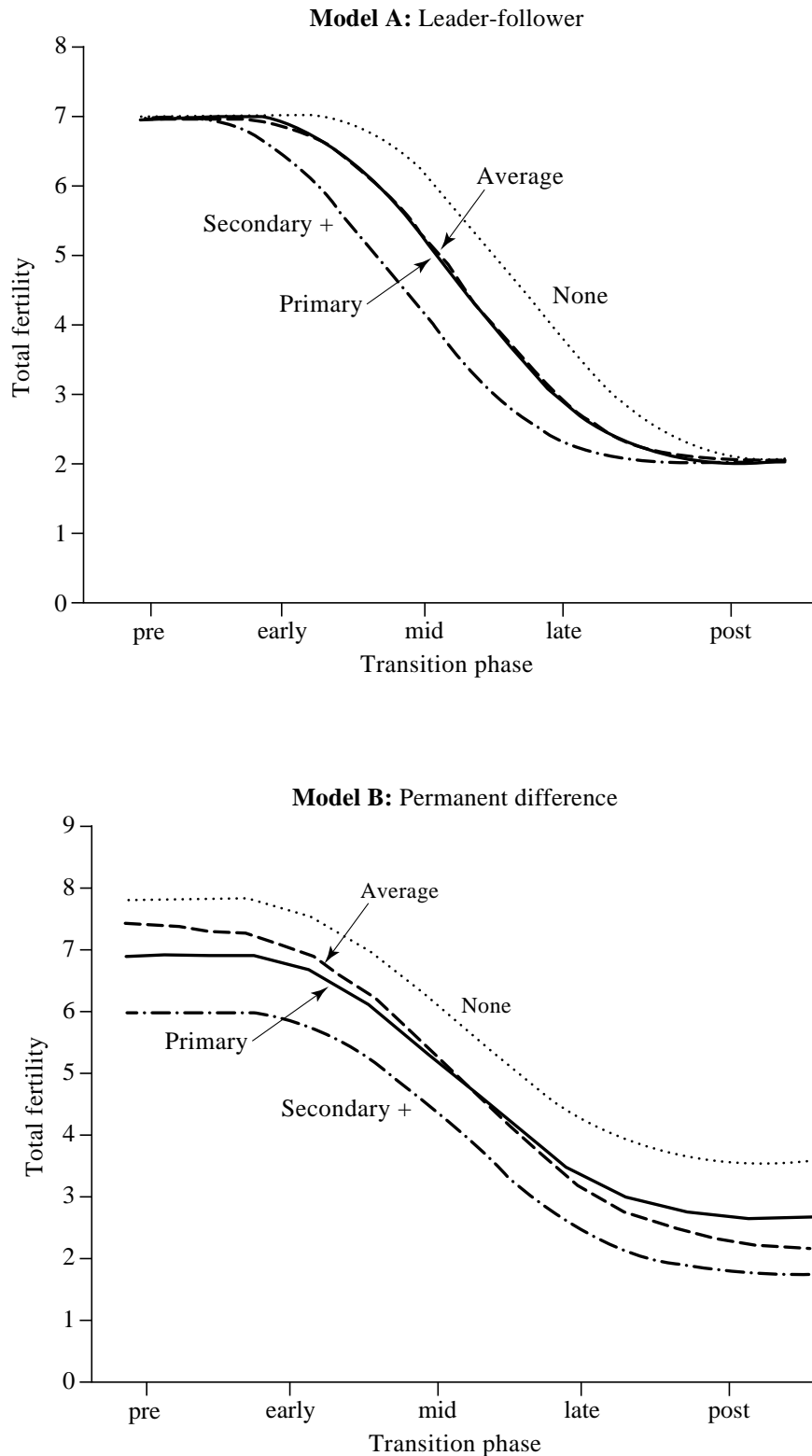


Figure 1 Model patterns for fertility transition by level of education

educated follow the pattern of the more educated with a lag. Levels of fertility at the beginning and end of the transition are the same in all education groups, but during the transition fertility is inversely associated with level of education. In this model educational differentials are considered a temporary phenomenon.

An alternative pattern for the evolution of educational differentials, plotted as Model B, may be called the 'permanent-difference' model. In this pattern differences exist at all stages of the transition, not just in middle stages.

The two models in Figure 1 also present the average total fertility for the entire population. This is a weighted average of the education-specific total fertilities, with the weights given by the size of each education group. In the earliest transition phase most women have no education. As a result, the lower fertility among the small group of women with primary or secondary-plus education has little effect on the overall total fertility, which is close to that of the group with no education. At the end of the transition a majority of women typically have more than primary education, and the average total fertility then approaches that of the highest education group. In the leader-follower model, average total fertility follows roughly the same time pattern as in each individual group. In contrast, in the permanent-difference model the average drops at a faster pace than the total fertility of any subgroup.

The differences between these two models are particularly significant in the last stages of the transition, which are the focus of this study. According to the leader-follower model the fertility of all education groups converges to the same value and, as a result, the distribution of the population by level of education has no direct effect on overall fertility. In contrast, the permanent-difference model assumes that fertility differentials remain at the end of the transition and the population's educational composition then clearly affects the average total fertility of a population. Other things being equal, average fertility in a population with little schooling will be higher than in a population in which schooling is common. Even with the permanent-difference model, however, much of the overall decline in fertility is attributable to declines of fertility within each education group rather than to an upward shift in the distribution of levels of schooling in the population.

To determine which model is more appropriate for the contemporary developing world we next summarize the empirical evidence.

Trends in educational differentials

Figure 2 presents total fertility by level of education for six illustrative countries. For each of these countries at least three observations from DHS surveys are available between 1985 and 2000. In addition, an estimate from a WFS survey in the 1970s is included to obtain a more complete picture of the fertility trend between the 1970s and the late 1990s. All six countries experienced substantial fertility declines from levels of around 7 births per woman in the early 1960s (United Nations 2001). Kenya dropped to 4.7 births per woman in 1998, Senegal to 5.7 in 1997, Bangladesh to 3.3 in 1999, Egypt to 3.5 in 2000, Colombia to 2.6 in 2000, and the Dominican Republic to 3.2 in 1996.

As shown in Figure 2, these declines in overall fertility were accompanied by declines in the fertility of all education groups. The total fertility of women with secondary-plus education is lower than that of women with no education in all six countries and at all observed points in time. Over time the difference between the highest and lowest education groups has widened slightly in Kenya, Senegal, and Bangladesh, the three countries that were pre-transitional at the time of the WFS in the 1970s. In the remaining three countries, the gap between the highest and lowest education levels narrowed over time as the total fertility of the lowest education group dropped more rapidly than that of the highest education group. However, the total fertility gap between women with no schooling and women with secondary-plus education remains substantial at the latest observation point in the late 1990s. Even in Colombia, where the overall total fertility reached 2.6 in 2000, this gap remains at 1.8 births per woman.

Cross-sectional patterns

Estimates of total fertility by level of education from surveys in 57 less developed countries are summarized in Figure 3 (for further details see Table A1). This figure provides averages for countries at each transition stage as described in Table 1. As expected, fertility is inversely related to level of education in each phase. In addition, for each education group the average total fertility is higher in pre-transitional than in late transitional countries: 7.7 vs. 4.0 for women with no schooling, 6.4 vs. 3.1 for women with primary education, and 4.3 vs. 2.1 for women with secondary-plus education. The absolute difference between the highest and lowest education groups narrows modestly with transition stage, but even for

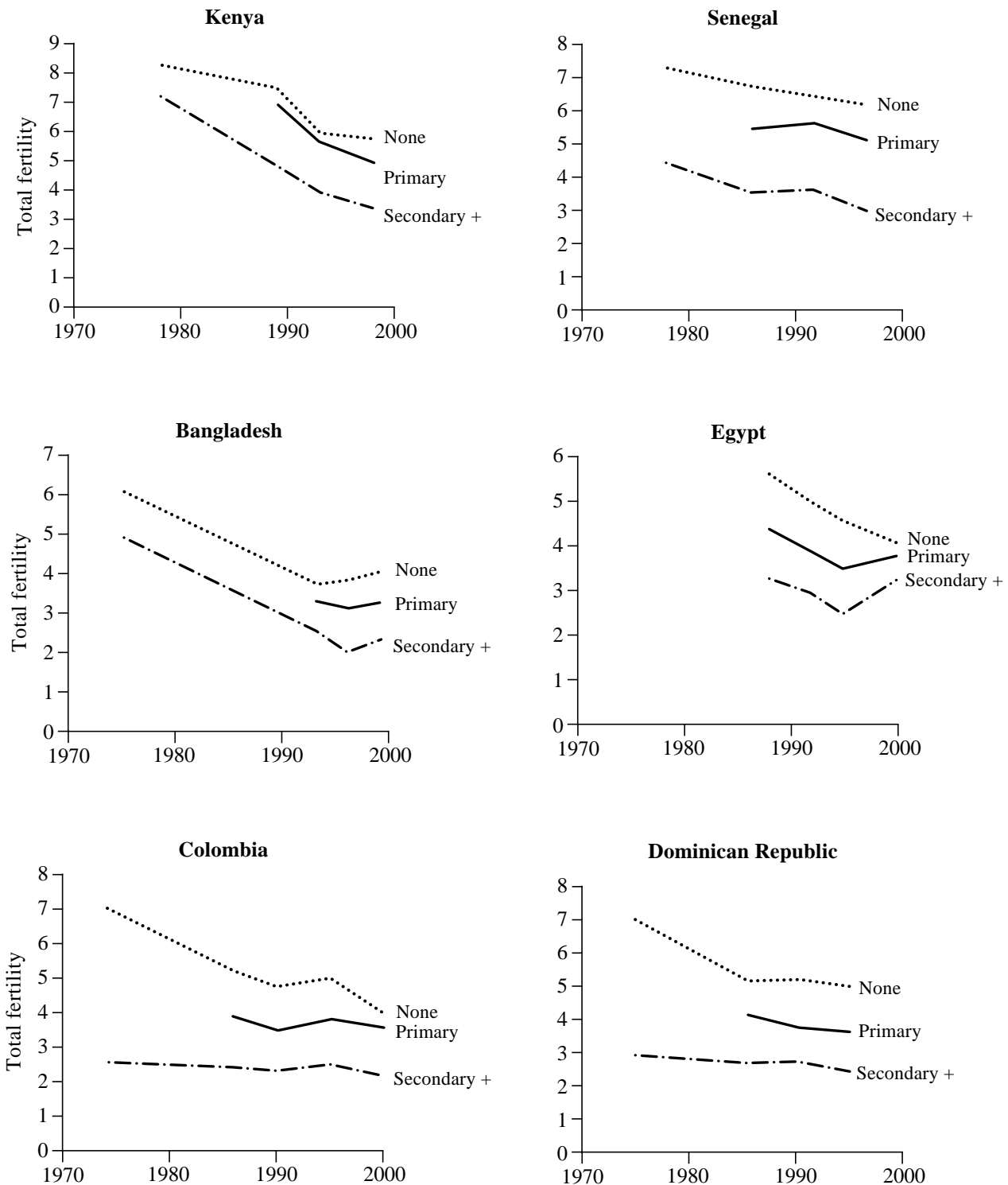


Figure 2 Trends in total fertility by level of education
Source: DHS data files

countries with overall total fertilities between 2 and 3, the differential remains a very substantial 1.9 births per woman (4.0 minus 2.1). However, both the relative difference between education groups and the ratio of the total fertilities of the highest to the lowest education group are substantially higher in the late than in the earliest transitional stages.

The empirical results summarized in Figures 2 and 3 are consistent with the findings from previous studies that have documented fertility differentials in the developing world. The possible causes of the education-fertility link have been examined in an extensive but inconclusive literature. In attempting to unravel the causal pathways, it has proved useful to

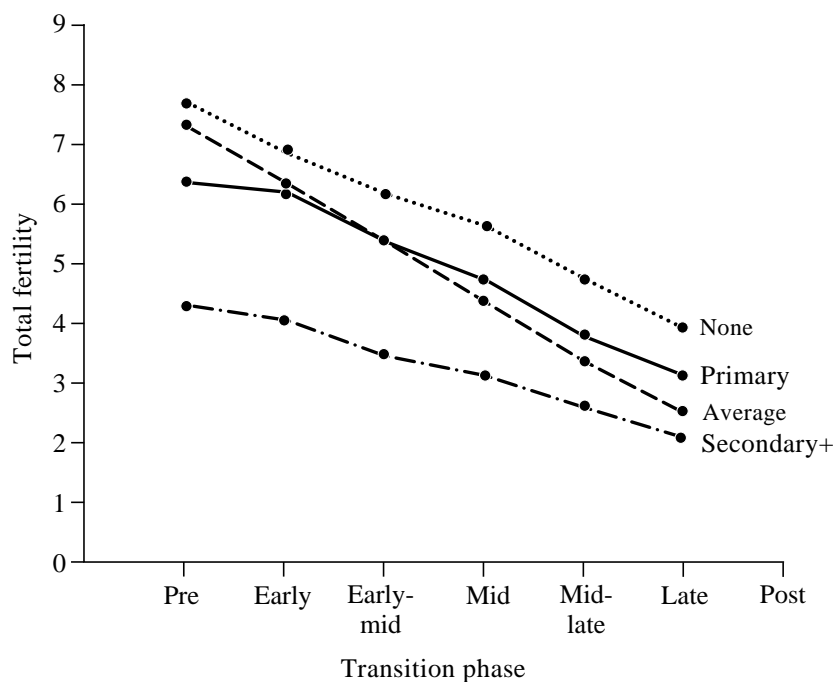


Figure 3 Total fertility by level of education: averages for 57 countries in different transition phases
Source: DHS data files

distinguish between the proximate determinants of fertility, such as marriage and the practice of contraception, and the more distant socio-economic determinants. The evidence on the former is fairly clear: the higher the level of schooling, the later the age at marriage and the more preferences are implemented by means of contraceptive use. On the other hand, there is no agreement on the socio-economic factors responsible for the inverse relationship between education and fertility. A variety of plausible explanations have been proposed, including the effect of schooling on women's autonomy, the opportunity costs of childbearing, and exposure to Western values (Cochrane 1979; Caldwell 1982; United Nations 1987, 1995; Cleland and Rodríguez 1988; Jejeebhoy 1995; Jeffery and Basu 1996; National Research Council 1999). A review of this literature by Cleland (2002) suggests that, given the complexity of these issues, researchers may never reach consensus.

We next examine the role of preferences and unwanted childbearing to shed further light on the reasons why educational differentials exist throughout the fertility transition.

Wanted and unwanted fertility

Following standard DHS practice, wanted total fertility is calculated in the same manner as the conventional total fertility, except that births are

excluded from the calculation if they occur after the mother has reached her desired family size (Bankole and Westoff 1995). Unwanted total fertility is simply the difference between overall and wanted total fertility.

Trends

Figure 4 plots trends in total fertility and its wanted and unwanted components for the same six countries that were included in Figure 2. The trend of wanted total fertility runs broadly parallel to that of total fertility, but is of course lower than the overall level. Unwanted total fertility shows no clear trend over time, although a weak inverted U-shape is suggested over the course of the fertility transition. This is clearest in Kenya, where unwanted total fertility initially rose from 0.3 to 2.2 between 1978 and 1989 but subsequently declined to 1.2 in 1998. A similar but less perceptible pattern is evident in Bangladesh and Egypt. The rise in unwanted fertility in Senegal is consistent with such a pattern because this country is still in the early stages of the transition. In Colombia, the Dominican Republic, and Egypt, unwanted fertility declined modestly over time as these countries approached the later phases of the transition, but in these three countries the early phases of the transitions were not observed because they occurred before the 1970s.

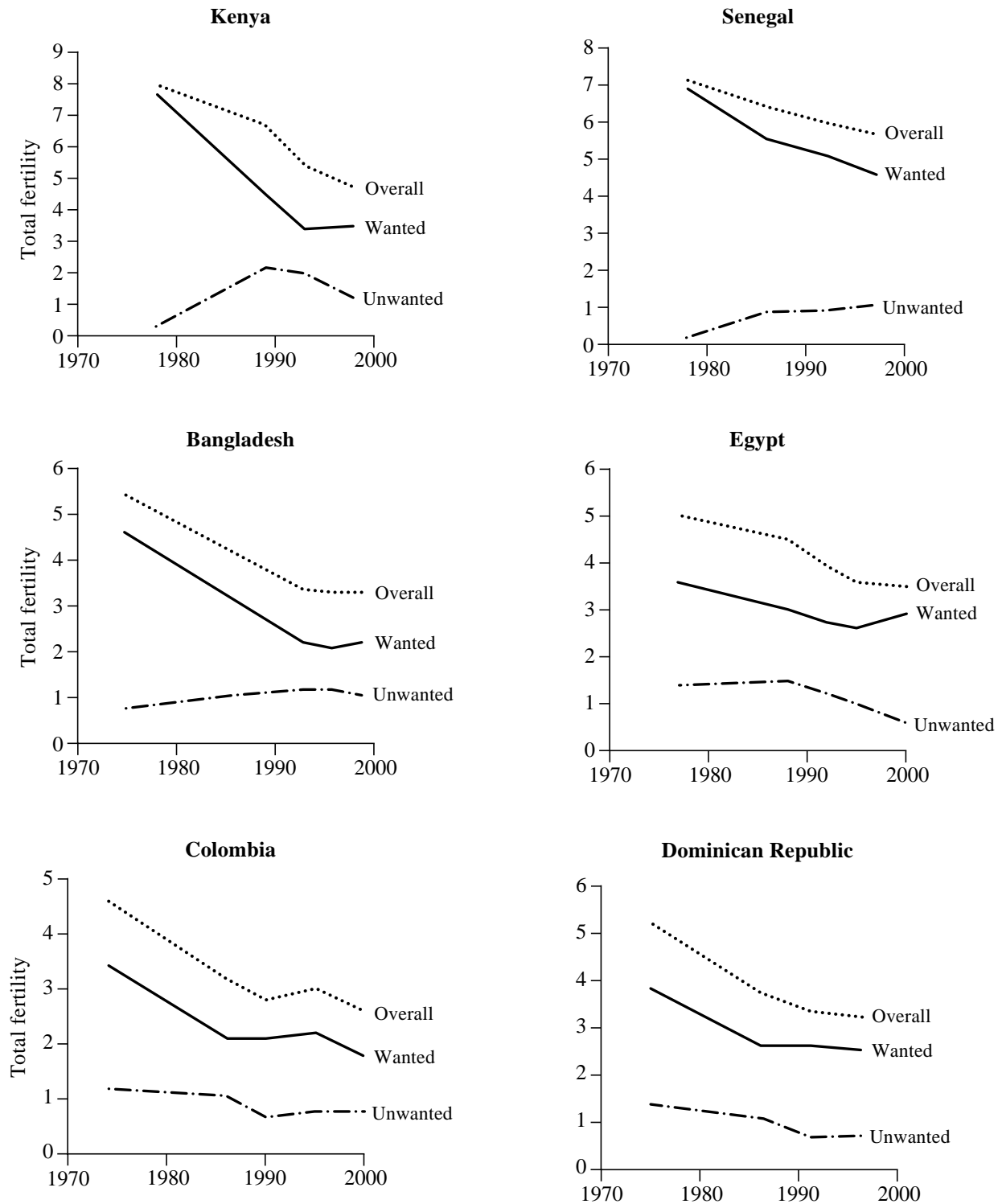


Figure 4 Trends in total fertility and its wanted and unwanted components in six illustrative countries
Source: DHS data files

Cross-sectional patterns

Figure 5 plots averages for overall total fertility and its wanted and unwanted components by transition stage, summarizing observations from surveys in 57 countries as discussed earlier. The pattern in the

unwanted fertility evident in this figure is consistent with a weak inverted U-shape suggested by the longitudinal data. For countries in the pre-transitional phase its average is 0.9 births per woman, but is higher (1.1 births per woman) in mid-transitional countries and lower (0.6 births per woman) in late

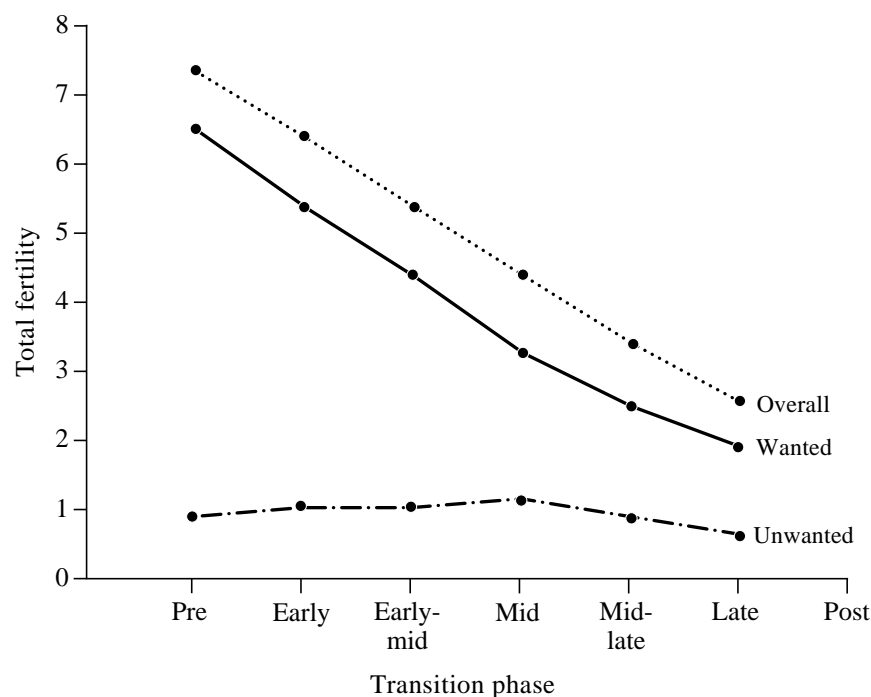


Figure 5 Total fertility and its wanted and unwanted components: averages for 57 countries in different transition phases
Source: DHS data files

transitional countries. These levels imply a more than doubling of the proportion of fertility that is unwanted, from 12 per cent (0.90/7.35) early in the transition to 25 per cent (0.63/2.54) late in the transition.

Explanation and further discussion of this pattern in unwanted fertility are provided by Bongaarts (1997). In short, unwanted fertility is low at the beginning of the transition because fertility preferences are high. Consequently, women at that stage need most of their reproductive lives after marriage to reach the large number of children they wish to have. In such settings, women who do reach their desired family size have little reproductive time left during which unwanted births can occur. Unwanted fertility is low early in the transition because there is limited exposure to the risk of unwanted childbearing. However, this exposure rises as the transition gets under way and desired family size declines. Unwanted fertility then usually rises because a significant proportion of women who want no more children do not practise effective contraception. Finally, in the latest stages of the transition the implementation of preferences (through the use of effective contraception) rises to levels sufficiently high for unwanted fertility to decline again. At the end of the transition women typically want two children on average. This implies that wanted childbearing can be completed in a few years and most women then face many years of marriage exposed to the risk of

unwanted childbearing. Even if the large majority of these women use highly effective contraception, the duration of exposure is long enough in most countries for unwanted fertility to remain substantial. This issue is discussed further in a later section of this paper.

Differentials in wanted and unwanted fertility

The preceding sections examined educational differences in fertility and the wanted and unwanted components of overall fertility. The next step is to consider separately the educational differentials in wanted and unwanted fertility.

Trends

Figure 6 plots trends in total fertility—overall, wanted, and unwanted—by level of education for the same six countries examined earlier. Only DHS observations are included because such detailed data have not been published for the WFS. The results in Figure 6 suggest two conclusions that were not evident in the earlier figures. First, both the wanted and unwanted components of fertility are inversely associated with level of education. That is, in all cases, women with secondary-plus education have lower wanted and unwanted fertility than women with

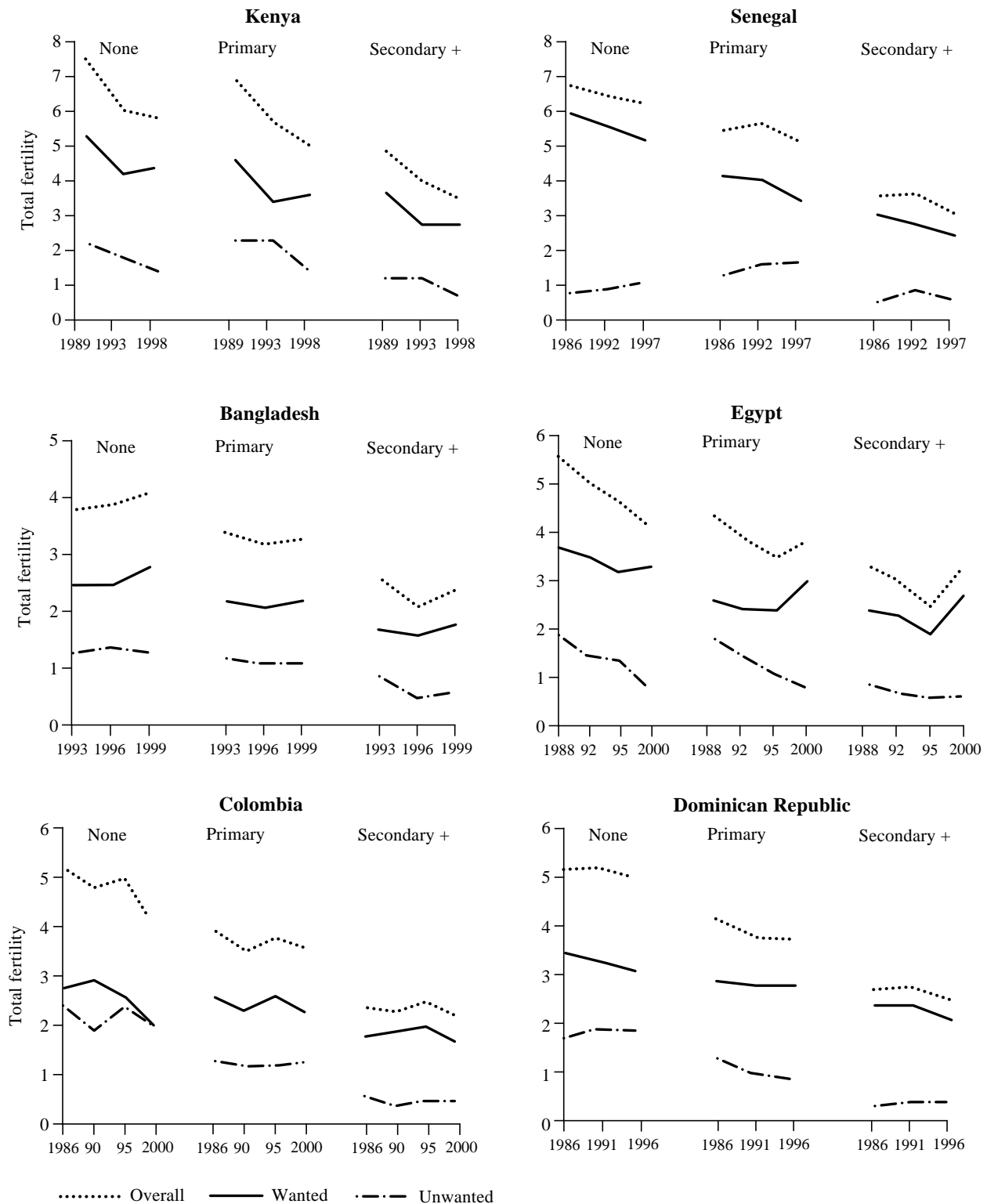


Figure 6 Trends in total fertility and wanted total fertility by level of education in six illustrative countries
Source: DHS data files

primary education. In turn, women with primary education frequently have lower wanted and unwanted fertility than their counterparts with no schooling. Two exceptions to this generalization occur in Kenya and Senegal, where unwanted total fertility among women with primary education is

higher than among women with no education. This finding is probably attributable to the high wanted fertility among women with no schooling in these countries, who, as a consequence, have little exposure to the risk of unwanted childbearing. Second, educational differentials in wanted and unwanted fertility

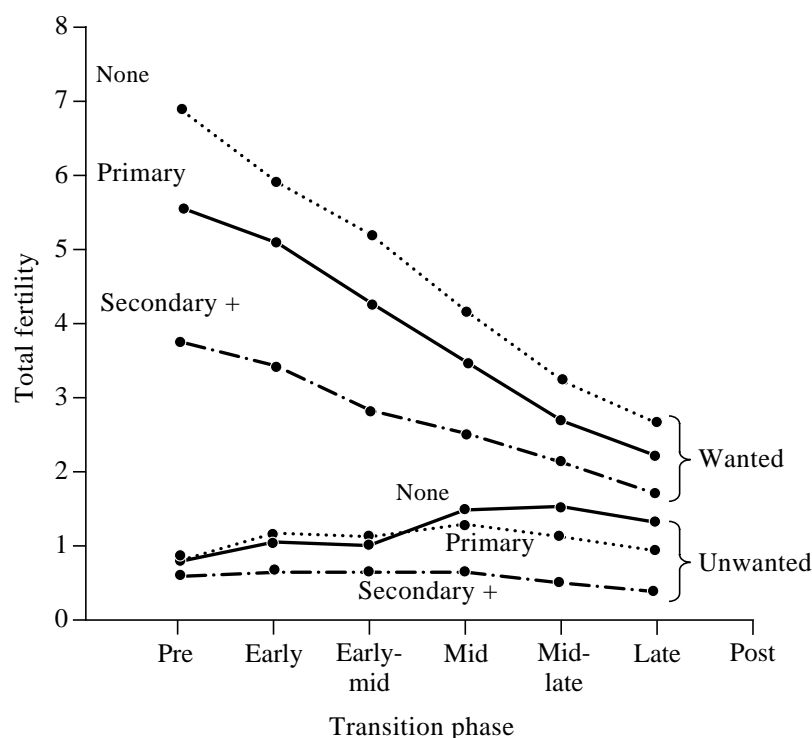


Figure 7 Average wanted and unwanted total fertility by level of education and transition phase
Source: DHS data files

appear to vary by stage of the transition. In Colombia and the Dominican Republic, two countries that are approaching the end of their transitions, educational differentials in wanted fertility are small and differentials in unwanted fertility are large. The reverse is the case in Senegal and Kenya, which are still in the early transition stages.

Cross-sectional patterns

These conclusions are consistent with the results in Figure 7, which presents the cross-sectional summary of this topic based on data from DHS surveys in 57 countries. In the pre-transitional countries differentials in wanted fertility are large: the wanted total fertility of women with no schooling exceeds that of the most educated by 3.2 births per woman (6.9 minus 3.7). Countries in the later stages have smaller differences in wanted fertility, and in the late stage the difference between women with no schooling and women with secondary-plus education is just 1.0 birth per woman (2.7 minus 1.7).

The cross-sectional results for unwanted fertility show a quite different pattern. In the earliest stage there is little difference by level of education, and unwanted total fertility averages about 0.8 births per woman for each group. In countries in the latest stages the figure is generally higher, reaching 1.5

births per woman among women with no schooling. In contrast, the unwanted total fertility of women with secondary-plus education averages just 0.4 births per woman in late transitional countries. As a result, in the later transitional stages unwanted childbearing is much more common among uneducated women than among women with secondary-plus education.

The main finding that emerges from this analysis is that the role of the wanted and unwanted components of educational fertility differences varies by stage of the transition. Early in the transition fertility differences are almost entirely attributable to differences in wanted fertility, and differences in unwanted fertility are relatively small. In late transitional countries differences in unwanted fertility are important and are comparable in magnitude to differences in wanted fertility.

Although a full explanation of these patterns is not attempted here, we suggest it is likely that the convergence of wanted fertility is in part attributable to diffusion and social interaction processes. Diffusion refers to the spread of information, ideas, and behaviours among individuals, communities, and countries; social interaction refers to the fact that the reproductive attitudes and behaviours of individuals can be influenced by the attitudes and behaviours of others. An extensive literature exists on this subject (Knodel and van de Walle 1979; Watkins 1986; Cleland and

Wilson 1987; Bongaarts and Watkins 1996; Montgomery and Casterline 1996; Casterline 2001; Cleland 2001; Kohler 2001; National Research Council 2001; Bongaarts 2002). Countries in the later stages of the fertility transition are generally more developed than those in the earlier stages. As a result, opportunities for social interaction increase—for example, through the influence of the media, mass schooling, and migration, all of which facilitate the spread of ideas and information about the desirability of limiting family size.

One would expect these same processes also to facilitate the spread of ideas and information about methods of birth control. No doubt they do, but other forces at work nevertheless produce a widening of educational differentials in unwanted fertility. As already noted, limited exposure to the risk of unwanted pregnancy keeps unwanted childbearing at low levels early in the transition. As the transition proceeds, the duration of exposure to the risk of unwanted pregnancy rises but this trend is offset by the increasing use of birth control. If birth control is highly effective, unwanted fertility can decline, as observed among women with secondary-plus education. However, if birth control is only moderately effective, unwanted fertility will increase with the rise in exposure, as observed among women with no schooling. (Despite this rise, unwanted fertility among women with no schooling is still much lower than it would have been in the absence of birth control.) The reasons why highly educated women are better able to implement their fertility preferences presumably include their higher degree of autonomy in reproductive decision making, better access to and better information about contraception, a greater willingness to tolerate various side effects and inconveniences associated with the use of methods of contraception, and greater cooperation from husbands.

The end of the fertility transition

The preceding analysis focused on fertility differentials in countries at all stages of the fertility transition except the last one. The final objective is to infer from available evidence the fertility differentials and levels of wanted and unwanted childbearing that are likely to be observed at the end of the transition. Post-transitional fertility will no doubt vary among countries, but the transition endpoint is often assumed to be replacement fertility with a total fertility of 2.1 births per woman. For example, this is the assumption incorporated in the population projections made by the United Nations (2001).

Fertility differentials

Estimates of total fertility by level of education for developed and less developed countries with low fertility are available from two survey programmes.

Demographic and Health Surveys. Although none of the less developed countries with DHS surveys has reached a total fertility of 2.1, fertility in three countries is close to the replacement level—Brazil (2.5), Thailand (2.3), and Vietnam (2.2). Their experience is therefore clearly relevant. Figure 8 plots estimates of differentials in fertility and its wanted and unwanted components. These patterns are consistent with those observed above in countries in mid- and late transitional stages. In particular, the gaps between the highest and lowest educational levels are large, ranging from 2.8 births per woman (4.9 minus 2.1) in Brazil to 1.4 (3.5 minus 2.1) in Vietnam.

Fertility and Family Surveys (FFS) in Europe, sponsored by the United Nations Economic Commission for Europe. Table 2 presents the average number of children ever born to women at the end of their childbearing years (aged 45–49) by level of education for ten countries for which this information has been published. Because the FFS does not use the no schooling/primary/secondary-plus categories, these results are not directly comparable to those of the DHS. In the FFS, women with a ‘low’ level of education have no, primary, or early secondary education; ‘medium’ refers to women with completed secondary or up to 4 years of post-secondary education; and ‘high’ refers to women with a university degree or equivalent. In these ten European countries women with low education have, on average, 0.6 births more than women with high education (2.27 minus 1.68). Estimates are not available for the small proportion of women with no schooling, but their fertility could well be significantly higher than the average of the ‘low’ group, which includes women with education up to the early secondary level.

In addition two country studies provide relevant estimates. In Taiwan, with an overall total fertility of 1.7 in 1991, fertility estimates by level of education range from 3.6 births per woman for primary school graduates to 1.2 for college graduates (Freedman et al. 1994). The USA has been post-transitional for a long time, but fertility differentials remain. In 1994, the total fertility of women with 0–8 years of education was 2.7 while for women with 16-plus years it was 1.7 (Mathews and Ventura 1997).

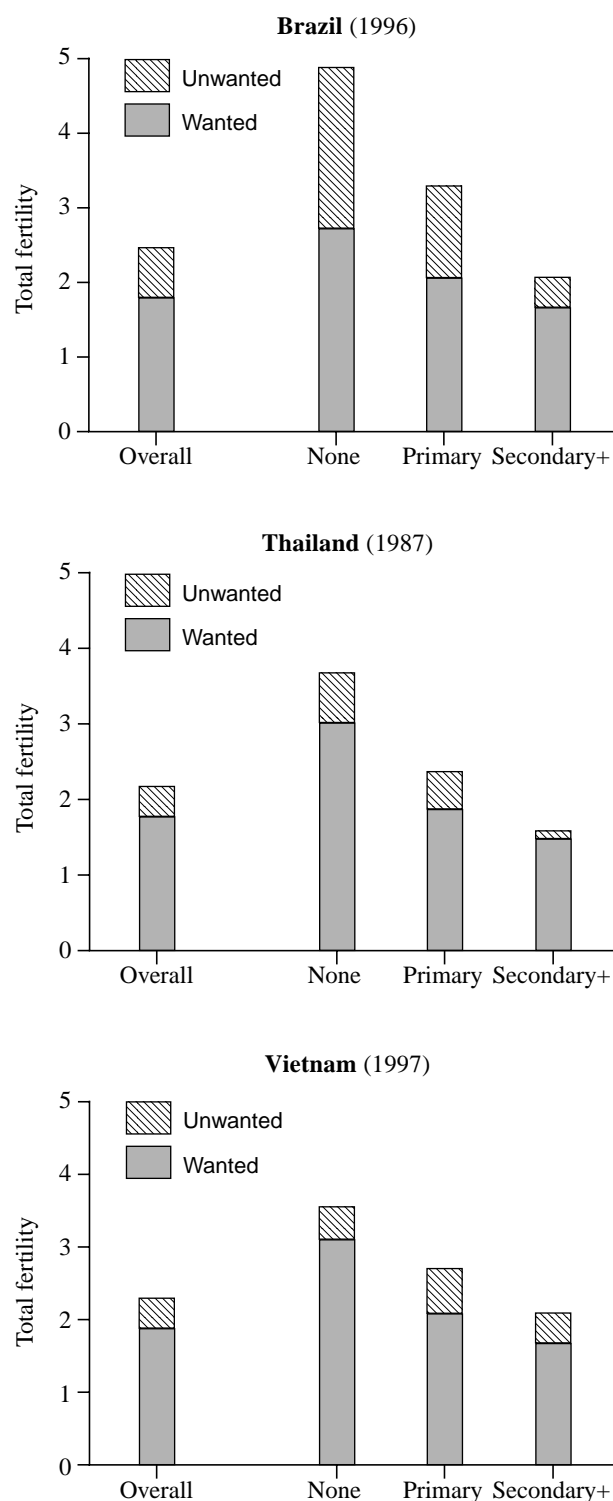


Figure 8 Total fertility and its wanted and unwanted components by level of education: Brazil, Thailand, and Vietnam
Source: DHS data files

Although comparisons of the data from these various sources are complicated by the use of different categories for level of education, the results show a consistent and substantial inverse association between fertility and level of education. Educational

Table 2 Average number of children ever born to women aged 45–49 in selected European countries

	Education level (ISCED)		
	Low (0–2)	Medium (3–4)	High (4–6)
Bulgaria	2.1	1.8	1.6
Finland	2.4	1.9	1.6
France	2.4	2.0	1.6
Greece	2.3	1.9	2.1
Italy	2.3	1.8	1.5
Lithuania	1.9	1.9	1.8
Poland	2.5	2.1	1.6
Portugal	2.2	1.5	1.7
Spain	2.6	2.1	1.9
Switzerland	1.9	1.7	1.4
Average	2.27	1.86	1.68

Note: ISCED refers to the International Standard for Classification of Education. See text for further details.
Source: UN Economic Commission for Europe, *Fertility and Family Surveys in Countries of the ECE Region*. New York and Geneva: Standard Country Reports for: Bulgaria 2001; Finland 1998; France 1998; Greece 2002; Italy 2000; Lithuania 2000; Poland 1997; Portugal 2000; Spain 1999; Switzerland 1999.

differentials in fertility clearly remain substantial in post-transitional societies, and the total fertility of women without schooling could well remain above 3.

Wanted status of births

The limited evidence on preferences from Brazil, Thailand, and Vietnam suggests that both wanted and unwanted fertility are inversely related to level of education and that levels of unwanted fertility remain substantial at the end of the transition (see Figure 8). The exception to this pattern is the level of unwanted fertility among women with no schooling in Vietnam, which is lower than among women with primary schooling. The reason for this is not clear, but is perhaps related to the one-or-two-child policy of the Vietnamese government (Goodkind 1995). Unwanted total fertility is 0.7 in Brazil and 0.4 in Thailand and Vietnam, representing, respectively, 28, 18, and 17 per cent of overall fertility. As noted, this finding is not surprising in view of the difficulties women often encounter in preventing unplanned pregnancy. Unwanted pregnancies are absent only in societies in which all women who want no more children use 100 per cent effective contraception. In practice, not all women in post-transitional societies who want no more children practise contraception

and those who do often rely on methods that are not 100 per cent effective. As a consequence, unwanted pregnancies remain fairly common even when overall fertility is low. In countries in which women have access to induced abortion, some of these pregnancies will be ended.

Implications

The leader–follower model for the pattern of fertility differentials at different stages of the transition, described at the beginning of this paper, does not appear to be the best way to describe the transition. Contrary to the model's assumption, educational differentials in fertility remain substantial in the late and post-transitional stages. The alternative permanent-difference model is also not entirely accurate because differentials are typically smaller at the end of the transition than in mid-transitional countries. On balance, the empirical evidence is more consistent with the permanent-difference than with the leader–follower model.

An important implication of this conclusion is that women's educational composition can play a key role in shaping levels and trends in fertility at the end of the transition. In most late-transitional and post-transitional countries more than 90 per cent of women have at least some primary education. As a result, the fact that the total fertility of a small group of women with no schooling remains at 3 or higher has little impact on overall fertility in these countries. However, the relatively high fertility of women with no schooling can have a significant impact in countries where a substantial proportion of married women have little or no schooling. For example, the proportion of married women with no schooling is 42 per cent in Egypt and 45 per cent in Bangladesh and the total fertility of this group of women exceeds 4. Fertility dropped rapidly in these two countries between the 1960s and early 1990s, but during the 1990s the fertility transitions appear to have stalled at a total fertility slightly above 3 (see Figure 4). The persistence of fertility differentials together with low levels of schooling among married women is probably a contributing factor to this stalling. In the three DHS countries with total fertilities at 2.5 or lower (Brazil, Thailand, and Vietnam) the proportion with no education is less than 10 per cent.

Conclusion

The fertility declines now underway in many less developed countries are almost invariably associated

with substantial fertility differences among socioeconomic subgroups. Women with primary education tend to have higher fertility than women with secondary-plus education, and women with no schooling tend to have higher fertility than women with primary education. The preceding analysis indicates that these educational differentials are slightly larger in countries in the earlier than in the later stages of the transition. Although the evidence is not entirely conclusive, educational differentials are likely to remain substantial when less developed countries reach the end of their transitions. The implication of this finding is that the educational composition of the population remains a key determinant of a country's overall level of fertility. Because the fertility of women with no schooling is expected to remain well above 2 births per woman at the end of the transition, it follows that countries with large proportions of women with no schooling are unlikely to see rapid declines to replacement fertility, and some may stall above replacement.

Fertility differences among education groups were found to be attributable to differences in both wanted and unwanted fertility. Higher levels of education are usually associated with lower levels of wanted and unwanted fertility, but this pattern varies by transition stage. On average, differences in wanted fertility are larger at early stages of the transition. In contrast, differences in unwanted fertility are typically smaller at early stages of the transition. These complex patterns can be explained by a combination of differences between education groups in exposure to the risk of unintended pregnancy and differences in the ability to implement reproductive preferences.

Nearly all early-transitional and mid-transitional countries will require substantial declines in both wanted and unwanted fertility in order to reach replacement fertility. Knowledge of these fertility components is useful to policymakers seeking to accelerate the transitions. For example, if unwanted fertility is particularly high, a first step should be to improve family planning services so that couples have access to the means to implement their preferences. The low levels of unwanted fertility in Indonesia, Thailand, and Vietnam are no doubt attributable in part to strong family planning programmes operating in these countries. If unwanted fertility is especially high among the uneducated (e.g., in a number of Latin American countries), the focus of efforts to improve services should be on this group. In countries where wanted fertility is high, other factors need to be encouraged. Although there is still disagreement about the socioeconomic causes of fertility decline, investments in

human capital such as education and lower mortality are considered particularly important (Caldwell 1982; Sen 1999). Regardless of whether declines in

wanted or unwanted fertility are sought, such changes are facilitated by improvements in levels of schooling.

Appendix

Table A1 Mean, standard deviation, and maximum–minimum range of wanted, unwanted, and overall total fertility by education level, for groups of countries at different stages of the fertility transition

	No education			Primary			Secondary or higheer			Total			No. of countries
	Wanted	Unwanted	Total	Wanted	Unwanted	Total	Wanted	Unwanted	Total	Wanted	Unwanted	Total	
Mean total fertility													
Pre	6.88	0.80	7.68	5.53	0.85	6.38	3.73	0.60	4.33	6.50	0.90	7.35	4
Early	5.86	1.04	6.91	5.07	1.16	6.23	3.41	0.65	4.06	5.34	1.03	6.36	19
Early/mid	5.19	1.01	6.19	4.24	1.15	5.39	2.84	0.64	3.49	4.39	0.99	5.38	16
Mid	4.16	1.49	5.65	3.44	1.30	4.74	2.51	0.63	3.15	3.27	1.12	4.39	21
Mid/late	3.23	1.54	4.77	2.69	1.14	3.83	2.14	0.50	2.64	2.48	0.89	3.38	12
Late	2.66	1.33	3.99	2.20	0.93	3.13	1.71	0.37	2.09	1.91	0.63	2.54	7
Standard deviation total fertility													
Pre	0.40	0.65	0.40	1.23	0.55	0.89	0.97	0.28	1.10	0.42	0.66	0.26	4
Early	0.47	0.60	0.36	0.82	0.50	0.71	0.66	0.35	0.75	0.54	0.57	0.30	19
Early/mid	0.68	0.68	0.56	0.71	0.71	0.55	0.57	0.35	0.72	0.65	0.55	0.26	16
Mid	0.82	0.89	0.67	0.81	0.60	0.78	0.54	0.24	0.57	0.64	0.46	0.30	21
Mid/late	0.44	0.87	1.08	0.33	0.46	0.63	0.32	0.17	0.37	0.28	0.24	0.26	12
Late	0.41	0.81	0.82	0.22	0.51	0.59	0.23	0.17	0.32	0.22	0.24	0.23	7
Maximum total fertility													
Pre	7.3	1.7	8.1	6.4	1.5	7.2	4.6	1.0	5.6	7.0	1.7	7.7	4
Early	6.4	2.2	7.8	6.6	2.3	7.3	4.6	1.4	5.8	6.1	2.2	6.9	19
Early/mid	6.1	3.0	7.2	5.4	2.9	6.4	3.7	1.5	5.1	5.2	2.3	5.8	16
Mid	5.9	3.3	7.1	4.8	2.6	5.7	3.6	1.3	4.2	4.4	1.9	4.9	21
Mid/late	4.0	3.0	6.9	3.3	2.2	5.0	2.7	0.7	3.3	3.0	1.3	3.8	12
Late	3.1	2.2	5.1	2.6	1.8	4.1	2.2	0.6	2.6	2.4	1.0	2.8	7
Minimum total fertility													
Pre	6.4	0.2	7.2	3.7	0.3	5.2	2.5	0.4	3.1	6.0	0.2	7.1	4
Early	4.8	0.2	6.4	3.7	0.4	4.8	2.3	0.2	2.8	4.2	0.2	6.0	19
Early/mid	3.4	0.3	5.1	3.1	0.4	4.6	1.9	0.2	2.3	2.7	0.4	5.0	16
Mid	2.9	0.2	4.6	1.7	0.3	2.4	1.6	0.3	2.0	2.3	0.3	4.0	21
Mid/late	2.6	0.5	3.3	2.2	0.6	3.0	1.8	0.2	2.0	2.2	0.5	3.0	12
Late	2.0	0.4	2.7	1.9	0.5	2.4	1.5	0.1	1.6	1.8	0.4	2.2	7

Source: DHS data files.

Notes

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References

- Bankole, Akinrinola and Charles F. Westoff. 1995. *Childbearing Attitudes and Intentions*, Demographic and Health Surveys Comparative Studies No. 17. Calverton, MD: Macro International, Inc.
- Bongaarts, John and Susan Cotts Watkins. 1996. Social interactions and contemporary fertility transitions, *Population and Development Review* 22(4): 639–682.
- Bongaarts, John. 1997. Trends in unwanted childbearing in the developing world, *Studies in Family Planning* 28(4): 267–277.
- Bongaarts, John. 2002. The end of the fertility transition in the developing world, in *Proceedings of Expert Group Meeting on Completing the Fertility Transition*,

- Population Division, United Nations (also forthcoming in *UN Population Bulletin*).
- Caldwell, John C. 1982. *Theory of Fertility Decline*. London: Academic Press.
- Casterline, John B. 2001. Diffusion processes and fertility transition: introduction, in John B. Casterline (ed.), *Diffusion Processes and Fertility Transition: Selected Perspectives*. Washington, DC: National Research Council, National Academy Press, pp. 1–38.
- Cleland, John and Christopher Wilson. 1987. Demand theories of the fertility transition: an iconoclastic view, *Population Studies* 41(1): 5–30.
- Cleland, John and Germán Rodríguez. 1988. The effect of parental education on marital fertility in developing countries, *Population Studies* 42(3): 419–442.
- Cleland, John. 2001. Potatoes and pills: an overview of innovation-diffusion contributions to explanations of fertility decline, in John B. Casterline (ed.), *Diffusion Processes and Fertility Transition: Selected Perspectives*. Washington, DC: National Research Council, National Academy Press, pp. 39–65.
- Cleland, John. 2002. Education and future fertility trends, with special reference to mid-transitional countries, in *Proceedings of Expert Group Meeting on Completing the Fertility Transition*, Population Division, United Nations (also forthcoming in *UN Population Bulletin*).
- Cochrane, Susan Hill. 1979. *Fertility and Education: What Do We Really Know?* Baltimore, MD: Johns Hopkins University Press.
- Freedman, Ronald, Ming-Cheng Chang, and Te-Hsiung Sun. 1994. Taiwan's transition from high fertility to below-replacement levels, *Studies in Family Planning* 25(6): 317–331.
- Goodkind, Daniel M. 1995. Vietnam's one-or-two-child policy in action, *Population and Development Review* 21(1): 85–111.
- Jeffery, Roger and Alaka M. Basu (eds.). 1996. *Girls' Schooling, Women's Autonomy and Fertility Change in South Asia*. New Delhi: Sage.
- Jejeebhoy, Shireen J. 1995. *Women's Education, Autonomy and Reproductive Behaviour: Experience from Developing Countries*. Oxford: Clarendon Press.
- Knodel, John and Etienne van de Walle. 1979. Lessons from the past: policy implications of historical fertility studies, *Population and Development Review* 5(2): 217–245.
- Kohler, Hans-Peter. 2001. *Fertility and Social Interaction: An Economic Perspective*. New York: Oxford University Press.
- Lutz, Wolfgang and Anne Goujon. 2001. The world's changing human capital stock: multi-state population projections by educational attainment, *Population and Development Review* 27(2): 323–339.
- Mathews, T. J. and Stephanie Ventura. 1997. Birth and fertility rates by educational attainment: United States, 1994, *Monthly Vital Statistics Report* 45(10, Suppl.): 1–20.
- Merrick, Thomas. 2001. Population and poverty: a review of reviews, in Nancy Birdsall, Allen C. Kelley, and Steven Sinding (eds.), *Population Matters: Demographic Change, Economic Growth, and Poverty in the Developing World*. New York: Oxford University Press, pp. 201–212.
- Montgomery, Mark R. and John B. Casterline. 1996. Social learning, social influence, and new models of fertility, in John B. Casterline, Ronald D. Lee, and Karen A. Foote (eds.), *Fertility in the United States: New Patterns, New Theories*, *Population and Development Review*, Supplement to Volume 22. New York: Population Council, pp. 151–175.
- National Research Council. 1999. *Critical Perspectives on Schooling and Fertility in the Developing World*, Caroline H. Bledsoe, John B. Casterline, Jennifer A. Johnson-Kuhn, and John G. Haaga (eds.). Washington, DC: National Academy Press.
- National Research Council. 2001. *Diffusion Processes and Fertility Transition: Selected Perspectives*, John B. Casterline (ed.). Washington, DC: National Academy Press.
- Rutstein, Shea. 2003. *Fertility Levels, Trends and Differentials: 1995–1999*, Demographic and Health Surveys Comparative Studies No. 3. Calverton, MD: Macro International, Inc.
- Sen, Amartya. 1999. *Development as Freedom*. New York: Knopf.
- United Nations. 1987. Fertility behavior in the context of development: evidence from the World Fertility Surveys, *Population Studies No. 100*. New York: United Nations.
- United Nations. 1995. *Women's Education and Fertility Behavior: Recent Evidence from the Demographic and Health Surveys*. New York: United Nations.
- United Nations. 2001. *World Population Prospects: The 2000 Revision*. New York: United Nations.
- Watkins, Susan Cotts. 1986. Conclusions, in Ansley J. Coale and Susan Cotts Watkins (eds.), *The Decline of Fertility in Europe*. Princeton, NJ: Princeton University Press, pp. 420–449.

