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Demographic Transition and Unwanted Fertility: A Fresh Assessment

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The distinction between wanted and unwanted fertility has been crucial in many of the more intense debates in recent decades over the nature of contemporary fertility declines and, in particular, the potential impact of expanded provision of family planning services. In a much-debated article published in 1994, Pritchett argues that decline in desired fertility is overwhelmingly the principal source of fertility decline, with the implication that family planning programmes are of little consequence. I revisit this debate drawing on a far larger body of survey data and, more importantly, an alternative fertility specification which relies on a non-conventional definition of wanted and unwanted fertility rates and which distinguishes rates and composition. Decompositions of fertility decline in the period from the mid-1970s to the present are carried out for 44 countries. The decomposition results indicate that declines in unwanted fertility rates have been at least as important, if not more important, than declines in wanted fertility rates. Surprisingly, shifts in the proportion of women wanting to stop childbearing—i.e., changes in preference composition—has contributed very little to fertility change in this period. Further, decline in wanted fertility and increases in non-marital exposure (due largely to delayed entry into first marriage) have also made substantial contributions, although on average they fall short of the contribution of declines in unwanted fertility rates. That declines in unwanted fertility have been an essential feature of contemporary fertility decline is the main conclusion from this research. This in turn opens the door to new perspectives on fertility pre-, mid-, and post-transition which recognises the inter-dependencies between fertility demand and unwanted fertility rates in the determination of the overall level of fertility.

JEL classification: J11, J13, R11
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I. INTRODUCTION

The two decades after the conclusion of World War II witnessed substantial declines in mortality in every region of the world. In those countries where fertility remained high (five or more births per woman during the reproductive career), demographers could easily demonstrate that the combination of sharp mortality decline and stable high fertility would lead to unprecedented population growth, i.e. population doublings in less than thirty years. Accordingly, fertility reduction was adopted as formal population policy in many countries (including Pakistan), and simultaneously scholars addressed the inter-related questions of what factors accounted for high levels of fertility

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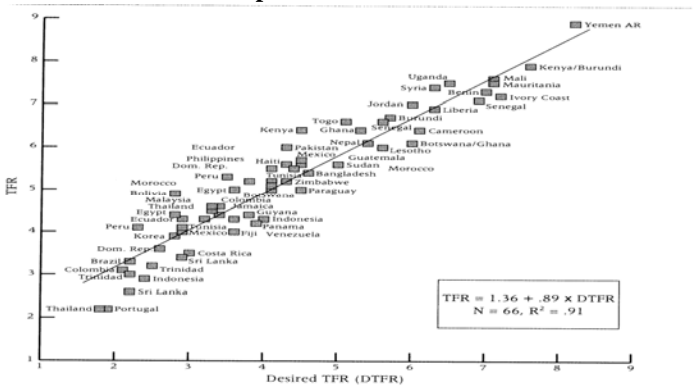
and what factors were most likely to nurture fertility decline. Perhaps no questions received more attention in the demographic literature during the three decades from the mid-1960s to the mid-1990s. An underlying motivation, and the rationale for the relative abundance of research funding, was the acute salience of the public policy choices, in particular whether investment in the provision of family planning services could be expected to lower fertility to a meaningful extent.

These questions are still urgent in those regions where population growth rates remain relatively high, in particular some portions of South Asia and most of sub-Saharan Africa. Public policy choices in those regions can benefit from the accumulated global experience of the past four decades. Influential scholarship from the past can be re-evaluated in light of a more expansive empirical record and alternative analytical strategies. An excellent example of how new assessment can lead to revision of the extant wisdom about fertility decline and its determinants is Bryant's (2007) examination of the explanatory power of macro-level development indicators (income, schooling). Bryant concludes that the explanatory power of such indicators was seriously under-estimated in influential research published during the 1990s.

In this paper I reconsider another topic that has received scholarly attention over the years and that has major implications for public policy, namely whether reduction in unwanted fertility is a common—and perhaps even necessary—ingredient of fertility decline. Pritchett (1994) concluded otherwise in an article that prompted a fierce debate in the mid-1990s. In arguing that fertility decline is driven almost entirely by reduced demand for children, Pritchett leaves almost no room for family planning services to make a contribution that justifies their financial cost. The article is relatively lengthy and Pritchett's argument has multiple strands, but his linchpin evidence is the strong association between the total fertility rate (TFR, the most common aggregate fertility indicator) and alternative measures of desired fertility (Pritchett considers three such measures). Figure 1 reprints this linchpin evidence: over ninety percent of the variation in the TFR among 66 countries is explained by the most widely-used measure of desired fertility. The slope near 1.0 (slope = .89) suggests that declines in desired fertility are matched nearly one-to-one by declines in overall fertility. Given this cross-country association between fertility and desired fertility, Pritchett argues that unwanted fertility and closely-related entities such as unmet need for contraception are incidental players in the larger drama of fertility decline.

Note that this is *not* a claim that unwanted fertility and unmet need are invalid concepts that lack empirical reality, a stance taken by some social scientists. More specifically, Pritchett acknowledges that the regression intercept is in excess of one birth (intercept = 1.36 in Figure 1). The regression intercept is the estimated level of fertility when desired fertility equals zero, and therefore can be regarded as an estimate of unwanted fertility. Given the slope near 1.0, the implication is that the unwanted fertility rate is on the order of 1.36 births per woman in all settings. Rather, Pritchett's stance is that fertility decline is not dependent on reduction in unwanted fertility, a conclusion supported by the fact that unwanted fertility evidently does not co-vary with fertility (note in Figure 1 the close adherence to the regression line throughout the range from TFR=8.0 to TFR=2.5).

Fig. 1. Relationship between Actual Fertility and Three Measures of Fertility Desires in Less Developed Countries



In this research I accept Pritchett's premise that the empirical contribution of unwanted fertility to fertility decline is highly relevant to the public policy debate about the potential payoff from investments in expanded provision of family planning services. To be sure, family planning programmes, not to mention other deliberate tools of population policy (e.g. mass media activities), could influence fertility desires by direct or indirect means. But there is little solid empirical evidence that this effect exists [Freedman (1997)], and hence effects on unwanted fertility stand as the principal mechanism through which family planning programmes can reduce fertility. My quarrel here is not with Pritchett's premise, but rather with his models and his measures. I will present empirical analysis that leads to a different conclusion. My research improves on Pritchett's much-debated 1994 article in three respects: (1) The measures of fertility desires are more valid; (2) Change is explicitly analysed rather than inferred on the basis of cross-sectional associations; (3) A more appropriate fertility model is employed.

II. DATA

My aim is to examine the contours of fertility decline in the period since World War II across the maximum number of middle- and low-income countries. Because the distinction between wanted and unwanted fertility is central to this research, measures of fertility attitudes are required, and this in turn means reliance on survey data. The first surveys containing the required measures were conducted in the 1960s, but these surveys are, regrettably, not easily accessed for a large number of countries in diverse settings. Hence the dissection of fertility decline must begin in the 1970s with the first major multi-region multi-country programme of demographic surveys, the World Fertility Survey [WFS], which coordinated the fielding of surveys in 43 countries between 1974 and 1983. The WFS was succeeded by the Demographic and Health Survey [DHS] project, which has conducted surveys from 1985 to the present. In Latin America, the U.S. Center for Disease Control has coordinated Reproductive Health Surveys [RHS] from the early 1990s to the present, and in the Arab region the Arab League has supported demographic surveys under the Pan Arab Project for Family Health [PAPFAM]. This research draws on surveys from all four of these data collection programmes, as follows:

Survey Programme	Number of Surveys	Historical Range
World Fertility Survey	41	1974 – 1983
Demographic and Health Surveys	175	1985 – 2008
Reproductive Health Surveys	14	1992 – 2006
Pan Arab Project for Family Health	6	2001 – 2004
Else	2	2003 – 2006
Total	*238*	*1974 – 2006*

As noted above, the distinction between wanted and unwanted fertility is central to this research, adhering to the terms of debate set by Pritchett in his 1994 article. Hence the incidence of wanted and unwanted fertility must be estimated from the survey data, and this is intrinsically a challenging task. At issue are couples' desires at the time conceptions occurred, but it is not practical to design data collection for national populations that ensures that interviews are conducted proximate in time to all (or even most) conceptions. Hence classification of births as wanted or unwanted will unavoidably depend on fertility desires measured prospectively or retrospectively, with the risk that the desires are not stable or, in the case of retrospective recall, incorrectly remembered. Adding to the challenge is the emotional sensitivity of the topic: respondents may feel that declaring a child "unwanted" is a violation of social or religious norms.

There are two widely-used methodologies for estimating the level of unwanted fertility, another method that has received little use, and the recently developed methodology of Casterline and el-Zeini that is applied in this paper [see discussion in Casterline and el-Zeini (2007)]. All methods permit direct estimation of either a "wanted TFR" [wTFR] or an "unwanted TFR" [uTFR], with the other obtained from the TFR by simple subtraction (i.e. TFR = wTFR + uTFR). The Casterline and el-Zeini method is an aggregate method: it does not classify individual births as unwanted or unwanted, rather generates birth-order-specific estimates of the proportions unwanted, with an estimate of the overall incidence of unwanted births calculated as a weighted average of the order-specific estimates. This method relies on the fertility attitude item that has been shown to have higher test-retest reliability and higher validity (by several criteria) than other standard fertility attitudinal items [see studies cited in Casterline and el-Zeini (2007)], namely the prospective preference item:

"Would you like to have (a/another) child, or would you prefer not to have any (more) children?"

This is a different method for estimating unwanted fertility than the method used by the DHS, which is the source of most commonly-cited estimates of unwanted fertility. The DHS uses the method popularised by Lightbourne (1985). The crux of this method is a comparison of the respondent's ideal number of children and the number of living children at the time of conception. The DHS wording of the key item is,

"If you could go back to the time you did not have any children and could choose exactly the number of children to have in your whole life, how many would that be?"

If this ideal number is equal to or less than the number of living children at the time of conception of the birth in question, the birth is classified as unwanted. This method has serious shortcomings that are well-recognised by demographers. For one

thing, it relies on a survey item that is known to have low test-test reliability [see studies cited in Casterline and el-Zeini (2007), including the PES following the 1990-91 Pakistan DHS]. Secondly, two response patterns undermine the method: the tendency to report an ideal that is no lower than the number of living children (so-called ":rationalization"), and the tendency in some societies to give a non-numeric answer ("up to God"). These two response patterns both lead to downwardly-biased estimates of unwanted fertility. Finally, there are valid reasons for the preference to have (or not have) more children to be inconsistent with the ideal number of children [Bongaarts (1990)]; this can occur, for example, if the household is economically stressed or if sex preferences have not been satisfied after the first few children.

Hence it is not surprising that the DHS method typically generates *lower* estimates of unwanted fertility than the Casterline and el-Zeini method that is employed in the present research. It would be extreme to claim that, among available estimators, the Casterline and el-Zeini estimator yields the most valid results in all instances; like any method of estimation, it is vulnerable to certain types of data deficiencies. But there are sound reasons for assuming that this estimator has the highest validity across a large set of surveys.

The analysis presented here also requires allocation of exposure time to wanted vs. unwanted states. This is based on the current status distribution at the survey (i.e., age-specific proportions wanting another child). The assumption is that this distribution characterises all months in the reference period (in this analysis, the 36 months preceding the survey).

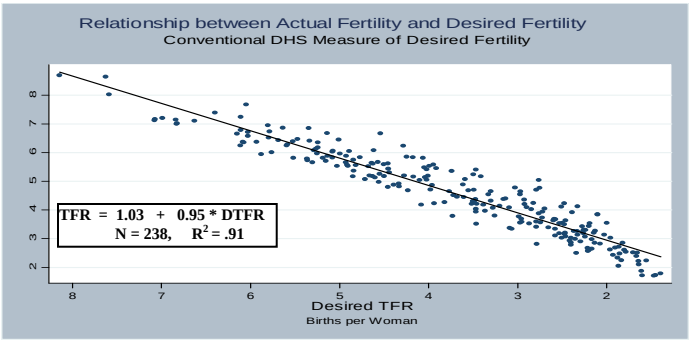
III. EMPIRICAL RESULTS

III.a. A Replication of Pritchett

I begin with a replication of Pritchett's key analysis, using a far larger number of surveys (n=238, as against n=66 in Pritchett's analysis) with greater historical range (a further fifteen years).

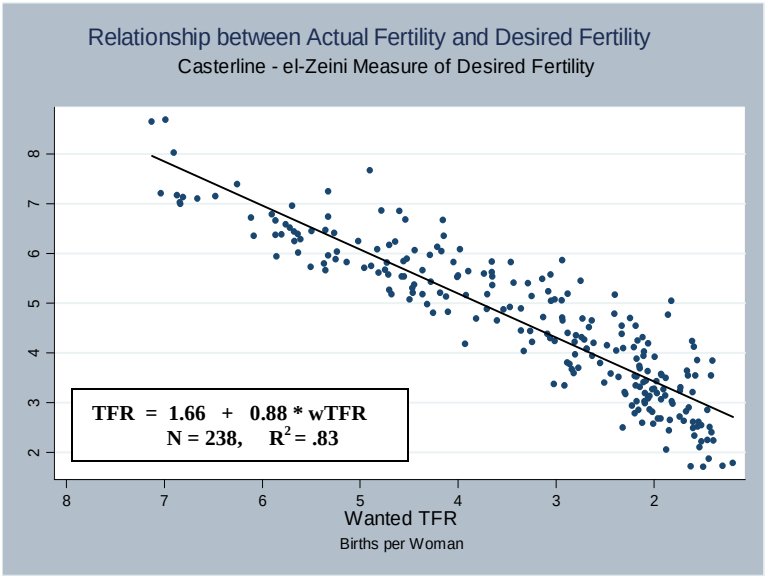
A replication with Pritchett's preferred measure of desired fertility—the conventional DHS measure of the wanted TFR—is presented in Figure 2a. The result is entirely consistent with Pritchett's, indeed if anything the outcome is more supportive of his conclusion: the slope is closer to 1.0, and the explained variance is identical despite the larger number of observations.

Fig. 2a. Relationship between Actual Fertility and Desired Fertility
Conventional Measure of Desired Fertility



But reliance on the conventional measure of desired fertility raises some concerns. As noted above, it is generally agreed that these are upwardly biased estimates of the true desired number of children. Moreover, the construction of the conventional (DHS) measure builds in a correlation with the TFR, as demonstrated by Knowles, *et al.* (1994). The Casterline and el-Zeini estimates are less susceptible to both shortcomings. An analogous regression using these estimates is presented in Figure 2b. This regression result does not depart radically from Pritchett's but offers somewhat less convincing evidence that overall fertility and desired fertility go hand-in-hand: (i) the slope declines from 0.95 to 0.88, and the R^2 declines from 0.91 to 0.83; (ii) visually there is far more dispersion around the regression line than in Figure 2a; (iii) a non-linearity is now evident—when the wanted TFR is below 2.5 births per woman, the TFR is lower than a linear regression would predict, which suggests that unwanted fertility falls more rapidly in the latter stages of fertility decline (an interpretation confirmed in further analysis presented below).

Fig. 2b. Relationship between Actual Fertility and Desired Fertility Alternative Measure of Desired Fertility



III.b. Explicit Analysis of Change

Pritchett draws conclusions about the nature of fertility decline from cross-sectional associations (e.g. as shown in Figure 1). Clearly this violates basic principles of research design. In his defense, at the time he carried out this research only a few countries offered two or more surveys spaced some distance apart (e.g. ten or more years).

In the subsequent fifteen years the set of countries with successive demographic surveys spanning a decade or more has greatly enlarged. For this research I examine change between two surveys in 44 countries, as listed in Appendix A (by region). The dates of the two surveys are also shown in Appendix A. The criteria for selecting these 44 countries, conditional on the availability of at least two surveys, are:

- Surveys spaced at least eight years apart.
- Annual rate of decline between surveys of at least 0.05 births/annum (i.e., 0.5 births per decade).

Nine of the inter-survey intervals are at least 30 years, and a further eighteen of the intervals are at least 20 years. The briefest inter-survey interval considered is 9 years (Honduras).

Given estimates of the TFR, wanted fertility (wTFR), and unwanted fertility (uTFR) for two dates, a straightforward decomposition of fertility decline consistent with Pritchett's analysis in Figure 1 (and the replications in Figures 2a and 2b) can be carried out based on the identity:

$$TFR = wTFR + uTFR \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1a)$$

which implies the following formula for change:

$$TFR_1 - TFR_2 = (wTFR_1 - wTFR_2) + (uTFR_1 - uTFR_2) \quad \ldots \quad \ldots \quad (1b)$$

from which a percentage decomposition is easily obtained. This is a two-element decomposition; there are contributions to fertility change of changes in wanted fertility and changes in unwanted fertility.

A summary of the results from such a simple decomposition exercise are shown in the upper panel of Table 1.[1] The decomposition is carried out country-by-country –44 decompositions in total. Table 1 shows the median values from these 44 decomposition, and also the 1st and 3rd quartiles. The Pakistan decomposition is shown in the lower panel.[2]

Table 1

Decomposition of Fertility Change:
Conventional Decomposition[a]
Percentage Contribution to Inter-Survey Fertility Change

Multi-Country (n = 44)	Median	1st Quartile	3rd Quartile
Due to Wanted Fertility	74	50	104
Due to Unwanted Fertility	26	-4	50
Pakistan	**1975–2006**	**1975–1991**	**1991–2006**
Due to Wanted Fertility	55	20	94
Due to Unwanted Fertility	45	80	6
Total	100	100	100

a. Based on: TFR = wTFR + uTFR.
where TFR is conventional period TFR.
wTFR is wanted TFR.
uTFR is unwanted TFR.

[1]Note that this analysis, and all subsequent analysis in this paper, uses the Casterline and el-Zeini method to estimate unwanted fertility.

[2]Results are shown for two inter-survey intervals in Pakistan—1975-1991, and 1991-2006. In the multi-country analysis in the top panel, only the interval 1975-2006 is included.

The decomposition results in Table 1 support Pritchett's argument that declines in desired fertility are the main engine of fertility decline, but the picture is far more mixed than his analysis suggests: while the median contribution of the decline in the wanted TFR is 73 percent, in one-quarter of countries it is 47 percent or less, and it is in excess of 103 percent in another one-quarter of countries. Pakistan is a case in point that fails to verify an assertion that fertility decline occurs almost entirely as a result of the decline in desired fertility: over the three-decade period from 1975–2006, the contribution of declines in wanted and unwanted fertility are roughly equal in magnitude (55 percent and 44 percent, respectively).

III.c. An Alternative Specification

One could regard the decomposition of Equation (1b), despite its simplicity, as a sufficient basis for addressing Pritchett's research questions in an explicit analysis of change. The structure of this model appears to correspond to the terms of the debate—fertility change is attributed to changes in either wanted or unwanted fertility. With these results in hand, one might explore patterns of cross-national variation, in particular associations between the decomposition results and various socioeconomic and programmatic country characteristics.

But as a behavioural model, Equation (1) is seriously flawed. Note that wTFR and uTFR are the simple sum of age-specific rates. In calculating the age-specific wanted rate, the numerator is wanted births and the denominator is woman-years of exposure in the appropriate age interval; similarly, for the age-specific unwanted rate, the numerator is unwanted births and the denominator is woman-years of exposure in the appropriate age interval. The denominator for both rates is *all women* rather than *women at risk* of wanted or unwanted births. This has been the custom for several decades, presumably because of uncertainty about how to allocate exposure in the reference period to risk of wanted vs. unwanted births. But in so doing, standard demographic and epidemiological practice has been violated: incidence rates are usually constructed with events in the numerator and persons at risk in the denominator. It is as if, for example, age-specific rates were calculated using events at age a in the numerator and persons of all ages in the denominator. Or regional rates were calculated using events in region *r* in the numerator and persons of all regions in the denominator.

This shortcoming has been noted by other scholars, most notably Bongaarts (1997) who posits that the uTFR should rise in the early stages of fertility decline due to growth in the fraction of all women who wish to terminate childbearing. Bongaarts is not describing a true behavioural change (i.e., change in the rate of childbearing among those at risk of unwanted births), rather simply a compositional change in the denominator (i.e., the distribution of all women according to their fertility preferences).

A deeper and more revealing investigation of the nature of fertility change would consider true incidence rates, i.e., events per woman at risk. Define

b_w wanted births
e_w woman-years of "want another birth"
$r_w = b_w / e_w$ wanted fertility rate, *conditional* on risk of wanted birth

and the same can be defined for unwanted fertility (subscripted *u*). Further, define

p_w proportion of women who "want another birth"
p_u proportion of women who "do not want another birth"

Noting that ($p_u + p_w = 1$), we have the following expression for the age-specific fertility rate f

$$f = r_w * p_w + r_u * (1 - p_w) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

The key feature of Equation (2) is that the component rates are constructed for those women at risk of the event in question (wanted birth or unwanted birth, respectively). I therefore term these "conditional rates" — conditional on preference status. The construction of these two rates is consistent with the logic of most comparable indicators in demography and epidemiology. There is good reason for this logic to hold sway: most social and economic theory is preoccupied with the choices of those persons at risk of an event, and such persons are also the targets of policy interventions. To be sure, the composition of the population is a further concern of both basic science and public policy. For example, from economic theory one might derive hypotheses about which women are more or less likely to desire another child conditional on their age or parity; and reducing the demand for children might be a public policy goal. In this vein, note that Equation (2) also explicitly recognises the contribution of composition (the p_w term). In short, Equation (2) is far more precise about the components of a fertility rate: the fertility rate is a somewhat complex outcome of summing two preference-specific entities, with each of the latter consisting of the product of rate and composition.

One might ask whether the conditional rates provide a portrait of fertility decline that differs from that provided by the conventional wanted and unwanted rates (wTFR and uTFR). To address this question, I select four countries for illustration: Colombia, Ghana, Egypt and Pakistan. The first three countries each have six or more surveys. The rates of interest are listed in Appendix C. The two pairs of fertility rates—conventional and conditional, wanted and unwanted—are displayed in Figures 3a and 3b. (Note that these rates are births per woman-year of exposure, all women ages 15-49, and not standardised for age.) It is immediately obvious that the conditional rates are much higher in value, as they must be because their denominators are a sub-set of woman-years rather than all woman-years of exposure as in the conventional rates. In the most general sense, the two pairs of rates—conventional on the left, conditional on the right—offer similar portraits of fertility change in these four countries. But there are substantial differences in the steepness of slopes, and even a few differences in the direction of slope (i.e. unwanted fertility in Ghana, wanted fertility in Pakistan). The most important difference is that the steepness of the decline in unwanted fertility, *relative to the decline in wanted fertility*, is greater according to the conditional rates. As a consequence, while the conventional rates tend to converge as decline progresses, the conditional wanted and unwanted rates tend to diverge. But these are patterns in only four out of forty-four countries analysed, and thus generalisations cannot be drawn. The purpose of Appendix C and Figure 3 is simply to give the reader a feel for the two types of rates.

Fig. 3a. Illustration of Trends in Fertility Rates: Conventional Rates and Conditional Rates

Births per Woman-Year, Women Aged 15-49

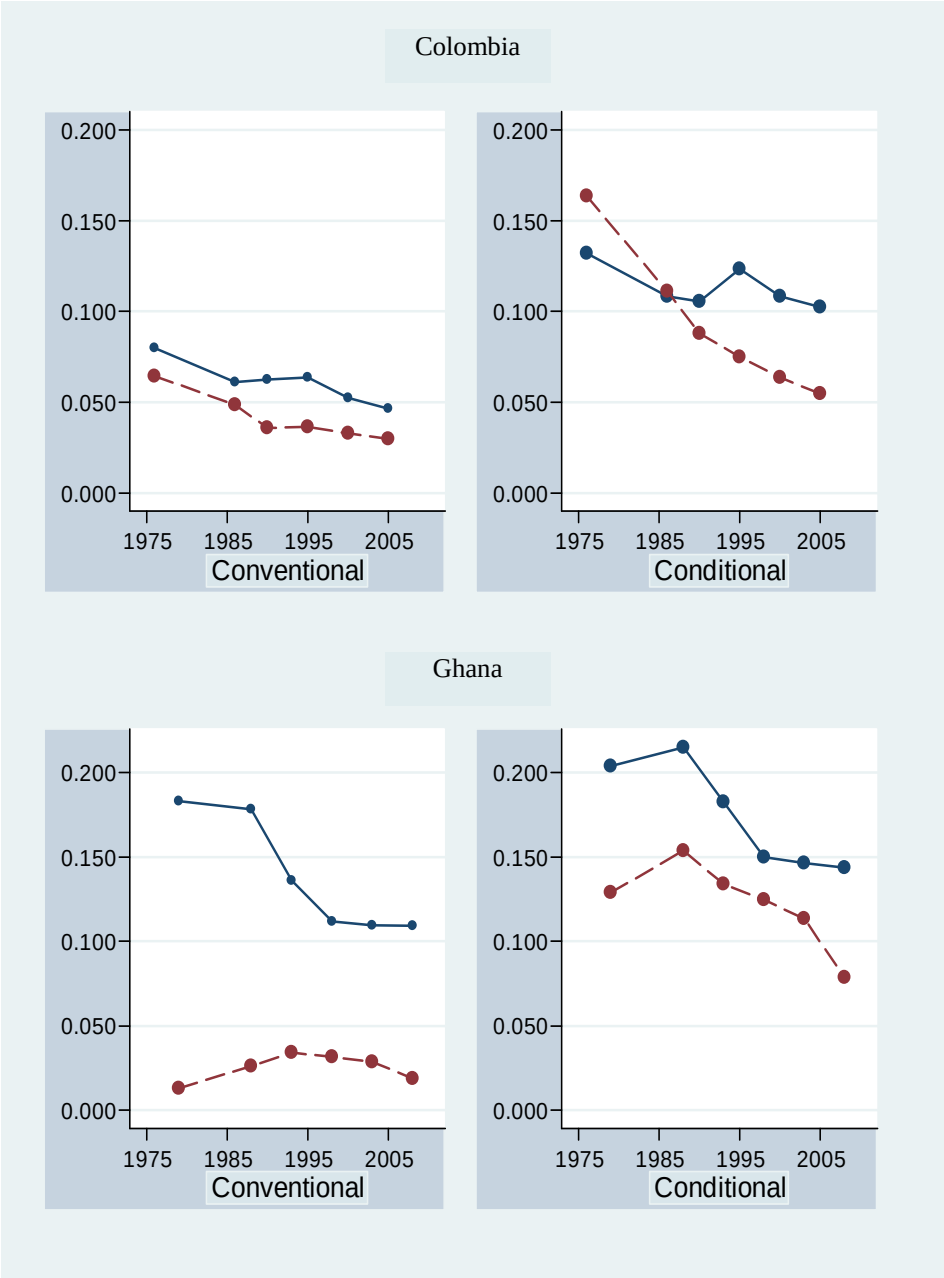


Fig. 3b. Illustration of Trends in Fertility Rates: Conventional Rates and Conditional Rates

Births per Woman-Year, Women Aged 15-49

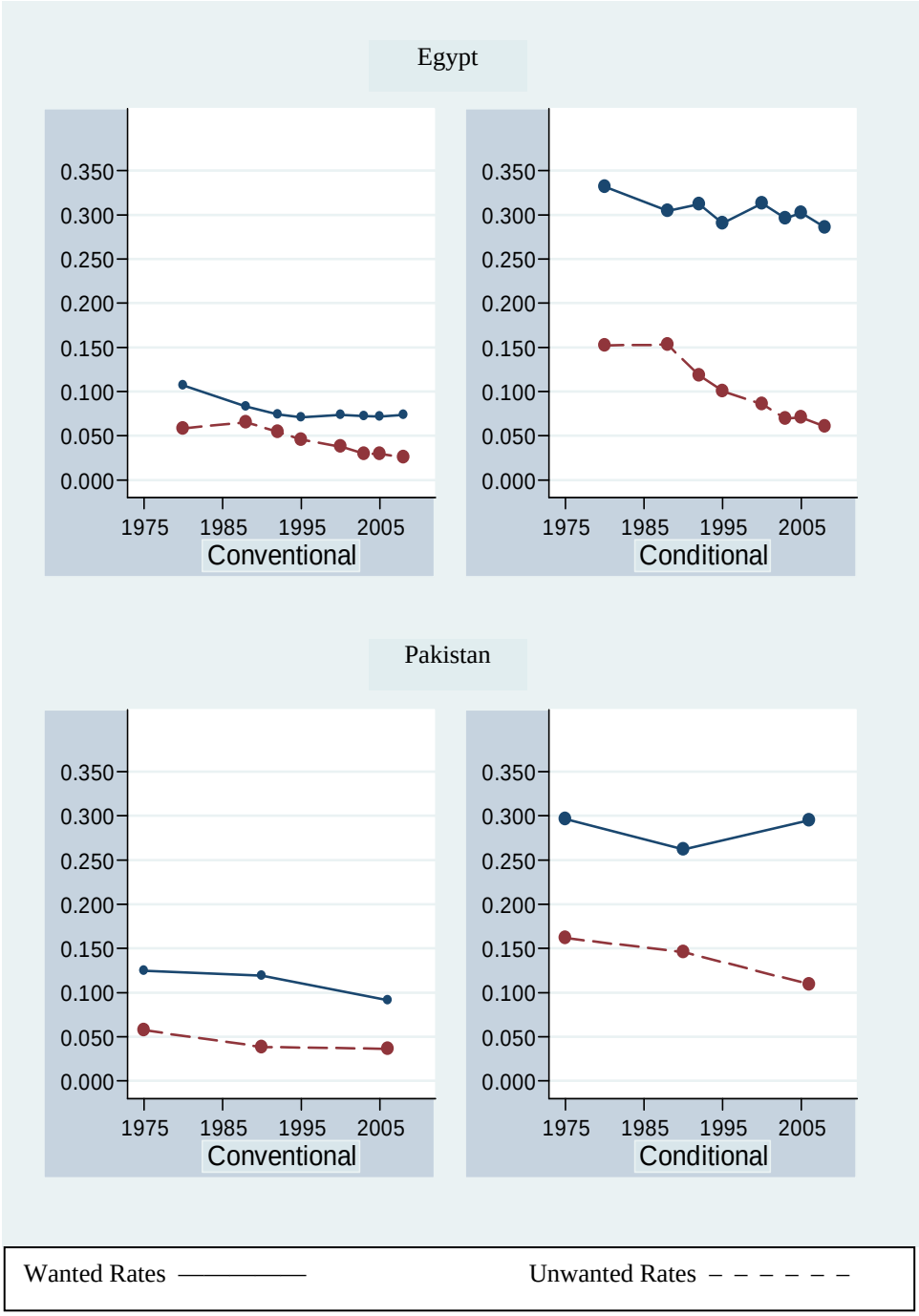
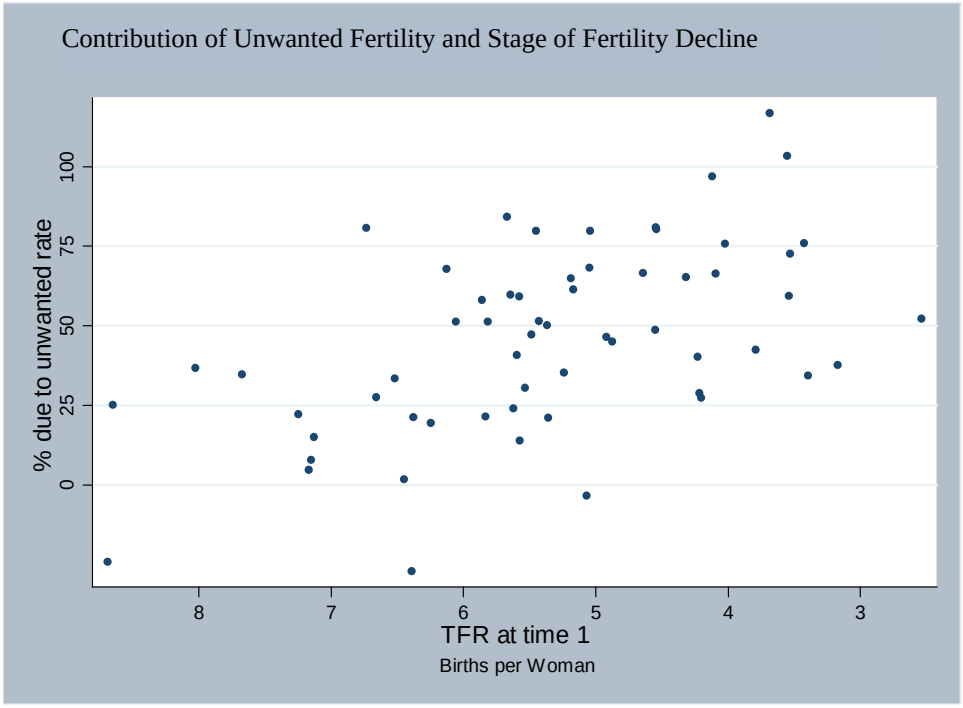


Fig. 4. Association between Contribution of Unwanted Fertility and Stage of Fertility Decline



Equation (2) is the basis for an alternative decomposition that consists of three elements:

- changes in the "conditional" wanted fertility rate (conditional on being at risk of having a wanted birth) r_w
- changes in the "conditional" unwanted fertility rate r_u
- changes in the composition of the population with respect to fertility preferences p_w

The algebra of a decomposition based on Equation (2) is presented in Appendix B.1. The formulae for the three elements just specified are relatively simple:

Wanted rate:	$(r_1^w - r_2^w)\,\bar{p}^w$
Unwanted rate:	$(r_1^u - r_2^u)(1-\bar{p}^w)$
Preference composition:	$(p_1^w - p_2^w)(\bar{r}^w - \bar{r}^u)$

with the subscripts denoting first and second survey and the over-score bar denoting a mean (of the first and second survey values). A key feature of these formulae is that changes in rates are weighted by average composition, and the change in composition is weighted by the average difference in rates. This is entirely sensible. For example, consider the consequence of a change in the wanted rate, which under the formula above is a function of the proportion of the population that "want another child". If one imagines a setting where the proportion wanting another child is very low, then clearly it

is of little import that the wanted rate declines; and the opposite conclusion applies in a setting where the proportion wanting another child is very high. That is, all three elements contain an inter-dependency between rates and composition. This is a very important point to which I return in the final section of this paper.

Empirical results from the application to the 44 countries of the decomposition based on Equation (2) are presented in Table 2. The findings are striking. Whereas the average (median) percentage point contribution of declines in wanted fertility was 73 percent under the decomposition based on the conventional Equation (1b) (Table 1), the average contribution of declines in wanted fertility is 56 percent under the alternative specification of Equation (2). The contribution of declines in unwanted fertility is of almost the same magnitude, an average contribution of 43 percent. That is, under this alternative specification, which I believe conforms more closely to a sensible reproductive model, the empirical experience of the past three decades provides no grounds for attributing fertility decline predominantly and overwhelmingly to declines in fertility demand. Note that the results for Pakistan 1975–2006 resemble the average for the 44 countries—60 percent of the decline is due to the decline in wanted fertility.

Table 2

Decomposition of Fertility Change:
Three-Element Decomposition [a]

Percentage Contribution to Inter-Survey Fertility Change

Multi-Country (n = 44)	Median	1st Quartile	3rd Quartile
Due to Wanted Rate [b]	56	40	70
Due to Unwanted Rate [c]	40	23	62
Due to Composition [d]	1	–2	7
Pakistan	**1975–2006**	**1975–1991**	**1991–2006**
Due to Wanted Rate [b]	60	85	41
Due to Unwanted Rate [c]	39	21	46
Due to Composition [d]	1	–6	13
Total	100	100	100

[a] See text and Appendix B.1.
[b] Births per woman-years at risk of wanted birth.
[c] Births per woman-years at risk of unwanted birth.
[d] Distribution of woman-years between wanting another birth and wanting no more births.

A final interesting, and unexpected, result in Table 2 is the trivial contribution of changes in preference composition. How can this be? Is it not the case that fertility desires fall over the course of fertility transition, with the result that the composition of reproductive-age women shifts from "want another child" to "do not want another child"? This is how Bongaarts (1997), among others, portrays fertility transition. There are two explanations for this puzzling outcome, each of which has some validity (based on my scrutiny of the data). First, note that shifts in preference composition only affect the fertility rate to the extent that wanted and unwanted fertility rates (the conditional rates r_w and r_u) differ from each other. As argued above, it is sensible to weight the

compositional change by the difference $r_w - r_u$, and the algebra in Appendix B.1 makes this explicit. As it happens, the age-specific values for r_w and r_u in many countries do not differ as much as one might assume.[3] Second, most never married women are classified as "want another birth". In some countries such as Pakistan this is assumed rather than directly ascertained, because never married women are not directly asked about their fertility desires. As a consequence, historical trends towards older age at first marriage and larger fractions never marrying exert upward pressure on the proportion "want another birth", everything else being equal. The upshot is that the preference composition of reproductive-age women changes far less over the course of fertility transition than has been assumed in the demographic literature. This is an unexpected empirical finding from this fresh assessment of the components of fertility decline.

The possibility that countervailing nuptiality changes account in part for the surprisingly trivial contributions of compositional change in the decompositions presented in Table 2 motivates a further specification that separates out the nuptiality component. I elaborate Equation (2) by distinguishing women by marital status (never married and ever married) among those women who "want another child". Fertility rates and composition specific to both groups can be defined.

r_n wanted fertility rate among the never married
r_n proportion never married among those who "want another child"

Then we have

$$f = r_u * p_u + r_n * p_n * (1 - p_u) + r_w * (1 - p_n) * (1 - p_u) \quad \ldots \quad \ldots \quad (3)$$

Note a change in the definitions r_w and p_w terms from Equation (2) to Equation (3): r_w now refers to the rate of fertility among those who "want another child" *and* are married. And p_w refers to the proportion of women who both "want another child" *and* are married *among those who "want another child"*. That is, this is a nested specification: the first level distinguishes those who want and do not want another child, and the second level breaks the first group ("want another child") into two sub-groups (never and ever married). The algebra for employing Equation (3) in a decomposition of fertility change is presented in Appendix B.2. This is a five-element decomposition, but for presentational purposes the contributions of the two wanted fertility rates—among the never married and the married, respectively—are combined.

Empirical results are presented in Table 3. As is necessarily the case given the nested specification, the contributions of the unwanted fertility rate and of preference composition are unchanged from the three-element decomposition of Table 2. What has changed in taking into account marriage composition (nuptiality) is the contribution to overall fertility decline of the decline in wanted fertility—the median value of this contribution has declined from 56 percent in the three-element decomposition of Table 2 to 34 percent in the more elaborate decomposition of Table 3. Evidently a substantial proportion of the change attributed to wanted fertility in the simpler decomposition is actually due to nuptiality change. Whether the nuptiality change, in turn, is motivated in part by reduced demand for children is an important question about which the research literature is undecided. My own view is that nuptiality change is primarily driven by

[3]Undoubtedly this is due in part to higher fecundability among those at risk of an unwanted birth.

factors other than falling demand for children; at the same time, the counter-factual of substantial first-marriage postponement while fertility desires remain stable and high may be far-fetched. In any case, there is no decisive evidence for one position or another on this question. If the change in nuptiality is treated as conceptually distinct from changes in wanted fertility, as in Table 3, then one concludes that the leading source of fertility decline has been declines in unwanted fertility. This interpretation is sharply at odds with the account of Pritchett and others who regard declining demand for children as the primary driver.

Table 3

Decomposition of Fertility Change:
Four-Element Decomposition[a]

Percentage Contribution to Inter-Survey Fertility Change

Multi-Country (n = 44)	Median	1st Quartile	3rd Quartile
Due to Wanted Rate [b]	35	20	50
Due to Unwanted Rate [c]	40	23	62
Due to Composition: preferences [d]	1	–2	7
Due to Composition: marriage [e]	15	0	43
Pakistan	**1975–2006**	**1975–1991**	**1991–2006**
Due to Wanted Rate [b]	30	–11	–50
Due to Unwanted Rate [c]	52	38	54
Due to Composition: preferences [d]	4	59	26
Due to Composition: marriage [e]	14	14	70
Total	100	100	100

[a] See text and Appendix B.2. This is a five-element decomposition; for presentation, the two contributions of the wanted rate among the never married and ever married, respectively, are combined in "due to wanted rate".
[b] Births per woman-years at risk of wanted birth.
[c] Births per woman-years at risk of unwanted birth.
[d] Distribution of woman-years between wanting another birth and wanting no more births.
[e] Among those women wanting another birth, distribution of woman-years between never and ever married states.

The Table 3 decomposition also reveals meaningful contributions of change in marriage composition (nuptiality) that also happen to be highly variable across countries. The median contribution is 15 percent. Pakistan is among the countries where the credit attributed to marriage composition is especially large –62 percent for the period 1975–2006, and evidently the main reason for the Pakistan fertility decline during this thirty-year period. Declines in unwanted fertility rank second and have also made a major contribution to the Pakistan decline to date –39 percent during the period 1975-2006. Equally notable results for Pakistan are the complete absence of contributions of declines in wanted fertility and in preference composition, the two components of the decomposition that are most closely linked to demand theories of fertility decline.

Returning to the upper panel of Table 3, while a decline in unwanted fertility is the leading source of fertility decline according to this decomposition, the inter-quartile range

suggests considerable across-country heterogeneity in this effect. To get a feeling for the types of settings (demographic and otherwise) in which the contribution of declines in unwanted fertility is relatively low or high, the decomposition results for the countries with low and high unwanted fertility contributions are shown in Table 4. The five countries with low contribution (upper panel) are primarily in the early stage of fertility decline—the initial TFR exceeds 7.00 in four of the five countries—and they are marked by relatively large contributions of marriage composition. This suggests a tradeoff between nuptiality and unwanted fertility rates as sources of fertility decline, with an indication that the former dominates in the early stage of transition in some countries. The four countries with relatively large unwanted fertility contributions (lower panel of Table 4) are in the middle stage of fertility transition (with the exception of Malawi, which presents results that raise concerns about consistency of measurement across surveys). The decompositions in these four countries differ considerably, with the only commonality other than the large contribution of unwanted fertility being the absence of a contribution of marriage composition (and, in the case of Bolivia and Colombia, nuptiality trends that work *against* fertility decline). The two Latin American countries also show large contributions of declines in *both* wanted and unwanted rates.

Table 4

Countries with Low and High Contribution of Declines in Unwanted Fertility Rate Results from Four-Element Decomposition [a]

4.a Low Contribution

	Jordan 1975 – 2007	Togo 1988 – 1998	Benin 1981 – 2006	Yemen 1979 – 2003	Senegal 1978 – 2005
TFRs	7.09 – 3.59	6.44 – 5.20	7.16 – 5.74	8.69 – 5.81	7.15 – 5.26
Due to:					
Wanted Rate	69	75	16	28	39
Unwanted Rate	–11	1	5	10	10
Composition: pref	–10	0	30	0	4
Composition: marr	52	24	49	62	47
Total	100	100	100	100	100

4.b High Contribution

	Bolivia 1989–2003	Colombia 1976–2005	Malawi 1992–2004	Sri Lanka 1975–1987
TFRs	5.04 – 3.84	4.54 – 2.39	6.73 – 6.04	3.55 – 2.67
Due to:				
Wanted Rate	71	41	–54	1
Unwanted Rate	80	80	80	103
Composition: pref	–8	–4	62	–2
Composition: marr	–43	–17	12	–2
Total	100	100	100	100

a. See text and Appendix B.2.

The decompositions of Tables 2 and 3—which are, to my knowledge, new to the literature—provide a basis for much further exploration of the nature of contemporary fertility declines. One might ask, for example, whether the substantial contribution of the decline in unwanted fertility revealed by this decomposition varies according to pace of decline, stage of fertility transition, or region. Differentials according to each of these three factors are examined in Table 5, which reveals some clear and even surprising findings. First, the most rapid declines are characterised by larger contributions of declines in the wanted rate and in marriage composition (top panel). Declines in the unwanted rate contribute most to the medium-paced fertility declines. Judging from the empirical experience represented by these countries, then, it is not the case achieving a fertility decline more rapid than the average is dependent *per se* on relatively large reduction in the rate of unwanted fertility. Second, the relative contributions of the four elements differ markedly by stage of decline (middle panel): declines above TFR=4.5 are characterised by a rather balanced contribution of all four elements (somewhat less contribution of preference composition), whereas declines below TFR=4.5 are overwhelmingly due to declines in the unwanted fertility rate. This point is also shown graphically in Figure 3, which plots the percentage point contribution of declines in unwanted fertility against the TFR at the start of the historical interval. The association in Figure 3 is rather weak but visible nevertheless—in Table 5, unwanted fertility's contribution is greater in the later stages of fertility decline. There is a clear message here: completing the fertility decline—i.e. progressing downward beyond a TFR of around four births per woman—hinges on successful reduction in unwanted fertility. Finally, regional differentials are presented in the bottom panel in Table 5. Evidently declines in unwanted fertility have made a relatively larger contribution to the Latin American and Asian fertility declines, whereas marriage composition has been crucial in the fertility declines in West Asia and North Africa (and to a lesser extent in the declines to date in sub-Saharan Africa as well).

Table 5

Differentials in the Relative Contributions
to Declines in Fertility
Results from Four-Element Decomposition [a]
Median Percentage Contributions

5.a Pace of Decline [b]

	Slow [< 0.075]	Medium [0.075 – 0.100]	Rapid [>0.100]
Due to:			
Wanted Rate	22	37	34
Unwanted Rate	39	55	24
Composition: pref	3	2	0
Composition: marr	24	3	35
(n countries)	(14)	(15)	(15)

5.b Stage of Decline

	Early $TFR_2 > 4.5$	Later $TFR_1 < 4.5$
Due to:		
Wanted Rate	33	33
Unwanted Rate	21	61
Composition: pref	10	0
Composition: marr	35	6
(n countries)	(20)	(20)

5.c Region

	Sub-Saharan Africa	Latin America	West Asia and North Africa	South and Southeast Asia
Due to:				
Wanted Rate	35	48	28	15
Unwanted Rate	27	61	21	57
Composition: pref	10	1	0	1
Composition: marr	24	–2	50	15
(n countries)	(15)	(13)	(8)	(8)

[a]See text and Appendix B.2.
[b]Births/woman/annum decline.

A caution about the differentials presented in Table 5, this analysis does not adjust for associations among the three factors (pace of decline, stage of decline, region). Suppose, for example, that there are intrinsic differences amongst the regions in the nature of fertility decline, possibly due to regional differences in structural factors such as kinship system and economy. If so, the fact that Asian and Latin American declines are relatively advanced whereas African declines are at an early stage will affect the sharp differential according to stage of decline evident in the middle panel of Table 5, it could be that later-stage fertility declines appear to be driven mainly by declines in unwanted fertility because in the period under observation Latin American and Asian countries predominate in the "Later" category. Or, instead, it could be that the regional differentials evident in the bottom panel of Table 5 are due in part to effects of stage of decline (with the African countries being at an earlier stage). These and other possible confoundings will be addressed in multivariate analysis yet to be conducted.

IV. A NEW AND MORE BALANCED UNDERSTANDING OF FERTILITY DECLINE

This is a study of reproductive change that takes advantage of the large number of national demographic surveys conducted during the past three decades in Asia, Latin America, and Africa. I use this empirical record to address questions that have been hotly debated for decades and that remain salient because fertility decline is by no means complete throughout the globe. The particular focus of this exercise has been the relative contribution of declines in wanted and unwanted fertility to the overall decline of fertility.

Pritchett's influential 1994 article concluded that almost all credit should be attributed to declines in wanted fertility. From this he infers that there is little potential for expanded provision of family planning services to have an impact that justifies their cost.

A revisiting of this argument on Pritchett's own terms indicates that his argument is over-sold: explicit analysis of change (Table 1) reveals a larger contribution of declines in unwanted fertility than his research suggested.

But my departure from this previous literature is sharper and more profound. In my view much of the existing research literature has employed a flawed fertility model. I have proposed an alternative model that I believe is sounder conceptually if evaluated according to demographic or epidemiological logic. This is the model of Equation (2), and elaborated in Equation (3). A decomposition based on this model comes to an entirely different conclusion than Pritchett and others who have been dismissive of the view that reduction in unwanted fertility is usually essential if fertility is to fall to low levels (i.e. near replacement level). In contrast to their dismissive stance, the clear conclusion from the results in Tables 2 and 3 is that declines in unwanted fertility have been, if anything, the single largest source of contemporary fertility declines.

It is important to understand that this conclusion is founded on far more than application of different technical approach. Equations (2) and (3), and the resulting decompositions, express an alternative understanding of the sources of variation in the level of fertility. According to Equation (1), fertility is the sum of a wanted and unwanted component, and either may increase or decrease independently of the other. This equation allows for a fertility decline due overwhelmingly to a decline in wanted fertility—the demand-driven decline perceived by Pritchett and others.

Equations (2) and (3) explicitly acknowledge preference composition, and this transforms the terms of the discussion. Consider again Equation (2):

$$f = r_w * p_w + r_u * (1 - p_w) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

If family size desires decline over time, then *ceteris paribus* the proportion of reproductive age women (or couples) who wish to stop childbearing — $(1 - p_w)$ – should increase. That is, the expectation is that due to the emergence of small family desires an increasingly larger fraction of the reproductive years are spent in the "do not want another child" state. Now note that $(1 - p_w)$ serves as a weight in Equation (2) for the (conditional) unwanted fertility rate r_u. *The implication is that declines in fertility demand have the effect of increasing the potential importance of unwanted fertility as a component of overall fertility.* And therefore fertility decline to low levels will follow from falling demand for children only to the extent that unwanted births can be avoided. Put otherwise, in those reproductive regimes in which a small number of children are desired, it is especially critical that unwanted fertility rates are low. In most societies achieving this condition depends on a reduction in the unwanted fertility rate because, according to the survey data of the past three decades, the (conditional) unwanted rate is moderate or high in the pre- and early-transition period.

The upshot is that more effective birth control is an essential ingredient in a demand-driven fertility decline. This is hardly a new insight, but it has been lost sight of in much of the debate of the past two decades. Separating out wanted fertility is an artificial exercise that ignores the inter-dependencies among fertility desires and unwanted fertility in the determination of overall fertility. To the extent that declines in

the desired number of children results in a decline in p_w (and a corresponding increase in $(1 - p_w)$), such a change if anything confers more importance on rates of unwanted fertility. For this reason it is entirely misleading to argue, as Pritchett and others have over the years, that an empirical demonstration that declining demand for children is the primary force underlying fertility decline serves to undermine the rationale for explicit population policy and, in particular, provision of family planning services. If anything the correct conclusion is just the opposite.

But according to Equation (2), fertility decline can also occur due to declines in the two conditional rates r_w and r_u. How are these to be viewed from the standpoint of the debate about the nature of fertility decline and the potential contribution of public policy?

Beginning with the wanted rate r_w, note that the decomposition results in Tables 2 and 3 indicate that declines in r_w have made a meaningful contribution; that is, the intensity of childbearing among those women who want another child has declined. Matter-of-factly, this may reflect greater birth-spacing, which is one type of improved birth control. But this is a description, not an explanation—why less intensity of wanted fertility? Might this indirectly reflect a decline in desired fertility? This is related to the above discussion of uncertainty about how to interpret nuptiality change and whether there are deliberate and self-conscious links between fertility goals and marriage timing. Just as we lack rigorous empirical assessments of whether reduced demand for children is one reason for later marriage, we lack empirical evidence of whether reduced demand for children underlies the apparent declines in wanted fertility rates.

Finally, and perhaps most critically from the standpoint of the debates about population policy (and family planning programmes in particular), how to interpret the dominant contribution of declines in unwanted fertility rates r_u? The empirical finding is that more effective avoidance of unwanted births among those at risk of such births is the leading source of fertility decline in the observation period. It is beyond the bounds of this paper to account for the reductions in unwanted fertility rates, but the leading explanations can be concisely summarised. Reduction in unwanted fertility could reflect widespread adoption of more effective contraceptive technology, which in turn might be due to the improved access and affordability of such technology. This has been the goal of publicly financed family planning programmes, and the impact of these programmes has been the subject of a large body of empirical research. At the same time it should be noted that adoption of more effective contraception may have been facilitated by reductions in non-access barriers (psychic, social, cultural). Alternatively, the reductions in unwanted fertility rates might be due primarily to more effective use of existing technology, itself a result of improved knowledge (e.g. various kinds of social learning) and/or more determination to avoid unwanted births. The latter could itself reflect reduced demand for children—by this reasoning, the large contributions of declines in unwanted fertility are not necessarily in contradiction to theories that feature change in fertility demand. This again reveals the false terms of much of the recent debate.

A final point is speculative in nature and concerns the nature of pre-transition reproductive regimes, in particular the possibility that African reproductive regimes differ from Western and Asian reproductive regimes in fundamental ways. A common assumption is that fertility in the past in all societies was almost entirely desired. But in fact the earliest fertility surveys in Asia (including the National Impact Survey in Pakistan) and more qualitative materials (diaries, fiction) from the pre-transition period in

Europe the existence of high unwanted fertility of moderately high incidence. The evidence is incomplete and hardly conclusive, but what is available does not suggest there was a time in Asian and European societies of the past when "every child a wanted child" applied. Hence it may be that some unwanted childbearing was a fixed feature of these societies; why this was so requires further thought and investigation. If this is a correct characterisation of these societies, then from the outset a reduction in unwanted fertility was a necessary component of their fertility declines.

African societies, by contrast, show extraordinarily low levels of unwanted fertility in the pre-transition period, if the fertility surveys of the past three decades are to be trusted. As compared to Asian and European societies, the demand for children in pre-transition African reproductive regimes appears to be high. If this too is a correct characterisation, then declines in unwanted fertility will prove to be a far less central feature of fertility decline in this region.

Appendices

Appendix A

Countries and Surveys in Trend Analysis
(n = 44 countries)

Region and Country	Dates of Surveys	
	1st Survey	2nd Survey
South Asia [n = 5]		
Bangladesh	1975	2007
India	1992	2005
Nepal	1976	2006
Pakistan	1975	2006
Sri_Lanka	1975	1987
Southeast Asia [n = 3]		
Indonesia	1976	2007
Philippines	1978	2008
Thailand	1975	1987
West Asia and North Africa [n = 8]		
Egypt	1980	2008
Jordan	1976	2007
Morocco	1980	2003
Sudan	1978	1989
Syria	1978	2001
Tunisia	1978	2001
Turkey	1978	2003
Yemen	1979	2003
Latin America and Caribbean [n = 13]		
Bolivia	1989	2003
Brazil	1986	2006
Colombia	1976	2005
Dominican_Republic	1975	2007
Ecuador	1979	2004
El_Salvador	1985	2003
Guatemala	1987	2002
Haiti	1977	2005
Honduras	1996	2005
Mexico	1976	2003
Nicaragua	1992	2006
Paraguay	1979	2004
Peru	1977	2004
Sub-Saharan Africa [n = 15]		
Benin	1981	2006
Burkina_Faso	1992	2003
Cameroon	1978	2004
Cote_dIvoire	1980	1998
Ghana	1979	2008
Kenya	1978	2003
Lesotho	1977	2004
Liberia	1986	2007
Madagascar	1992	2003
Malawi	1992	2004
Namibia	1992	2006
Rwanda	1983	2005
Senegal	1978	2005
Togo	1988	1998
Zimbabwe	1988	2005

Appendix B

Decomposition Formulae

The expressions below are for effects on age-specific fertility rates (ages 15-19, ..., 45–49). Effects on the total fertility rate [TFR] are obtained by simple (unweighted) summation of the age-specific effects.

Let
- f fertility rate
- r fertility rate conditional on exposure to wanted or unwanted birth
- p proportion
- w want
- u do not want
- n never married
- 1,2 first, second survey
- s "simulated"

B.1. Three-element decomposition of TFR

$$f_1 = r_1^w p_1^w + r_1^u (1 - p_1^w)$$
$$f_2 = r_2^w p_2^w + r_2^u (1 - p_2^w)$$
$$f_1 - f_2 = (r_1^w p_1^w - r_2^w p_2^w) + (r_1^u - r_2^u) - (r_1^u p_1^w - r_2^u p_2^w)$$

Let $\bar{p}^w = \frac{p_1^w + p_2^w}{2}, \bar{r}^w = \frac{r_1^w + r_2^w}{2}$ and $\bar{r}^u = \frac{r_1^u + r_2^u}{2}$

$$f_{sw1} = r_1^w \bar{p}^w + \bar{r}^u (1 - \bar{p}^w)$$
$$f_{sw2} = r_2^w \bar{p}^w + \bar{r}^u (1 - \bar{p}^w)$$

Effect of change in wanted fertility rate:

$$f_{sw1} - f_{sw2} = (r_1^w \bar{p}^w - r_2^w \bar{p}^w) = (r_1^w - r_2^w)\bar{p}^w$$
$$f_{su1} = r_1^w \bar{p}^w + r_1^u (1 - \bar{p}^w)$$
$$f_{su2} = r_2^w \bar{p}^w + r_2^u (1 - \bar{p}^w)$$

Effect of change in unwanted fertility rate:

$$f_{su1} - f_{su2} = (r_1^u - r_2^u) - (r_1^u \bar{p}^w - r_2^u \bar{p}^w) = (r_1^u - r_2^u)(1 - \bar{p}^w)$$
$$f_{sp1} = \bar{r}^w p_1^w + \bar{r}^u (1 - p_1^w)$$
$$f_{sp2} = \bar{r}^w p_2^w + \bar{r}^u (1 - p_2^w)$$

Effect of change in composition:

$$fsp1 = fsp2 = (\bar{r}^w p_1^w - \bar{r}^w p_2^w) - (\bar{r}^u p_1^w - \bar{r}^u p_2^w) = (p_1^w - p_2^w)(\bar{r}^w - \bar{r}^u)$$

And confirming that components sum to overall difference:

$$(f_{sw1} - f_{sw2}) + (f_{su1} - f_{su2}) + (f_{sp1} - f_{sp2})$$
$$= r_1^w \frac{p_1^w}{2} + r_1^w \frac{p_2^w}{2} - r_2^w \frac{p_1^w}{2} - r_2^w \frac{p_2^w}{2} + r_1^u - r_2^u - r_1^u \frac{p_1^w}{2} - r_2^u \frac{p_2^w}{2} - r_2^u \frac{p_1^w}{2}$$
$$+ r_2^u \frac{p_2^w}{2} + \frac{r_1^w}{2} p_1^w + \frac{r_2^w}{2} p_1^w - \frac{r_1^w}{2} p_2^w - \frac{r_2^w}{2} p_2^w - \frac{r_1^u}{2} p_1^w - \frac{r_2^u}{2} p_1^w + \frac{r_1^u}{2} p_2^w$$
$$+ \frac{r_2^u}{2} p_2^w = r_1^w p_1^w - r_2^w p_2^w + r_1^u - r_2^u - r_1^u p_1^w + r_2^u p_2^w = f_1 - f_2$$

B.2. Five-element decomposition of TFR

$$f_1 = r_1^u p_1^u + r_1^n p_1^n (1 - p_1^u) + r_1^w (1 - p_1^n)(1 - p_1^u)$$
$$f_2 = r_2^u p_2^u + r_2^n p_2^n (1 - p_2^u) + r_2^w (1 - p_2^n)(1 - p_2^u)$$

$$f_{sn1} = \bar{r}^u \bar{p}^u + r_1^n \bar{p}^n (1 - \bar{p}^u) + \bar{r}^w (1 - \bar{p}^n)(1 - \bar{p}^u)$$
$$f_{sn2} = \bar{r}^u \bar{p}^u + r_2^n \bar{p}^n (1 - \bar{p}^u) + \bar{r}^w (1 - \bar{p}^n)(1 - \bar{p}^u)$$

Effect of change in non-marital wanted fertility rate:

$$f_{sn1} - f_{sn2} = (r_1^n - r_2^n) \bar{p}^n (1 - \bar{p}^u)$$

$$f_{sw1} = \bar{r}^u \bar{p}^u + \bar{r}^n \bar{p}^n (1 - \bar{p}^u) + r_1^w (1 - \bar{p}^n)(1 - \bar{p}^u)$$
$$f_{sw2} = \bar{r}^u \bar{p}^u + \bar{r}^n \bar{p}^n (1 - \bar{p}^u) + r_2^w (1 - \bar{p}^n)(1 - \bar{p}^u)$$

Effect of change in marital wanted fertility rate:

$$f_{sw1} - f_{sw2} = (r_1^w - r_2^w) \bar{p}^n (1 - \bar{p}^n)(1 - \bar{p}^u)$$

$$f_{su1} = r_1^u \bar{p}^u + \bar{r}^n \bar{p}^n (1 - \bar{p}^u) + \bar{r}^w (1 - \bar{p}^n)(1 - \bar{p}^u)$$
$$f_{su2} = r_2^u \bar{p}^u + \bar{r}^n \bar{p}^n (1 - \bar{p}^u) + \bar{r}^w (1 - \bar{p}^n)(1 - \bar{p}^u)$$

Effect of change in unwanted fertility rate:

$$f_{su1} - f_{su2} = (r_1^u - r_2^u) \bar{p}^n$$

$$f_{spu1} = \bar{r}^u \bar{p}_1^u + \bar{r}^n \bar{p}^n (1 - \bar{p}_1^u) + \bar{r}^w (1 - \bar{p}^n)(1 - p_1^u)$$
$$f_{spu2} = \bar{r}^u \bar{p}_2^u + \bar{r}^n \bar{p}^n (1 - \bar{p}_2^u) + \bar{r}^w (1 - \bar{p}^n)(1 - p_2^u)$$

Effect of change in proportion wanting no more children (preference composition):

$$f_{spu1} - f_{spu2} = (p_1^u - p_2^u)(\bar{r}^u - \bar{r}^n - \bar{r}^w (1 - \bar{p}^n))$$

$$f_{spn1} = \bar{r}^u \bar{p}^u + \bar{r}^n p_1^n (1 - \bar{p}^u) + \bar{r}^w (1 - p_1^n)(1 - \bar{p}^u)$$

$$f_{spn2} = \bar{r}^u \bar{p}^u + \bar{r}^n p_2^n (1 - \bar{p}^u) + \bar{r}^w (1 - p_2^n)(1 - \bar{p}^u)$$

Effect of change in proportion never-married among women wanting more (marriage composition):

$$f_{spn1} - f_{spn2} = (p_1^n - p_2^n)(\bar{r}^n - \bar{r}^w)(1 - \bar{p}^u)$$

The residual (interaction term)

$$= (p_1^u - \bar{p}^u)(p_1^n - \bar{p}^n)[(r_1^n - r_2^n) - (r_a^w - r_2^w)]$$

Appendix C

Illustration of Trends in Fertility Rates:
Conventional Rates and Conditional Rates
Births per Woman, Women Aged 15-49

	Survey	Total Fertility		Conventional Rates[b]		Conditional Rates[c]		% Not Wanting
Country	Year	TFR	Rate[a]	Wanted	Unwanted	Wanted	Unwanted	Another Child
Colombia	1976	4.54	0.144	0.080	0.064	0.178	0.164	39
	1986	3.20	0.110	0.061	0.049	0.144	0.111	44
	1990	2.82	0.098	0.063	0.036	0.122	0.088	41
	1995	2.97	0.100	0.064	0.036	0.102	0.075	49
	2000	2.61	0.085	0.052	0.033	0.089	0.064	52
	2005	2.39	0.076	0.047	0.030	0.080	0.055	55
Ghana	1979	6.24	0.196	0.183	0.013	0.204	0.129	10
	1988	6.41	0.204	0.178	0.026	0.215	0.154	17
	1993	5.16	0.170	0.136	0.034	0.183	0.134	26
	1998	4.44	0.143	0.112	0.032	0.150	0.125	25
	2003	4.45	0.138	0.110	0.029	0.146	0.113	25
	2008	4.03	0.128	0.109	0.019	0.144	0.079	24
Egypt	1980	5.07	0.165	0.107	0.058	0.332	0.153	38
	1988	4.54	0.148	0.083	0.065	0.304	0.153	43
	1992	3.93	0.129	0.074	0.055	0.312	0.118	46
	1995	3.63	0.117	0.071	0.046	0.290	0.101	45
	2000	3.53	0.111	0.074	0.038	0.313	0.086	44
	2003	3.18	0.102	0.072	0.030	0.296	0.070	43
	2005	3.13	0.101	0.072	0.030	0.302	0.071	42
	2008	3.02	0.099	0.074	0.026	0.286	0.060	42
Pakistan	1975	5.83	0.182	0.125	0.058	0.296	0.162	36
	1990	4.91	0.158	0.119	0.039	0.262	0.146	26
	2006	4.08	0.128	0.092	0.036	0.295	0.109	33

[a] Births per woman, all ages 15-49 (not standardised for age).
[b] Wanted and unwanted births per woman, all ages 15-49 (not standardised for age).
[c] Wanted births per ever married woman wanting more, unwanted births per woman not wanting more, age ages 15-49 (not standardised for age).

REFERENCES

Bongaarts, John (1990) The Measurement of Wanted Fertility. *Population and Development Review* 16:3, 487–506.

Bongaarts, John (1997) Trends in Unwanted Childbearing in the Developing World. *Studies in Family Planning* 28:4, 267–277.

Bryant, John (2007) Theories of Fertility Decline and the Evidence from Development Indicators. *Population and Development Review* 33:1, 101–127.

Casterline, John B. and Laila O. el-Zeini (2007) Estimation of Unwanted Fertility. *Demography* 44:4, 729–745.

Freedman, Ronald (1997) Do Family Planning Programmes Affect Fertility Preferences? A Literature Rview. *Studies in Family Planning* 28:1,1–13.

Knowles, James C., John S. Akin, and David K. Guilkey (1994) The Impact of Population Policies: Comment. *Population and Development Review* 20:3, 611–615.

Lightbourne, Robert E. (1985) Individual Preferences and Fertility Behaviour. In John Cleland and John Hobcraft (eds*.) Reproductive Change in Developing Countries: Insights from the World Fertility Survey*. 165–198. Oxford: Oxford University Press.

Pritchett, Lant H. (1994) Desired Fertility and the Impact of Population Policies. *Population and Development Review* 20:1, 1–55.

Comments

Brief

Pakistan is experiencing rapid population growth despite the fact that it was one of the first countries in the world to initiate an organised family planning programme back in 1965. The underlying causes for the limited success of the programme are many, however, the most obvious ones the limited and wavering political and bureaucratic support, very low literacy levels, nearly non-existent in females, and strong religious opposition. In this context, John Casterline's contention that family planning programmes affect fertility through influencing the unwanted fertility is very appealing, though apparently it may not look very desirable.

The decomposition of fertility into wanted and unwanted fertility shows that about 43 percent decline in fertility was attributable to unwanted pregnancy. Interestingly, the result shows a very trivial contribution of changes in composition of preference. Casterline attributes this to possible changes in age of marriage, which might have a countervailing effect on the compositional change.

The net contribution of changes in age of marriage, though they may vary considerably across countries, is not trivial; the median being 15 percent. However, for Pakistan, this is especially large –62 percent for the period 1975–2006. Surprisingly, the analysis shows no contribution of decline in wanted fertility during this period. Casterline raised the question whether this is true or is it a fallacy of the way the analytical model is set up? Dr Zeba Sattar elaborated further using Pakistan-specific data and concluded that the contribution of unwanted fertility is roughly half of the total fertility decline.

Discussant's Comments

I enjoyed reading the paper. As a firm believer in the merits of family planning programmes and their contribution to demographic transition, I have always believed that organised efforts to change people's perception about the virtues of small family size have played a major role in the worldwide fertility revolution and Casterline's analysis has further confirmed my belief.

What I failed to fully appreciate is that the past programmatic efforts had no impact on wanted fertility in Pakistan. Is it because the programme efforts were meager or is it because the Pakistani society is so rigid that no efforts are likely to succeed in changing its attitudes and behaviour.

Either way, this is a bleak scenario for the reproductive health/family planning programme, which needs to be carefully evaluated. We have a tendency to quickly embark on new surveys and studies without fully exhausting already existing data sources. In my view, time has come when we should immediately start looking more

closely at all the evidence we have gathered over the years, through surveys, operational studies, qualitative studies, etc. in a holistic manner, before we undertake any more studies to find out the underlying causes for this behaviour.

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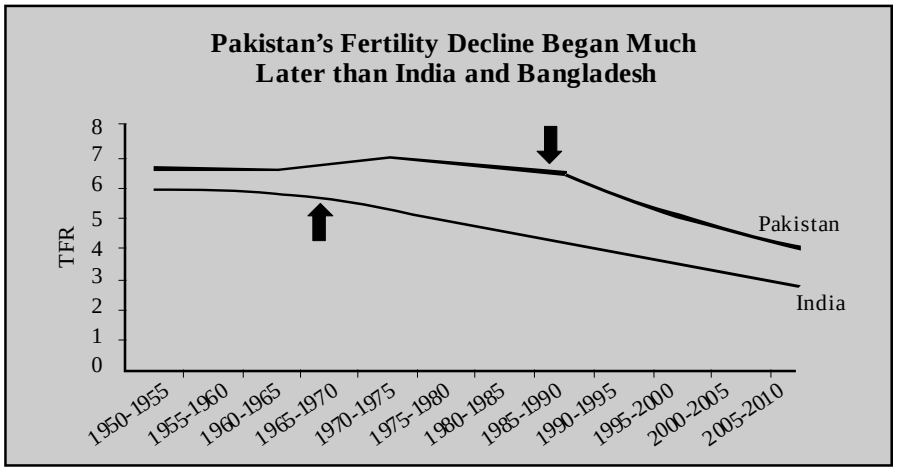
Comments

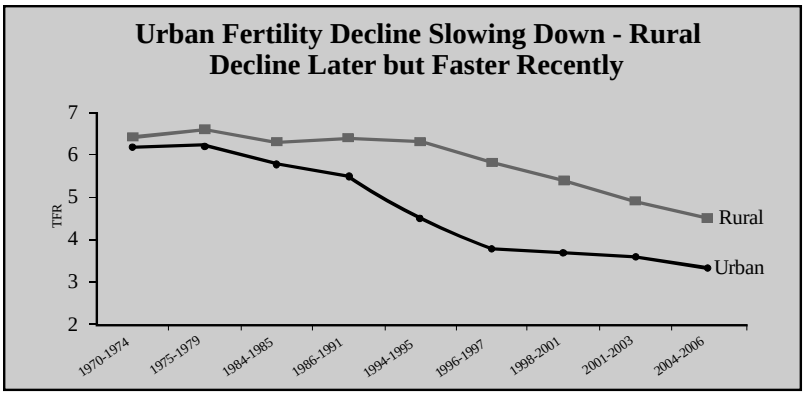
I want to begin by thanking PSDE for giving me the privilege of discussing the Mahbub ul Haq Memorial lecture by John Casterline. This is especially so because of my long friendship, with John Casterline since 1980. We have worked together in the 90s and continue to plan a future project on unmet need in Pakistan. John Casterline's lecture is in his classic style: it is *Illuminating, Enticing, Engaging* and plain challenging for any reader. He never fails to surprise us with his insights and novel thinking, matched with a complete analysis and a grasp of the data.

I would like to restrict my comments on highlighting the relevance and usefulness of his work for Pakistan's current scenario where we are seeking answers to our own Demographic Transition and preparing the 10th Five Year People's Plan 2010-15. The demographic transition in Pakistan started late—it sped along initially and is now stagnating or slowing down and many questions remain unanswered about why. Why was the transition late? Why rapid and then slow later? I will not try to amplify some of points he has already made, but mainly raise points about applicability of the model to answer these questions.



Source: UN World Population Prospects, 2008 Revision. Medium Variant.

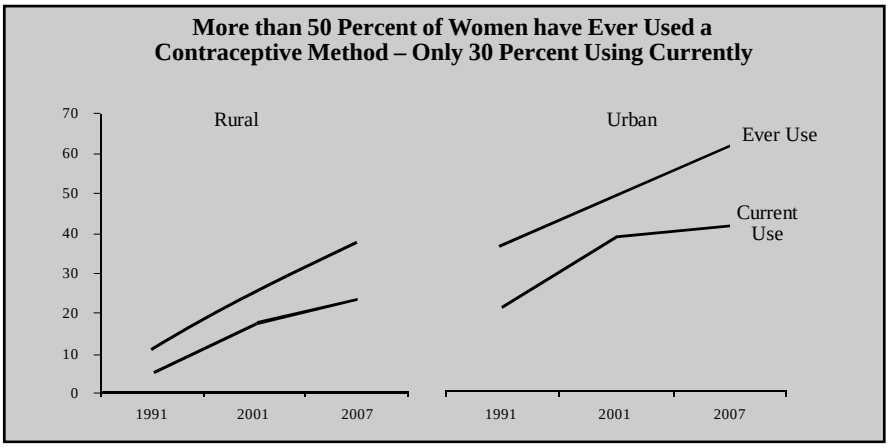
When trying to make sense of country wide transition, which has reached a total fertility rate of 4, we need to look at urban rural fertility trends. On first glance we can see that urban-rural differentials started small, with both rural and urban areas having a fertility rate of more than 6 births per woman. During the 1990s the differential grew bigger, with urban fertility declining at a more rapid rate. Since the turn of the century, the gap in urban-rural fertility levels has been narrowing, reflecting a slowdown in urban fertility decline coupled with a continuing decline in rural fertility.



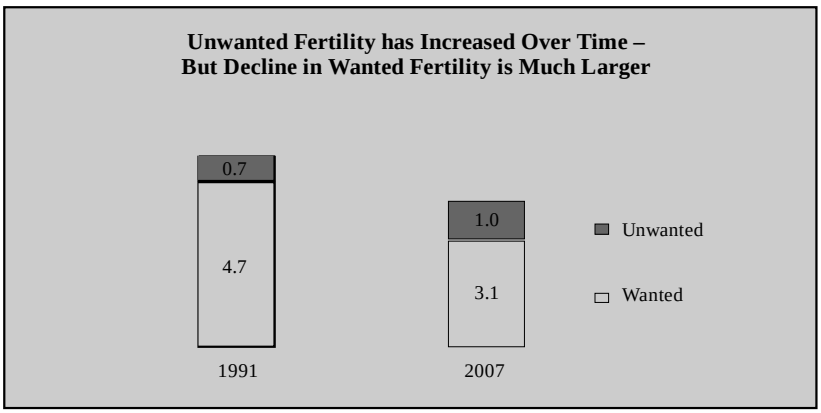
Source: PDS 1985 till 2005; PCPS 1984-85; PDHS 1990-91; PCPS 1994; PFFPS 1997; PRHFPS 2001; SWRHFPS 2003; PDHS 2006-07.

While ever use of contraception remains higher in urban areas, there is "catching up " in rural areas. For current use there is a leveling off of in urban areas and a slight slowdown in the rate of increase in rural areas.

The decomposition technique utilised by Casterline becomes really very important in understanding transitions generally and in Pakistan particularly. A common assumption is that increased supply of services will ensure a reduction of fertility. Contraceptive use affects fertility but Professor Casterline argues that its contribution is really broken down into wanted vs. unwanted fertility with very different dimensions.



In this context, it is important to look at differentials over the 1991-2006 time period. A decline in total fertility of 1.3 children resulting from a 1.6 decline in wanted fertility but an increase of 0.3 in unwanted fertility. That means the impact of a reduction in wanted fertility is being undermined by the increase in unwanted fertility. The decomposition by regions (urban-rural) is as important. Unwanted fertility declined in urban and rose in rural areas. A further comparison with 1975 data would be instructive.



Source: PDHS 1991 and 2007.

Turning to methodological issues, I can only say that I am curious as to how further analysis can take place using this model.

Methodological Questions

1. How robust is the method to inconsistencies in reporting of wanted and unwanted fertility?

The wanted or unwanted fertility as the main driver of trends has different proponents. Pritchett and Bongaarts belong to different sides of the debate. Pritchett argues strongly for wanted fertility as the main driver, while Bongaarts claims it is unwanted fertility. Both do point out that preferences can be fragile, and there are variations in reporting in by men and women, etc. Can we trust responses given by individuals?

2. This is the role of marriage—is it fair to treat unmarried women as part of the group at exposure to wanted fertility?

Marriage behaviour brought in by Casterline in his model is very important. Firstly, marriage prospects are such a powerful part of fertility desire and presumably WANTED fertility in a country like Pakistan. Casterline assumes that years of non-marriage, are years of wanted fertility and not unwanted fertility. Non-marriage being a period of non-exposure, it would affect the impact of wanted fertility on overall tends and is very significant in the case of Pakistan. Perhaps Casterline could elaborate on the justification of this assumption. How is this factored in and how would you interpret this huge contribution? How and why has age at marriage risen so significantly, is an interesting and challenging question in itself?

3. How would you use the method ’s predictive powers?

How can we use the model to project forward? Bongaarts in his decomposition of unmet need and momentum is doing something similar. What are the methodological differentials and differences in interpretation?

4. How would this pan out for largely heterogeneous populations and sub groups e.g. India and China. Could one large group's behaviour change the story for rationally? How would the model work in disaggregated populations? Urban-rural or provincial in the case of a country as large as Pakistan, or let's say India or China? Is there robustness in the model or is aggregation help an integral part of the model?

RESULTS

I would like to use this opportunity to discuss the results for Pakistan.

The importance of this research is huge—changes in Pakistan are explained here as I read and reread this paper. In this decomposition Pakistan is similar to average trends but it is also quite different—differences across the two periods are especially interesting. For instance, wanted fertility declines in 1975-1991 are higher that unwanted fertility decline (30 percent vs. 21 percent) but in 1991-2000 unwanted declines are 26 percent larger and much higher (46 percent). Much more interpretation is required to determine the factors behind this. It is important to point out, that the largest contribution to fertility decline is of marriage—much less of wanted fertility and even less of unwanted fertility. This too requires us to do much more careful interpretation.

Decomposition of Fertility Change: Four-Element Decomposition

Percentage Contribution to Inter-Survey Fertility Change

Pakistan	1975-1991	1991-2006	1975-2006	Median
Due to Wanted Rate	30	–27	–2	35
Due to Unwanted Rate	21	46	39	40
Due to Composition: Preferences	–6	13	1	1
Due to Composition: Marriage	55	68	62	15
Total	100	100	100	91

In the end, I can make two points safely.

Firstly, both wanted and unwanted fertility are important components of total fertility. Wanted and unwanted fertility both contribute differentially at different points in transition. It is important to remember the theme of today—wanted fertility is determined by human characteristics, particularly education. Investing in people, Pritchett too lays importance to girls schooling as a lever emphasised by Larry Summers in 1992—Investing in all people means not leaving girls behind!

Secondly, good quality Family Planning services—that highlighting birth spacing rather than limiting—that are equitable, cheap, and accessible for all women are a must. CPR—the means to the end has to rise for fertility to fall. Marriage is unlikely to contribute endlessly to fertility decline. Therefore, contraceptive use has to increase, for reducing population growth, for lowering child mortality and maternal mortality and as a fundamental right to achieve desired fertility.

CONCLUSIONS

It appears that Pakistan has untapped potential in terms of reducing wanted fertility.

The role of increased schooling for girls, employment, poverty reduction in further decline in wanted fertility and therefore in overall fertility is huge.

High levels and rises in unwanted fertility imply even greater opportunities lost for fertility decline.

The importance of widely/easily available, low cost, and high quality family planning services is compelling when addressing high unwanted fertility.

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Comments

According to the author, the distinction between wanted and unwanted fertility has been crucial in many of the more intense debates in recent decades, particularly the potential contribution to expansion of the provision of family planning. The decomposition of fertility decline in 44 countries indicates that the contribution of unwanted fertility had been as important, if not more, to decline in wanted fertility. He concludes that decline in unwanted fertility has been an essential feature of contemporary fertility decline and therefore, an in-depth understanding of Pakistan's ongoing fertility transition could best be understood if one could fully understand the trends in wanted and unwanted fertility in Pakistan over the last 45.

The ongoing demographic transition in Pakistan is not fully understood and in many ways remains a mystery. If therefore, the trends in wanted and unwanted fertility could shed some light; it will be a real contribution to our ongoing family planning programme debate. This debate however, is not a new one. It was furiously debated and argued in 1970s and 1980s, when East and South-East Asian countries started their rapid fertility transitions. Lot was written about the role of unwanted fertility in these declines. A better understanding however, of what women mean when they respond to questions on topics such as wanted and unwanted births, ideal/preferred number of children, and what factors (environmental and psychological) influences their responses, lead researchers to conclude that responses to such questions are highly conditioned to the respondent immediate environment/exposure, such as recent exposure to mass media messages, to discussions at parental clubs (South Korea) or to other similar situations and therefore, responses are very subjected and have questionable validity. (For further elaboration see Ronald Freedman (1997) and references quoted there in. Also see KIHASA reports).

The topic of the lecture is very timely. Pakistan is at the verge of revamping its RH/FP programme. The programme is being drastically modified/changed. Surprising though, these changes are being implemented with very limited understanding of underlying causes for past failures. A thorough understanding will require considerable efforts, time and resources and should have been done in a systematic way over the years. Most of the past efforts were directed to address specific programme's operational and implementation issues and did not address the broader societal level issues working against the acceptance of small family norms by the population at large. Even where data were available very limited efforts were directed to analyse the data beyond the survey objectives. Professor Casterline's provocative presentation on fertility transition using secondary data sources has provided us an opportunity to rethink our future demographic data analysis priorities. We are not short of raw data, but we are short of commitment and

patience and institutional capacities. No other institution in Pakistan is better equipped than Pakistan Institute of Development Economics undertake this challenge and as student of demography I will humbly urge the Institute to lead an effort to undertake a series of studies to document last 60+years of demographic changes and the lesson learned.

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REFERENCE

Freedman, R. (1997) Do Family Planning Programmes Affect Fertility Preferences? A Literature Review. *Studies in Family Planning* 28:1, 1–13.