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The Proximate Determinants of Fertility

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1 Introduction

Kingsley Davis and Judith Blake (1956) proposed the first systematic classification of what they termed the intermediate variables through which economic, social and other factors must operate to influence fertility itself. Davis and Blake identified eleven intermediate variables, which they placed in three groups: factors affecting exposure to intercourse; factors affecting exposure to conception; and factors affecting gestation and successful parturition. Absent from the set of intermediate variables identified by Davis and Blake is lactation, variation in which is now recognized as a principal source of societal variation in fertility. The model developed by John Bongaarts (1978) incorporates this factor. Moreover, Bongaarts presents evidence that most of the variation in fertility levels among national populations is attributable to just four intermediate or 'proximate' determinants, namely marriage, contraception, abortion and post-partum infecundability. The latter is mainly a function of lactation.

One of the strengths of the WFS programme is the provision of broadly comparable data on the major proximate determinants of fertility for a large number of countries. Data have been collected in all WFS countries on the timing of first unions, union dissolutions, breastfeeding and contraceptive use.[1] With these data it is possible to study variation in the proximate determinants not only across countries but also among socio-economic subgroups within countries. Other reports in the *Comparative Studies* series investigate levels and socio-economic differentials in specific proximate determinants in detail.[2] In this report, the fertility-reducing impacts of three of the four major proximate determinants identified by Bongaarts — marriage, contraception and post-partum infecundability — are considered together. Examination of the three determinants in one analysis permits identification of uniformities and patterns in the relationships among them.

To simplify and structure the analysis, the model proposed by Bongaarts (1978) is adopted. It is multiplicative and expresses the actual level of fertility (the total fertility rate, TFR) as the outcome of the fertility-reducing effects of the four main proximate determinants on a total fecundity rate (TF), which represents the hypothetical fertility level in the absence of any reduction by the four determinants:

$$TFR = C_m \times C_c \times C_a \times C_i \times TF \qquad (1)$$

where C_m is the index of nuptiality, C_c the index of contraception, C_a the index of abortion and C_i the index of post-partum infecundability. The index of abortion is omitted from this application, due to lack of data for all countries.

The complement of each index represents the proportionate reduction in fertility attributed to the determinant. Under this model, the estimated proportionate reduction obtains regardless of the levels of the other determinants. This means that the effects attributed to each determinant are measured independently of the effects of other measured or unmeasured factors.

In section 2 the construction of each index is described in detail. As each one is based on age-specific inputs, the construction is somewhat complex, but the underlying principles are simple:

1 C_m is a weighted index of time spent within union during the five years preceding the survey. Observed age-specific marital fertility rates serve as the weights. Thus, the assumption is made that women not in a union would experience the same fertility as their married counterparts if they themselves were married.

2 C_c is a weighted index of one minus the proportion currently using contraception at the survey date, with the proportion using adjusted for the assumed effectiveness of specific methods used and for the assumed level of infecundability by age. Estimated natural (marital) fertility rates (which are influenced by fertility-reducing effects of post-partum infecundability) serve as the weights, so that contraceptive use is assumed to curtail natural marital fertility.

3 C_i assumes an average live birth interval of 20 months in the absence of any effects of lactational amenorrhoea and post-partum abstinence and a fixed relationship between the duration of breastfeeding and that of lactational amenorrhoea. The ratio of the assumed interval length in the absence of breastfeeding and the estimated interval length given observed durations of breastfeeding is taken as the measure of the fertility impact of lactation-induced post-partum infecundability. C_i, like C_m and C_c, is a weighted index, with estimated age-specific total fecundity rates serving as the weights.

Note that the model assumes an ordering of effects: post-partum infecundability modifies total fecundity, contraceptive use modifies natural marital fertility, and nuptiality modifies observed marital fertility.

[1]Data on foetal wastage, including induced abortions, in some countries have been collected (Casterline and Ashurst forthcoming). For a few countries information on coital frequency is available (Cleland *et al* forthcoming). Because of the incomplete coverage and questionable quality of these data, they are not examined in this report.

[2]Age at First Marriage (D. Smith, no 7), Contraceptive Practice (E. Carrasco, no 9), Urban–Rural Differentials in Contraceptive Use (R. Lightbourne, no 10), Breastfeeding (B. Ferry, no 13), Differentials in Age at First Marriage (J. McCarthy, no 19) and Breastfeeding Differentials (B. Ferry and D. Smith, no 23), Marriage Dissolution and Remarriage (David P. Smith, Enrique Carrasco and Peter McDonald, no 34), Differentials in Contraceptive Use (Zeba A. Sathar and V. C. Chidambaram, no 36).

We analyse data from twenty-nine countries: five African, twelve Latin American/Caribbean and twelve Asian/Middle Eastern. Results at the national level are presented, but the emphasis of this report is on findings for socio-economic subgroups. We choose to examine education and residence subgroups because numerous other studies demonstrate that these two variables are among the most powerful correlates of reproductive behaviour (Kuznets 1974, Cochrane 1979) and because they are measured in roughly comparable ways in all WFS surveys.

2 Measurement of the Components of the Model

An attractive feature of the Bongaarts approach is the minimal data requirements. Ignoring C_a, all components can be calculated from the following: (a) age-specific fertility rates, (b) age-specific marital fertility rates, or proportions currently in union, (c) age-specific proportions currently using contraception, and the distribution of users by type of method, and (d) the average length of breastfeeding (Bongaarts and Potter 1983). (Throughout this section, references to Bongaarts are to Bongaarts and Potter 1983, unless otherwise specified.) These figures are typically available in published form where a survey has been carried out, so that the primary data source need not be consulted.

The minimal data needs are in part inherent in the design of the model and in part the consequence of simplifying assumptions. Some of the simplifying assumptions are of questionable validity, but the extent to which violation of them distorts findings has not been explored empirically. As we have access to the primary data for each country, we are not bound to all of the simplifications and are thus in a position to assess the sensitivity of the model to differing measurements of the indices.

In this section we specify the construction of the indices utilized in this analysis and assess the impact of alternative constructions. Two general considerations, both following from the decision to examine residence and education subgroups, guide the measurement of all components. First, in view of large differences in age structure between subgroups and the tendency for most aspects of reproductive behaviour to be age related, all components are constructed from age-specific measures. Secondly, efforts were made to maximize the amount of experience on which the indices are based and thereby increase sampling precision; this is achieved by using a five-year reference period for the TFR and C_m.

For ease of reference, the construction of all components of the model is specified in appendix A.

2.1 TOTAL FERTILITY RATE (TFR)

We calculate the TFR, conventionally, as

$$\text{TFR} = 5\Sigma f(a) \tag{2}$$

where the f(a) are age-specific fertility rates for five-year age groups, ages 15–49. The rates are calculated for the five-year period preceding the survey. For the model to be internally consistent, births occurring outside the marital exposure which C_m represents should be excluded from the f(a). Hence, the f(a) are based on births occurring *within union only* (ie the f(a) are 'legitimate' fertility rates), as determined by fitting together the separately gathered maternity and union histories. Calculation of these rates clearly relies heavily on the accuracy of the two histories. In the decision to use within-union rates we follow the Bongaarts formulation, but previous studies by necessity have utilized TFRs based on all births, within union and extra-union. The two TFRs are compared in table 1. The TFR based on within-union births only is, on average, about one-quarter of a child smaller than the more commonly used TFR, with the difference greatest for women with less schooling and for women residing in rural areas. The country showing the greatest difference at the national level is Kenya (0.85 births), followed by Lesotho (0.49),

Table 1 Comparison of TFR calculated from all births and from within-union births only

Subgroup	Mean difference[a]	Number of cases with absolute difference			
		<0.10	0.10–0.24	0.25–0.49	0.50+
National	0.23	10	7	10	2
No schooling	0.30	6	5	3	5
1–3 years	0.35	5	2	4	6
4–6 years	0.25	8	2	10	2
7+ years	0.19	6	8	4	1
Major urban	0.18	11	7	7	1
Other urban	0.23	11	2	12	2
Rural	0.24	11	5	7	5

[a]TFR for all births minus TFR for within-union births.
NOTE: TFR expressed per woman. Subgroups containing less than 200 currently in union women are excluded.

Jamaica (0.47), Colombia (0.42), Costa Rica (0.41) and Paraguay (0.40). These relatively large differences can be attributed mainly to the treatment of pre-union births, as births during periods of union dissolution are less frequent. Differentials among countries and subgroups in the size of the difference between the two TFRs is one justification for using the within-union rates, as otherwise cross-national and subnational relationships will be affected by differentials in levels of extra-union fertility.

2.2 INDEX OF MARRIAGE (C_m)

The index of marriage is based on the simple assumption that women not in a union would experience the same fertility as their married counterparts if they were themselves in a union.

C_m is calculated as

$$C_m = \frac{TFR}{TMFR} = \frac{\Sigma f(a)}{\Sigma f(a)/m(a)} = \frac{\Sigma f(a)}{\Sigma g(a)} \quad (3)$$

where TMFR is the total marital fertility rate, the m(a) are age-specific proportions of time spent within union during the five years preceding the survey and the g(a) age-specific marital fertility rates based on within-union births only. The five-year reference period for C_m ensures consistency with the TFR. Again, accurate dating of events in the union history, in particular complete reporting of periods of dissolution, is assumed. Current union status may on balance be more accurately reported, but where there have been recent rapid changes in union status distributions the current status data will not be appropriate for the five-year period on which the fertility rates are based.

In table 2 the C_m based on five years of exposure is compared with a C_m constructed from proportions currently in union at the survey date (ie proportions currently in union are used as the m(a) in equation 3). The former is, at the national level, always equal to or larger than the latter, which indicates that the current status data show greater lost union exposure. The average difference, at the national level, is about three points out of one hundred. The differences may be due to under-reporting of time spent in dissolution, or change over the five-year period in the age-specific proportions in union (due, for example, to a rise in age at first union). A displacement backwards in time of dates of recent first unions would have the same effect as a genuine rise in age at first union. Countries with relatively large differences are North Sudan (0.060), Dominican Republic (0.055), Trinidad and Tobago (0.053), Venezuela (0.050) and Peru (0.040). The relatively large differences for Philippines (0.040) and Sri Lanka (0.040) are probably related to the marked recent rise in age at first marriage shown by the union history data from these two surveys. In general, however, the national-level figures, along with the finding of larger differences for less educated and rural women, suggest that incomplete reporting of periods of dissolution contributes more to the differences than secular changes in patterns of union formation and dissolution.

Despite indications that the fertility impact of lost exposure is slightly underestimated, we retain the C_m based on a five-year reference period in this analysis, to maintain consistency with the measurement of the TFR.

We also examined the impact on C_m of another optional feature of the standard construction. Bongaarts recommends that the marital fertility rate (g(a)) for women aged 15–19 be taken as 0.75 of the rate for women aged 20–24, because the marital rates for women aged 15–19 do not properly reflect the potential fertility of all women throughout this age interval, due to the short average marital durations and the high incidence of pre-marital conceptions of within-union women aged 15–19 (the latter leading to selection of more fecund women). The observed mean marital fertility rates, across all countries and subgroups included in this study, are 0.371 both for women aged 15–19 and for women aged 20–24. The mean imputed rate following Bongaarts' recommendation for women aged 15–19 is 0.278, which, given the likelihood of some degree of adolescent subfecundity, seems a more plausible rate of childbearing at these ages and is therefore adopted for this

Table 2 Comparison of two constructions of C_m: within-union exposure for the five years preceding the survey[a] and proportions currently in union at the survey[b]

Subgroup	Mean difference[c]	Mean absolute difference	Number of cases with absolute difference					Correlation between two C_ms
			<0.015	0.015–0.029	0.030–0.044	0.045–0.059	0.060+	
National	0.030	0.031	4	10	11	3	1	0.99
No schooling	0.033	0.036	4	4	4	6	1	0.97
1–3 years	0.038	0.039	3	2	3	8	1	0.96
4–6 years	0.032	0.034	5	5	5	3	3	0.96
7+ years	0.020	0.020	9	5	3	2	–	0.99
Major urban	0.029	0.031	1	14	5	6	–	0.99
Other urban	0.032	0.033	5	8	7	6	1	0.97
Rural	0.034	0.035	3	6	12	7	1	0.98

[a]The measure is calculated as TFR/TMFR. Both rates are based on within-union births during the five years preceding the survey; within-union exposure is used for the denominator of the age-specific marital fertility rates.
[b]The measure is constructed as a weighted average of proportions currently in union at the survey date, using as the weights age-specific within-union fertility rates for the five years before the survey.
[c]C_m constructed using five-year exposure data minus C_m constructed using proportions currently in union at the survey date.
NOTE: Subgroups containing less than 200 currently in union women are excluded.

analysis. Imputing the rate in this fashion has a moderate impact on C_m. If the observed marital rates are used instead when calculating the TMFR, C_m is smaller by 0.037 on average (at the national level), the difference being slightly larger for better educated and urban women.

2.3 INDEX OF CONTRACEPTION (C_c)

The construction of C_c assumes that contraceptive use reduces marital fertility rates from estimated natural marital fertility rates. The estimated natural fertility rates are obtained by dividing observed within-union fertility by the proportion of within-union exposure to risk of conception lost due to contraception. In determining the lost exposure, the effectiveness of methods used and presumed age-specific levels of infecundability are taken into account.

C_c is calculated as

$$C_c = \frac{\Sigma tn(a)cc(a)}{\Sigma tn(a)} = \frac{\Sigma tn(a)[1 - \{u(a,m)e(m)/fec(a)\}]}{\Sigma tn(a)} \qquad (4)$$

where cc(a) are age-specific indices of contraception, tn(a) is a schedule of natural marital fertility, obtained as g(a)/cc(a), u(a,m) are age- and method-specific proportions of currently in union women currently using contraception, e(m) is a set of method-specific effectiveness weights, and fec(a) is a schedule of age-specific proportions fecund. Women breastfeeding a child aged six months or less are automatically counted as non-users in the u(a,m) to avoid double-counting of protection provided by breastfeeding and contraception. The fec(a) are means of proportions self-reported fecund in 28 WFS surveys. Note that C_c reflects levels of use at the time of the survey, whereas the TFR and C_m pertain to the five-year period preceding it. WFS surveys did not collect information permitting a reconstruction of the history of use over these five years by month or by year. Skeletal information on use in the open and last closed birth interval can be utilized to fill in some of this period, if certain assumptions are made (see Hobcraft and Little 1984).

Equation (4) is taken directly from Bongaarts, but there are alternative measurements of several of the elements. For some we depart from previous applications of the Bongaarts model. Here we consider three types of variations in the construction of C_c: age-specific versus non-age-specific construction; correction of the u(a,m) for overlap between use and lactation; and alternative schedules of the fec(a).

Bongaarts (1978) proposes that the age pattern of the tn(a)/fec(a) (that is, the fertility rate of fecund women) is relatively flat and that the age pattern of u(a,m)·e(m), which normally will take an inverted U-shape, can for practical purposes be ignored, so that equation (4) is well approximated by

$$1 - 1.08ue \qquad (5)$$

where 1.08 is the weighted mean $\Sigma\{tn(a)/fec(a)\}/\Sigma tn(a)$, u is the mean of age-specific proportions of currently in union, non-pregnant women currently using contraception, and e is the mean method effectiveness of all current users.

In table 3, panel A, we compare C_c indices constructed from equations (4) and (5). (Neither C_c is corrected for overlap between breastfeeding and contraception.) The two sets of indices differ hardly at all. Note that the differences between the non-age and age-specifically constructed C_c indices are greatest for those subgroups with the highest levels of use — the better educated women and urban residents. Among better educated women, for example, the C_c constructed age-specifically is roughly 0.015 greater than the non-age-specific C_c, that is, the age-specific C_c indicates slightly less fertility-reducing impact of contraceptive use. This occurs because users are concentrated at ages 30 and above, which are given less weight by the tn(a) weights of equation (4). An adjustment for improvement with age in *method-specific* use effectiveness — as contrasted with a changing method mix with age, which equation (4) takes into account — would possibly eliminate the difference shown in table 3. But the evidence we have seen (Laing 1981) suggests that variation in method use effectiveness with age is slight compared to the differences between methods in use effectiveness.

The calculation of C_c can be further simplified by defining u in equation (5) as the overall proportion using contraception, rather than the mean of the age-specific proportions. In fact, sometimes Bongaarts does not specify that u designates the mean of the age-specific proportions (see, for example, Bongaarts 1982), leaving the impression that u is the overall proportion using among currently in union women. Indeed, Bongaarts and Potter (1983) suggest that u is adequately represented by this overall proportion. This is difficult to accept, since variation in age structures and age patterns of use, especially among socio-economic subgroups, could be of some consequence. Moreover, age-specific proportions are routinely available. Comparison of C_c indices computed defining u as the mean of age-specific proportions using and, in its place, u as the proportion currently using among women of all ages reveals that, at the national level, the former index is on average 0.017 larger than the latter (panel B of table 3). The difference increases to 0.025 in major urban areas, and although the mean difference is only 0.008 for women with 7+ years of schooling the direction varies, so that the mean absolute difference for this subgroup is 0.026. Moreover, for a large proportion of the urban and more educated groups, the difference exceeds 0.030.

We now consider the impact of adjusting for overlap between contraceptive use and post-partum amenorrhoea. As Bongaarts defines the u(a) of equation (4), amenorrhoeic women are not counted as contraceptive users. However, the u(a) utilized in previous analyses have not been calculated according to this definition because of lack of data on proportions of current users who are amenorrhoeic. The derivation of equation (4) also assumes that average fecundability does not differ between users and non-users. Bongaarts and Kirmeyer (1981) argue that the almost inevitable violation of both of these assumptions cancels them both out, or at the least affects C_c in opposite directions, so that adjustment for only one of them would bias C_c more than no adjustment at all. (This statement is not valid when the corrected effect is more than twice as great as the

Table 3 Comparisons of constructions of C_c

Subgroup	Mean difference[a]	Mean absolute difference	Number of cases with absolute difference		
			<0.015	0.015–0.029	0.030+
A Non-age and age-specific construction[b]					
National	−0.001	0.008	26	3	0
No schooling	−0.001	0.009	21	1	2
1–3 years	−0.004	0.013	13	5	3
4–6 years	−0.015	0.017	15	6	5
7+ years	−0.018	0.023	12	4	7
Major urban	−0.010	0.017	16	5	5
Other urban	−0.004	0.012	20	5	2
Rural	0.000	0.008	24	4	1
B 'u' as the mean of age-specific proportions using and as the overall proportion using[c]					
National	0.016	0.017	13	11	5
No schooling	0.013	0.016	17	3	4
1–3 years	0.018	0.023	6	10	5
4–6 years	0.012	0.024	8	8	10
7+ years	0.008	0.026	9	6	8
Major urban	0.025	0.026	7	9	10
Other urban	0.019	0.022	12	5	10
Rural	0.013	0.014	17	9	3
C Without and with correction for overlap between breastfeeding and contraception[d]					
National	−0.012	0.012	20	8	1
No schooling	−0.007	0.007	17	4	0
1–3 years	−0.013	0.013	11	10	0
4–6 years	−0.014	0.014	14	10	2
7+ years	−0.016	0.017	10	11	2
Major urban	−0.015	0.015	13	11	2
Other urban	−0.014	0.014	13	14	0
Rural	−0.011	0.012	19	9	1
D Non-age-specific construction without correction for overlap and age-specific construction with correction for overlap[e]					
National	−0.007	0.010	22	5	2
No schooling	−0.004	0.011	17	6	1
1–3 years	−0.011	0.016	13	4	4
4–6 years	−0.021	0.023	13	5	8
7+ years	−0.024	0.028	11	2	10
Major urban	−0.017	0.020	14	5	7
Other urban	−0.011	0.014	17	7	3
Rural	−0.006	0.010	22	4	3

Table 3 — *continued*

Subgroup	Mean difference[a]	Mean absolute difference	Number of cases with absolute difference		
			<0.015	0.015–0.029	0.030+
E Standard and group-specific schedules of proportion self-reported fecund by age[f]					
National	−0.002	0.006	28	0	1
No schooling	−0.001	0.005	22	1	1
1–3 years	−0.004	0.007	17	4	0
4–6 years	−0.003	0.007	24	2	0
7+ years	−0.006	0.009	20	3	0
Major urban	−0.001	0.007	24	2	0
Other urban	−0.001	0.006	25	1	1
Rural	−0.002	0.005	27	2	0

Subgroup	Mean difference[a]	Mean absolute difference	Number of cases with absolute difference				
			<0.015	0.015–0.029	0.030–0.044	0.045–0.059	0.060+
F Two standard schedules of proportion fecund by age[g]							
National	0.034	0.034	8	7	10	2	2
No schooling	0.021	0.022	12	8	2	0	2
1–3 years	0.039	0.039	4	6	6	2	3
4–6 years	0.048	0.048	6	0	12	3	5
7+ years	0.071	0.072	1	1	4	7	10
Major urban	0.053	0.053	4	2	5	8	7
Other urban	0.040	0.040	6	3	10	4	4
Rural	0.023	0.023	12	9	5	1	2

[a]In panel A, C_c constructed non-age-specifically minus C_c constructed age-specifically. In panel B, C_c constructed with u as the mean of age-specific proportions minus C_c constructed with u as the overall proportion using. In panel C, C_c constructed with no correction for overlap minus C_c constructed with overlap correction. In panel D, C_c constructed non-age-specifically with correction for overlap. In panel E, C_c constructed using standard schedule minus C_c constructed using observed subgroup proportions. In panel F, C_c constructed using self-reported fecund schedule minus C_c constructed using behavioural fecundity schedule.

[b]Both versions of C_c are constructed without correction for the overlap between breastfeeding and contraceptive use.

[c]Both versions are constructed non-age-specifically and without correction for the overlap between breastfeeding and contraceptive use.

[d]Both versions of C_c are constructed from age-specific measures.

[e]For the non-age-specifically constructed index, u is defined as the mean of the age-specific proportions using.

[f]The standard schedule is shown in footnote[g], labelled 'self-reported'. Both versions of C_c are constructed from age-specific measures, with correction for overlap between breastfeeding and contraceptive use.

[g]One standard schedule is the mean of the proportion self-reported fecund for 28 countries (Vaessen 1984). The other is the mean of a behavioural measure of fecundity for seven non-contracepting countries. The measure is the proportion of currently married women with no birth in the last five years, and (a) no contraceptive use in the open interval and (b) continuously married in the open interval. The seven countries are Bangladesh, Kenya, Lesotho, Nepal, Pakistan, Senegal and North Sudan (Vaessen 1984). The table gives the two schedules:

Age	Self-reported	Behavioural
15–19	0.99	0.98
20–24	0.99	0.95
25–29	0.98	0.93
30–34	0.95	0.87
35–39	0.91	0.77
40–44	0.78	0.59
45–49	0.52	0.43

Both versions of C_c are constructed from age-specific measures, with correction for overlap between breastfeeding and contraceptive use.

NOTE: Subgroups containing less than 200 currently in union women excluded throughout.

uncorrected effect.) The problem with this argument is that it assumes compensating effects of unknown dimensions. For the purpose of comparisons across countries or across subgroups within countries, one must assume that the final bias in C_c due to those two effects is roughly the same in all groups. Such assumptions are defensible where no direct corrections are feasible, but in the long run it is clearly desirable to develop adjustments for these biases. We regard adjustment for one effect as progress, for then there is a more common basis for the indices across countries and subgroups, the bias remaining being of a known direction.

Correcting for the probable selectivity of users with respect to fecundability is difficult (see Hobcraft and Little 1984), but with some reasonable simplifying assumptions adjustment for the overlap between amenorrhoea and use can be achieved by drawing on information on the duration of breastfeeding. The adjustment works on the assumption that, for a certain length of time during breastfeeding, the majority of women will still be amenorrhoeic and hence should not be counted as users. A subset of WFS surveys provides direct information on amenorrhoea. Tabulations for these countries indicate that the month at which roughly half of the women breastfeeding are no longer amenorrhoeic ranges from the sixth to the eleventh, depending on the country and the subgroup. We choose the lowest value as the appropriate figure for the overlap correction, considering that breastfeeding women who choose to initiate contraception soon after a birth are less likely to be amenorrhoeic than other women. Tabulations for the Philippines and Syria, for breastfeeding women, of length of the open interval by amenorrhoea status by contraceptive use status confirm that such selectivity exists and also suggest that the figure of six months is reasonable. The overlap correction consists, then, of counting women currently breastfeeding a child aged six months or less as non-users, regardless of their use status.

C_c indices calculated without and with correction for overlap are compared in panel C of table 3. The correction raises the value of C_c very minimally, about one point out of one hundred on average. Even among the better educated, where use levels are higher, the effect of the adjustment averages less than two C_c points. Clearly in most populations the potential distortion caused by overlap is small. However, in this analysis we utilize C_c indices corrected for overlap in order to adhere to as strict a formulation of the model as possible.

Age-specific construction and correction for overlap are the two respects in which the C_c index of this analysis differs from the C_c used in past applications of the Bongaarts model. In panel D of table 3 the combined impact of these two modifications is assessed. If the effects evident in panels A and C were unrelated, the mean differences in these panels would sum to the mean difference in panel D. As this mean difference is always less than the sum, the effects are correlated. In fact, at the national level, and among the rural and less educated groups, the combined effect shown in panel D is less than the effect of overlap shown in panel C, indicating that for these groups the impacts on C_c of age-specific construction and correction for overlap partially cancel each other out. They are, however, reinforcing for urban women and the more educated. The combined effect on C_c at the national level is small, amounting to one point out of one hundred on average. National-level analysis would appear to be minimally affected by our refinements of C_c. This conclusion is less applicable to analysis of socio-economic subgroups; analysis involving educational groups, in particular, would appear sensitive to these modifications in the construction of C_c.

Finally, a third modification of the C_c index can be introduced by varying the schedule of proportions fecund by age, the fec(a) in equation (4). Bongaarts proposes using a schedule of proportions self-reported fecund derived from 12 WFS surveys and presented in Nortman (1980). We have revised this standard schedule by drawing on Vaessen's (1984) tabulations for 28 WFS surveys. The revised schedule is presented in appendix A. Vaessen notes considerable variation across countries in age-specific levels of self-reported fecundity. This may reflect genuine differences among countries and subgroups in fecundity, differences in self-perceptions, or differences in responses to the interview inquiry. To the extent that genuine differences in fecundity levels are the source of the variation, a case can be made for using the reported proportion fecund for each group. In table 3, panel D, we compare two C_c indices, one based on the revised standard schedule and the second on observed group-specific proportions fecund. The two sets of indices differ remarkably little, despite the large variation in the group-specific schedules noted by Vaessen. The explanation for this surprising outcome seems to be that in those groups where use is high, the standard and observed schedules do not diverge significantly. In part, the close correspondence in high-use groups reflects the fact that current users were not asked the question on fecundity but automatically assumed to be fecund. Where use is low, variation in the fec(a) has little impact on absolute variation in C_c. A further factor explaining this outcome is that the differences between the schedules are greatest for women aged 40 and over, and these women contribute little to the value of C_c due to the weighting by a schedule of natural fertility.

There is considerable evidence that the self-reported proportions fecund are upwardly biased. Vaessen compares the self-reported proportions with the sterility schedule of Henry (1961), derived from fertility data for historical European populations, and with several 'behavioural' measures of fecundity levels derived from the WFS surveys themselves. We assess the impact on C_c of using one such behaviourally-based standard schedule in panel E of table 3. The behavioural measure assumes that women are infecund if they had no birth in the five years preceding the survey, despite no reported use of contraception and no union dissolution in the open interval. In countries with high levels of use, non-users may be selected for low fecundity, thus biasing this behavioural measure. Accordingly, the standard schedule is based on data from only seven countries in which contraceptive use is extremely low. Even in these countries, unreported use of traditional methods or induced abortion may lead to underestimation of levels of fecundity. Conversely, other considerations suggest that this behaviourally based standard schedule may *overestimate* levels of fecundity and thus bias C_c

upwards. The five-year reference period is rather long, and Hobcraft and Little (1984) suggest three years. Even then, women fecund several years before the survey may no longer be fecund at the survey date. Hence, although the behavioural schedule shows fecundity levels distinctly lower than the self-reported schedule (see footnote e of table 3), one could argue that the behavioural schedule too is upwardly biased.

The results in panel E show that C_c is sensitive to the choice of standard fecundity schedule, especially in those socio-economic subgroups and countries where use is high, where the two sets of indices differ by five or more points on average. The biggest differences are very substantial, as is shown in the table at the foot of the page.

The countries and subgroups shown are characterized by relatively high levels of contraceptive use and a relatively young age pattern of use. It should also be noted in panel E of table 3 that not only do the two sets of C_cs differ substantially, but the subgroup differentials in mean C_c values are larger when C_c is constructed using the behavioural fecundity schedule. (In the case of the two extreme education subgroups, the differential increases by roughly five C_c points on average.)

The most important message here is that C_c is affected by the choice of standard fecundity schedule. A case can be made for selection of either of the schedules compared here. In defence of the self-reported schedule, Bongaarts and Kirmeyer (1981) note that the role of the fec(a) in equation (4) is to yield u(a)/fec(a) which represent the prevalence of contraception among women who are actually fecund. The self-reported fec(a) probably overestimate actual fecundity, but the u(a) will normally be biased upwards since some users will be infecund. With the plausible assumption that use status among those who think they are fecund is random with respect to actual fecundity, the self-reported fec(a) are preferred. We accept this argument and utilize the self-reported fec(a) in the construction of C_c, but it must be conceded that other reasonable assumptions would imply preference for alternative schedules.

2.4 INDEX OF POST-PARTUM INFECUNDABILITY (C_i)

The index of post-partum infecundability is obtained by first assuming an average live birth interval in the absence of any lactational amenorrhoea and post-partum abstinence. The index is constructed by taking the ratio of this interval to the estimated interval resulting from the effects of post-partum amenorrhoea and abstinence.

Specifically, C_i is constructed as follows:

$$C_i = \frac{\Sigma tf(a)ci(a)}{\Sigma tf(a)} = \frac{\Sigma tf(a)\left\{\frac{p(a)}{q(a)+i(a)}\right\}}{\Sigma tf(a)} \qquad (6)$$

where the ci(a) are age-specific indices of infecundability, tf(a) is an age schedule of total fecundity rates, calculated as tn(a)/ci(a), i(a) is an age schedule of mean durations of post-partum amenorrhoea, estimated from the mean duration of breastfeeding by an expression provided by Bongaarts (see appendix A), and the p(a) and q(a) represent the expected length of the birth interval in months without the effects of lactational amenorrhoea and without the effects of lactational and non-lactational amenorrhoea, respectively.

A non-age-specific version of equation (6) has been used in previous analyses:

$$C_i = \frac{20.0}{18.5+i} \qquad (7)$$

In table 4 the age-specifically and non-age-specifically constructed versions are compared. There is virtually no difference between the two, reflecting the rather slight association of breastfeeding durations with age and the relatively flat age pattern of total fecundity rates.

A more troubling feature of C_i in this and most applications is the estimation of the period of post-partum infecundability from the duration of breastfeeding. The period of post-partum infecundability is defined as the length of amenorrhoea or abstinence, whichever is longer. Direct information on amenorrhoea and abstinence is provided for only eight of the 29

	C_c constructed with		
	Behavioural fecundity schedule	Self-reported fecundity schedule	Number of currently married women
National level			
Costa Rica	0.44	0.29	2684
Panama	0.50	0.37	2723
Venezuela	0.60	0.54	2280
7+ years' schooling			
Colombia	0.46	0.29	485
Costa Rica	0.47	0.37	687
Dominican Republic	0.55	0.43	338
Syria	0.60	0.40	533
Thailand	0.60	0.49	242

Table 4 Comparision of two constructions of C_i: non-age and age-specific construction

Subgroup	Mean difference[a]	Mean absolute difference	Number of cases with absolute difference		
			<0.015	0.015–0.029	0.030+
National	−0.003	0.006	28	1	0
No schooling	−0.012	0.013	15	8	1
1–3 years	−0.006	0.008	17	4	0
4–6 years	0.002	0.007	24	2	0
7+ years	0.003	0.005	22	1	0
Major urban	0.008	0.010	22	2	2
Other urban	0.001	0.004	27	0	0
Rural	0.001	0.013	25	3	1

[a]C_i constructed non-age-specifically minus C_i constructed age-specifically.

Table 5 Comparison of mean durations of post-partum infecundability and the index of post-partum infecundability, as estimated from current status data[a] on amenorrhoea, abstinence and breastfeeding: national level

Country	Mean duration of infecundability, estimated from data on			Index of post-partum infecundability[e] based on		
	Amenorrhoea[b]	Amenorrhoea & abstinence[c]	Breastfeeding[d]	Amenorrhoea	Amenorrhoea & abstinence	Breastfeeding
Ghana	13.9	16.7	12.2	0.62	0.57	0.65
Kenya	11.6	12.6	10.7	0.66	0.64	0.68
Lesotho	10.4	17.9	12.7	0.69	0.55	0.64
Sudan (North)	11.6	12.3	10.6	0.66	0.65	0.69
Haiti	12.9	16.8	9.7	0.64	0.57	0.71
Bangladesh	16.1	17.6	19.7	0.58	0.55	0.52
Philippines	8.5	9.2	7.7	0.74	0.72	0.76
Syria	7.7	7.7	7.2	0.76	0.76	0.78

[a]Mean durations estimated using the 'prevalence/incidence' method. See Mosley, Warner and Becker (1982).
[b]Mean duration of amenorrhoea.
[c]Mean duration of amenorrhoea or abstinence, whichever is longer.
[d]Computed by $1.753 \exp(0.1396\,bf - 0.001872\,bf^2)$ where bf is mean duration of breastfeeding.
[e]Computed by $\frac{20.0}{(18.5+i)}$, where i is mean duration of infecundability.

countries examined here. For these eight countries, three measures of the duration of infecundability are compared in table 5: two direct measures of amenorrhoea and of amenorrhoea and abstinence combined, and amenorrhoea estimated from the duration of breastfeeding. The corresponding C_i indices are also shown. Comparison of the first and third columns in table 5 provides an indication of the validity of inferring the duration of amenorrhoea from the duration of breastfeeding through a standard formula. The means are nearly the same in four countries, diverge to some extent in Ghana and Lesotho, and differ by more than three months in Haiti and Bangladesh. The differences are not consistent in sign. With the exception of Haiti and Bangladesh, the C_i values are little affected, and hence it appears, from this limited evidence, that the method of converting period of lactation to period of amenorrhoea is acceptable. Comparison of the second column of table 5 with either the first or third columns indicates that ignoring post-partum abstinence introduces a more serious bias in some countries. In three of the eight countries (Ghana, Lesotho and Haiti) abstinence adds more than two months to the duration of post-partum infecundability, and in these countries the effect on C_i is substantial. The role of abstinence in lengthening the infecundable period in a country such as the Philippines may come as a surprise, as the overall mean duration of post-partum abstinence is only 3.3 months. The explanation is that, in the Philippines and in most of these countries, abstinence increases the mean post-partum period chiefly by lengthening the infecundable period for women whose menses return soon after the birth.

2.5 MULTIPLICATIVE AND ADDITIVE MODELS

In the Bongaarts model, the indices of the proximate determinants are related multiplicatively. In recent work relating the proximate determinants to fertility, Hobcraft and Little (1984) propose an additive decomposition of fertility exposure in terms of the various proximate determinants:

$$Tf = Tp\,\{1 - D_m - D_u - D_l - D_i - D_c\} \qquad (8)$$

where Tf is total observed fertility, Tp is total potential fertility, and the D elements are proportions of exposure lost due to non-marriage (m), marriage dissolution (u), lactational infecundability (l), non-lactational infecundability following a live birth (i) and contraceptive use (c). Note that the lost exposures measured by D_m and D_u are combined in C_m. Also note that the D indices represent lost exposure, whereas the C indices represent 1.0 minus lost exposure. Throughout our discussion, comparison of D and C indices will always assume that the D indices have been subtracted from 1.0.

The additive D components differ from the multiplicative C indices in two fundamental ways. First, under applications of either approach to WFS data, the counting of the amount of exposure lost due to each determinant is equivalent, but this lost exposure is assigned to populations of differing sizes. The Cs refer to proportionate reductions in fertility within a succession of nested states (females of reproductive age for C_m, married females of reproductive age for C_c and non-contracepting married females of reproductive age for C_i). Hence the relative size of base population to which the C indices refer depends on the value of preceding indices, but the value of each index can be taken as independent of that of the others. The D indices, on the other hand, all pertain to the same population base (all women of reproductive age), and for this reason the value of one index is not independent of that of the others: a large value of one implies smaller values of the others, everything else being equal. More precisely, the difference in base populations under the two approaches affects the values of the indices for contraception and post-partum infecundability and their size relative to the index of nuptiality. D_c and D_i refer to the experience of all women, regardless of union status, whereas C_c refers to currently in union women explicitly and C_i does so implicitly, since the vast majority of recent births, the source of breastfeeding information used in the construction of C_i, occur within union. The larger base means that D_c and D_i will assume larger values than C_c and C_i (once D_c and D_i are subtracted from 1.0). The larger values of the D indices imply *less* impact on fertility. It is important to recognize that nuptiality assumes greater significance under the Hobcraft and Little additive model: the nuptiality index will necessarily be larger in relation to the indices of contraception and lactation as compared to the multiplicative approach of Bongaarts. This is because in the additive model exposure lost due to non-marriage or marital dissolution is counted against age-specific rates of potential fertility, whereas in the Bongaarts model it is assumed that non-married women would bear children at the same age-specific rates as married women. The assumption underlying the additive model, it may be noted, contradicts conventional demographic wisdom on this subject.

A second, and less important difference between the models is the sets of age-specific weights used in the construction of overall indices from age-specific measures. The weights for the C indices are the age patterns of fertility assumed to be modified — observed marital fertility for C_m, estimated natural marital fertility for C_c and estimated natural fecundity for C_i. Every one of the D components uses the estimated age pattern of 'potential fertility'. The weighting will differ most for the union exposure indices (C_m, and $D_m + D_u$).

There are other differences beyond these fundamental conceptual ones. The Hobcraft and Little approach has the merit of methodological clarity and directness. It consists of a strict decomposition of observed fertility *exposure*. Bongaarts' C_m and C_c indices are essentially measures of proportionate loss of exposure, but C_i achieves this only indirectly. The Hobcraft and Little approach can be applied in such a way that all components are measured for precisely and similarly defined time periods, whereas in the usual applications of the Bongaarts model the separate components refer to roughly defined and different reference periods. (In our application, for example, current contraceptive status is related to fertility over the past five years, clearly inappropriate where secular increases in contraceptive use have been rapid.) The Bongaarts approach has the compensating virtue of being undemanding in terms of required data.

Although it is not convenient to calculate the Hobcraft and Little indices in the manner they recommend, we can calculate D indices from the same age-specific inputs which are used to construct the C indices, interpreting these age-specific measures as indicators of proportionate reduction in fertility exposure for the base population to which they apply. We make two types of comparisons between the D and C indices. First, we compare differences in absolute values of the corresponding indices. As the above discussion indicated that C_c and C_i will *necessarily* be larger than the corresponding D indices, the object of this comparison is not to demonstrate the existence of differences but rather to document their magnitude. Secondly, we compare the relative standing across countries, and between subgroups within countries, of specific indices. The second comparison addresses the question: are conclusions about national or subnational differences in the importance of specific determinants affected by the choice of model?

The first comparison is summarized by panels A and B of table 6. Remember that C_c and D_c, and C_i and D_i, must take rather different values, because they refer to different population bases, whereas C_m and $D_m + D_u$ differ only in the weighting (observed marital fertility for the former, estimated potential fertility for the latter) and thus should assume similar values (once either one is subtracted from 1.0, of course). In panel A, the mean differences for the indices of union exposure are small, as expected, although it is interesting to note that the difference is not negligible for low fertility subgroups (7+ years' schooling, major urban areas), for whom the age patterns of observed marital fertility and of estimated potential fertility will differ the most. The indices of contraception and post-partum infecundability differ by six and ten points on average, respectively, and of course the additive indices are larger, indicating less fertility impact.

The important consequence of these expected differences in absolute values is a change in the ranking of the indices, as demonstrated at the national level in panel B of table 6. Bear in mind that a larger index value indicates less fertility impact. According to the multipli-

Table 6 Comparison of indices for multiplicative and additive models[a]

A Mean difference: additive minus multiplicative indices

Subgroup	Union exposure	Contraception[b]	Post-partum infecundability
National	−0.008	−0.058	−0.100
No schooling	0.011	−0.026	−0.077
1–3 years	0.001	−0.041	−0.091
4–6 years	0.001	−0.061	−0.092
7+ years	−0.034	−0.131	−0.084
Major urban	−0.022	−0.107	−0.089
Other urban	−0.013	−0.075	−0.100
Rural	−0.001	−0.038	−0.095

B Relative size of indices: distribution of countries by ranking of indices

Indices from multiplicative model	Indices from additive model				Total
	$D_c > D_m > D_l$	$D_c > D_l > D_m$	$D_l > D_m > D_c$	$D_l > D_c > D_m$	
$C_m > C_c > C_i$	0	1	0	0	1
$C_c > C_m > C_i$	5	3	0	0	8
$C_c > C_i > C_m$	0	1	0	4	5
$C_i > C_m > C_c$	0	0	5	3	8
$C_i > C_c > C_m$	0	0	0	7	7
Total	5	5	5	14	29

C Correlations between multiplicative and additive indices

Subgroup	Correlation between indices for		
	Union exposure	Contraception[b]	Post-partum infecundability
National	0.98	0.99	0.92
No schooling	0.97	0.99	0.96
1–3 years	0.96	0.99	0.97
4–6 years	0.97	0.98	0.96
7+ years	0.98	0.94	0.95
Major urban	0.98	0.96	0.91
Other urban	0.97	0.98	0.92
Rural	0.98	0.99	0.90
Across educational subgroups, within countries[c]	0.99	0.94	0.90
Across residential subgroups, within countries[d]	0.99	0.94	0.91

[a]The multiplicative model follows Bongaarts. The additive model follows Hobcraft and Little (1984) in form, but the indices are measured with the same age-specific inputs used throughout this analysis. D_m and D_u are combined in an index of union exposure. The additive indices are subtracted from 1.0.
[b]Constructed age-specifically, with correction for overlap between breastfeeding and contraception.
[c]The indices are transformed into deviations from mean indices for the education subgroups in each country (N = 77 subgroups).
[d]The indices are transformed into deviations from mean indices for the residential subgroups in each country (N = 82 subgroups).

cative model, the relative importance of the three determinants varies considerably across countries. In only one country (Indonesia) does lost union exposure exercise the least effect; among the other 28 countries, contraception and post-partum infecundability have the least effect in 13 and 15 countries, respectively. The greatest impact on fertility is credited to lost union exposure in 12 countries, to post-partum infecundability in nine countries, and to contraception in eight. There is less diversity of rankings of the additive indices, and one pattern is dominant: in 14 countries, lost union exposure has the greatest impact and post-partum infecundability the least. Post-partum infecundability also assumes the lowest ranking in five other countries where contraception has the greatest impact. Thus, there are seven countries where according to the additive model nuptiality impinges the most on fertility while according to the multiplicative model it is of less importance than either contraception or post-partum infecundability. Indonesia is the most dramatic example of such a change in relative ranking of the indices, but other countries also illustrate the possible changes:

	C_i	C_c	C_m	D_i	D_c	D_m+D_u
Indonesia	0.574	0.752	0.753	0.758	0.800	0.749
Lesotho	0.645	0.954	0.741	0.751	0.964	0.726
Venezuela	0.865	0.566	0.635	0.952	0.692	0.649

In Indonesia, the pre-eminence of post-partum infecundability found in the multiplicative model disappears in the additive model. Similarly in Lesotho post-partum infecundability as the determinant with the greatest impact is replaced in the additive model by lost union exposure. In these two countries, the counting in the additive model of lost union exposure against potential fertility, as opposed to observed marital fertility (which reflects the fertility-reducing effects of long durations of breastfeeding), substantially strengthens the importance of nuptiality relative to post-partum infecundability. In Venezuela, the relative effect of contraception and nuptiality is reversed, contraception being of less importance under the additive approach. These countries illustrate the significantly greater relative impact attributed to nuptiality in the additive approach, a direct consequence of counting lost union exposure against potential fertility. These illustrations and the summary statistics in panels A and B of table 6 emphasize the importance of interpreting the indices according to the underlying model.

Because the multiplicative and additive indices refer to different population bases, differences in the absolute values are expected and thus not of great analytical interest, although they serve to emphasize the conceptual differences between the models. Less predictable are differences in the relative standing of countries or subgroups on a particular index. The product-moment correlations in panel C of table 6 are one means of assessing this. In the first eight rows of the panel, the relative standing of countries is considered. In the final two rows, the correlations refer to the relative standing of subgroups *within* countries. By either standard, it seems to make little difference which approach is chosen. C_m and $D_m + D_u$ are highly correlated. Modifying the fertility schedules used as weights has little effect on the relative values of the nuptiality indices among countries and among subgroups within countries. C_c and D_c are similarly highly associated, despite the substantial group difference in $D_m + D_u$ and D_i which influences the size of the base population for D_c. C_i and D_i should diverge the most. While C_c can be influenced by levels of breastfeeding, C_i, which is based on the duration of breastfeeding for recent births irrespective of the proportion of women giving birth, need not be related to levels of either C_m or C_c. As expected, C_i and D_i do show a weaker association, but the correlations remain remarkably high. In sum, conclusions about the strength of a specific proximate determinant in one country as compared to others, or in a certain subgroup within a country compared to other subgroups in the same country, will be very nearly the same whichever model is applied.

We wish again to stress that in this analysis the Hobcraft and Little indices have not been measured as recommended. Proper measurement might modify the conclusions emerging from table 6. This seems doubtful, however. It is clear that there are fundamental conceptual differences between the multiplicative and additive approaches examined, especially in the treatment of lost union exposure. These differences can substantially affect conclusions concerning the sources of fertility levels and differentials derived from applications of the models.

2.6 DISCUSSION

There are many criteria for assessing the effects of measurement decisions. We have opted for considering the components of the model one by one, attention being directed chiefly to the size of differences between alternative constructions of the same index. By this criterion, the choices of some import seem to be total or within-union births for the TFR, current status or five-year exposure information for C_m, the standard fecundity schedule employed in the construction of C_c, and whether C_i is estimated from data on breastfeeding alone or from data on breastfeeding and post-partum abstinence. We have chosen to use within-union births, five-year exposure, and a standard fecundability schedule based on proportions self-reported fecund. Data constraints force us to estimate C_i on the basis of breastfeeding alone.

Another approach to evaluating the impact of measurement decisions would be to consider the full model, eg the relative ranking of the indices, within countries and subgroups. However, in view of the small impact on the index values of most of the alternative measures as compared to the national and subgroup differences in the indices (as documented in subsequent sections of this report), the impact of measurement decisions on conclusions derived from the full model must be very minor. Those index differences which exceed 0.045 are exceptions. These summary statements apply least well to effects on the TF, which is calculated by inflating the TFR by the product of the indices. A change in an index from, say, 0.70 to 0.74 can change the estimated TF from 13.1 to 13.8. We shall return to this matter in section 5, where we consider the TF at greater length.

3 Substantive Results: National-Level Estimates

We shall first describe variation in the proximate determinants at the national level. In table 7, the five components of the model are presented for the 29 countries.

The range in legitimate total fertility levels among the 29 countries is very wide, with Costa Rica (3.2 births) and Jordan (7.6 births) at the two extremes (first column of table 7). This spread is maintained within each of the three regions. In the Americas, the ordering of countries

Table 7 Total fertility, total fecundity, and indices of three proximate determinants: national values

Country	Observed total fertility rate	Index of marriage	Index of contraception	Index of post-partum infecundability	Total fecundity rate
A Africa					
Ghana	6.22	0.820	0.923	0.666	12.35
Kenya	7.40	0.790	0.944	0.695	14.27
Lesotho	5.27	0.741	0.958	0.645	11.52
Senegal	6.90	0.859	0.980	0.661	12.39
Sudan (North)	5.93	0.762	0.962	0.694	11.67
Regional mean[a]	6.34	0.794	0.953	0.672	12.44
B Americas					
Colombia	4.27	0.602	0.633	0.846	13.24
Costa Rica	3.17	0.567	0.432	0.908	14.26
Dominican Rep.	5.39	0.689	0.697	0.852	13.17
Guyana	4.75	0.732	0.722	0.890	10.09
Haiti	5.15	0.646	0.862	0.726	12.73
Jamaica	4.52	0.738	0.641	0.851	11.22
Mexico	5.93	0.684	0.730	0.842	14.09
Panama	3.84	0.618	0.489	0.853	14.90
Paraguay	4.56	0.625	0.711	0.811	12.65
Peru	5.35	0.629	0.755	0.769	14.66
Trinidad and Tobago	3.18	0.701	0.569	0.887	8.97
Venezuela	4.36	0.635	0.580	0.865	13.68
Regional mean[a]	4.54	0.656	0.652	0.842	12.80
C Asia					
Bangladesh	5.96	0.889	0.930	0.524	13.74
Fiji	4.14	0.688	0.672	0.835	10.73
Indonesia	4.51	0.753	0.771	0.574	13.54
Jordan	7.63	0.755	0.797	0.807	15.72
Korea, Rep. of	4.23	0.597	0.753	0.697	13.51
Malaysia	4.62	0.634	0.736	0.901	10.97
Nepal	6.12	0.850	0.976	0.567	13.03
Pakistan	6.24	0.813	0.960	0.657	12.15
Philippines	5.12	0.605	0.739	0.769	14.90
Sri Lanka	3.70	0.558	0.771	0.613	14.04
Syria	7.46	0.743	0.836	0.786	15.27
Thailand	4.55	0.657	0.688	0.662	15.23
Regional mean[a]	5.36	0.712	0.802	0.699	13.57
Overall mean[a]	5.20	0.705	0.766	0.753	13.06

[a]Unweighted averages.

by fertility level largely reflects the stage of fertility transition reached at the time of the respective surveys, with the examples of more recent declines (Dominican Republic, Mexico, Peru) still clearly distinguished by their higher fertility levels. In the Asian region, the correspondence between stage of transition and fertility level in the mid-1970s is looser and several different categories of country need to be distinguished. At one extreme are the two Arab countries, Jordan and Syria, with very high fertility and little or no recorded decline before 1975. This latter characteristic of pre-transitional fertility is shared by the three countries of the Indian subcontinent, Bangladesh, Nepal and Pakistan, but their levels of legitimate fertility are about 1.5 births lower than in Jordan and Syria. All the remaining countries of the Asian group had experienced appreciable declines in fertility by the mid-1970s. In Fiji, Republic of Korea, Malaysia and Sri Lanka, secular declines had begun in the late 1950s or early 1960s, while in Indonesia, the Philippines and Thailand they were of more recent origin. The level of legitimate total fertility for these transitional nations ranges from 3.7 births for Sri Lanka to 5.1 births for the Philippines.

With the possible exception of Ghana, where there is some evidence from the main survey report of a modest and recent decline (Ghana, Central Bureau of Statistics 1983), the five African countries have experienced no major changes in fertility level in the recent past. Nevertheless their fertility levels vary substantially, ranging from 5.3 births in Lesotho to 7.4 births in Kenya.

We turn now to discuss the ways in which the fertility-reducing impact of the three major proximate determinants of fertility — marriage, contraception and post-partum infecundability — varies across countries and between regions.

Considering the index of marriage (C_m) first, we will find it useful to distinguish two distinct sources of loss of union exposure. Exposure may be lost due to delayed first union or permanent celibacy, or it may be lost due to union dissolution (separation/divorce or widowhood). In table 8 the index of marriage is expressed as the product of two indices, one measuring levels of ever marriage and the second levels of current marriage among those ever married. (These two components of C_m will be denoted C_{em} and C_{cm}.)

A stark regional contrast in C_m is apparent between Africa on the one hand, where the fertility-depressing effect of nuptiality is weak, and the Americas and Asia on the other, where the average effect is much stronger. These regional generalizations overlie considerable intra-regional variability. The dispersion is least apparent in Africa, but even in this region there is a ten-point range. It appears that loss of union exposure exerts the least constraint in predominantly Muslim Senegal, where female age at first marriage is lower than in the other countries (note C_{em}, in table 8). Senegal, however, has a very high rate of marital dissolution (21 per cent of first unions are dissolved by divorce or separation within ten years compared to a typical dissolution rate of about 10 per cent in the other African countries) but this trait is offset by rapid remarriage so that C_{cm} is also relatively high. This is a good illustration of the dangers of inferring a fertility impact simply from the incidence of

Table 8 National-level values of the index of marriage, the index of ever marriage and the index of current marriage[a]

Country	Index of marriage (C_m)	Index of ever marriage (C_{em})	Index of current marriage (C_{cm})
A Africa			
Ghana	0.790	0.876	0.902
Kenya	0.775	0.844	0.918
Lesotho	0.739	0.834	0.887
Senegal	0.863	0.909	0.950
Sudan (North)	0.701	0.759	0.923
Regional mean[b]	0.774	0.844	0.916
B Americas			
Colombia	0.564	0.646	0.873
Costa Rica	0.555	0.617	0.899
Dominican Rep.	0.633	0.775	0.817
Guyana	0.695	0.767	0.906
Haiti	0.620	0.736	0.842
Jamaica	0.700	0.835	0.838
Mexico	0.657	0.718	0.915
Panama	0.600	0.697	0.861
Paraguay	0.593	0.677	0.875
Peru	0.589	0.649	0.908
Trinidad and Tobago	0.648	0.717	0.903
Venezuela	0.584	0.694	0.842
Regional mean[b]	0.620	0.711	0.873
C Asia			
Bangladesh	0.859	0.952	0.902
Fiji	0.654	0.688	0.951
Indonesia	0.730	0.829	0.881
Jordan	0.716	0.739	0.969
Korea, Rep. of	0.576	0.593	0.970
Malaysia	0.604	0.638	0.947
Nepal	0.849	0.902	0.942
Pakistan	0.788	0.827	0.953
Philippines	0.563	0.583	0.965
Sri Lanka	0.517	0.557	0.929
Syria	0.709	0.731	0.970
Thailand	0.629	0.675	0.932
Regional mean[b]	0.683	0.726	0.942
Overall mean[b]	0.665	0.733	0.908

[a]The index of marriage is a weighted average of proportions currently in union at the survey date. The index of ever marriage is a weighted average of proportions ever in union as of the survey date. The index of current marriage is a weighted average of proportions currently in union among those ever in union, obtained as the quotient of the index of marriage and the index of ever marriage. Hence, index of marriage = (index of ever marriage)·(index of current marriage). Note that all refer to union status at the survey date.
[b]Unweighted means.

union disruption. At the other end of the African spectrum is Lesotho. Here the relatively low index value of 0.74 is the consequence both of relatively later age at first union and of a higher level of permanent widowhood for women aged 25 and over. Undoubtedly this phenomenon is linked to the economy of the country, which is heavily dependent on the export of male labour to the mining industry of South Africa.

In describing these African findings, we have ignored the complicating factor of polygamy, the prevalence of which varies widely across the five countries under consideration. In this matter there was little choice, because the relationship between union type and fertility in Africa is neither constant across countries nor amenable to simple explanations in terms of varying sexual exposure. For instance, polygamy in Kenya is associated with lower fertility than is monogamy, at least in part because of the selective entry of infecund women into polygamous unions (Mosley *et al* 1982). Conversely, in Senegal, there is no apparent difference in fertility between women in these two union types (Senegal, Ministère de l'Economie et des Finances 1981).

These problems become more acute with regard to the marriage indices for Latin America and the Caribbean. While a liberal definition of union, such as to include all cohabiting partnerships, has been used routinely in WFS surveys, the definition was further widened in the Caribbean surveys to embrace non-cohabiting (ie visiting) sexual relationships. One approach to this problem of definitional variability is to regard visiting unions as an intermediate state between non-marriage and cohabitation, and to assume a correspondingly midway fertility impact. However, the relevant empirical evidence lends little support to this interpretation of visiting unions[3] and no distinction has been made in this analysis between the different types of union.

Bearing in mind these definitional difficulties, the fertility-reducing effect of nuptiality appears to be modest in the Caribbean countries compared to the continental states of Central and South America. Of these latter, only high-fertility Mexico has an index value close to those found in the Caribbean. In the remaining countries (Colombia, Costa Rica, Panama, Paraguay, Peru and Venezuela), the strength of the marriage factor is similar, despite the wide variations in fertility levels. This finding is consistent with the view that marriage changes have made little contribution to the fertility transition in Latin America. The smaller impact of lost union exposure in the Caribbean as compared to the continental states is essentially the consequence of earlier ages at first partnership and lower levels of permanent celibacy in the Caribbean which more than compensate for the higher levels of union dissolution (table 8). In fact, the Caribbean countries and those bordering on the Caribbean (Colombia, Panama, Venezuela) show the greatest fertility-reducing effects of union dissolution among the 29 countries in this study, with Dominican Republic (where C_{cm} equals 0.817) at the extreme.

Within Asia we find both the greatest and the least impacts of marriage on fertility, reflecting the great diversity in female age at first marriage. According to the model, fertility in Bangladesh, where the singulate female mean age at marriage is 16 years, is reduced from its potential maximum by a mere 11 per cent, whereas in Sri Lanka, with a corresponding age at first marriage of 25 years, the reduction is 44 per cent. Close to Bangladesh are Nepal and Pakistan, followed by Indonesia (where a young age at marriage is partially offset by a high rate of union dissolution) and the two Arab countries. It is worth noting that the very high fertility levels of Jordan and Syria are achieved despite singulate mean ages at marriage of well over 20 years, reflected in C_m values markedly below those found in the Indian subcontinent. Finally Fiji, Malaysia, Thailand, Philippines and Republic of Korea have mean ages of marriage between 21 and 24 years and a range in C_{cm} values of between 0.69 and 0.58. With the exception of relatively high levels of separation and divorce in Indonesia (as noted above) and relatively high levels of widowhood in Bangladesh, marital dissolution during the reproductive ages is rare throughout the Asian societies (C_{cm} is at 0.93 or above in the other ten countries). The variability in C_m is almost entirely the consequence of societal diversity in age at first marriage.

Whereas the striking regional contrast in the marriage index lies between Africa on the one hand and the Americas and Asia on the other, all three regions are sharply divergent in terms of the contraceptive index (C_c). For the five African countries, the average fertility-reducing impact of contraception is only 5 per cent, whereas in Asia it is 20 per cent and in the Americas it reaches 35 per cent. For further insight into the sources of this diversity in the fertility impact of contraceptive use, we also present in table 9 the two components of C_c, namely the mean proportion currently using and the mean effectiveness of methods used. (As the analysis of table 3 revealed that non-age-specific construction of C_c yields almost identical values to age-specific construction, the non-age-specific inputs are shown in table 9: the mean of the seven age-specific proportions using and the mean method effectiveness of users of all ages, u and e in equation (5). The C_c values in table 7, which are derived age-specifically, *cannot* be reproduced precisely from these u and e values.)

There is little variation in C_c across the African countries, though a slightly greater effect can be discerned in Ghana, which has both the most educated population and the longest established family planning programme. The moderate variation in levels of method effectiveness in Africa is of no significance because of the low level of use.

In Asia, the average fertility reduction achieved through contraception is 20 per cent, but this regional figure conceals a wide spread. In the mid-1970s, the impact of contraception was negligible in Bangladesh, Nepal and Pakistan, where the index of contraception is about 0.95, and modest in Syria and Jordan, with values of about 0.8. The results for the remaining Asian countries are more surprising. There is a tight cluster of

[3]A survey carried out in the early 1970s by G. Roberts and S. Sinclair (1978) found that the frequency of sexual relations for visiting unions was 5–7 times per month for age groups over the range 15–44, only slightly lower than the average for married and common-law unions, 5–8 and 7–8 times per month, respectively.

Table 9 National-level values of the components of the index of contraception: mean proportion using and mean method effectiveness[a]

Country	Mean proportion using (u)	Mean method effectiveness (e)
A Africa		
Ghana	0.086	0.776
Kenya	0.062	0.840
Lesotho	0.047	0.778
Senegal	0.022	0.735
Sudan (North)	0.038	0.872
Regional mean[b]	0.051	0.800
B Americas		
Colombia	0.382	0.848
Costa Rica	0.587	0.862
Dominican Rep.	0.307	0.891
Guyana	0.307	0.884
Haiti	0.171	0.751
Jamaica	0.367	0.877
Mexico	0.270	0.858
Panama	0.517	0.909
Paraguay	0.329	0.791
Peru	0.281	0.772
Trinidad and Tobago	0.478	0.811
Venezuela	0.448	0.856
Regional mean[b]	0.370	0.842
C Asia		
Bangladesh	0.078	0.817
Fiji	0.366	0.889
Indonesia	0.230	0.874
Jordan	0.230	0.840
Korea, Rep. of	0.291	0.849
Malaysia	0.294	0.817
Nepal	0.024	0.951
Pakistan	0.052	0.827
Philippines	0.300	0.790
Sri Lanka	0.265	0.842
Syria	0.182	0.836
Thailand	0.296	0.915
Regional mean[b]	0.217	0.854
Overall mean[b]	0.275	0.843

[a]Mean proportion using is the mean of the seven age-specific proportions currently using. Mean method effectiveness is the mean use effectiveness of the methods currently used. The effectiveness weights are given in appendix A.
[b]Unweighted means.

countries (Indonesia, Republic of Korea, Malaysia, Philippines, Sri Lanka) where the fertility-reducing effects of contraception are similar, and Thailand and Fiji where the impact is somewhat greater. The similarity in C_c values is surprising in view of the great diversity of economic and cultural settings and stages of transition, and, above all, of the varying duration and alleged efficiency with which family planning policies have been pursued. It is thus unexpected to find that the fertility impact of contraception, as estimated by the model, is much the same in Republic of Korea and Malaysia, with long-established and apparently successful programmes, as in Indonesia, the Philippines and Sri Lanka, where in the mid-1970s family planning programmes were either very recent or lacked strong government commitment. Even more surprising is the finding that contraception at that time was probably having more effect on fertility in Thailand, where the major diffusion of birth control practices began only in the early 1970s, than in Republic of Korea. One particular reason for this flouting of expectations is the higher levels of use in Thailand compared with Republic of Korea among younger women, which is only partially offset by higher contraceptive prevalence in Republic of Korea among older women. As the model used in this analysis is constructed on an age-specific basis, the greater fertility-reducing impact of contraception among younger compared with older women is taken into account in the C_c index. In addition, method effectiveness is relatively high in Thailand (highest among the 29 countries), reflecting the predominance of the pill and injection methods (table 9). It is entirely the high effectiveness of the methods used which sets Thailand apart from Malaysia and the Philippines, where overall contraceptive prevalence is nearly the same. A final reason for the surprising ranking of Republic of Korea is the heavy reliance on abortion as a means of fertility control. There is probably no profound significance in these results for the Asian countries; rather they may well represent an historical coincidence from which no general lessons can be drawn.

Whereas contraception reduces fertility from its potential maximum by only 5 per cent in Africa and 20 per cent in Asia, its effect is much greater in the Americas, being 45 per cent on average. Within this region the index values are also more predictable and consistent with stage of transition and fertility level. Thus in countries such as Mexico, Peru, Haiti and Dominican Republic, with relatively late onsets of fertility decline, the impact of contraception is modest. Haiti and Peru are distinguished both by low levels of use and, among users, choice of traditional, inefficient methods. At the other extreme, contraception reduces fertility by more than 50 per cent in Costa Rica and Panama, where levels of use are very high (Costa Rica in particular) and the methods employed are relatively effective (Panama, where about 40 per cent of current users are sterilized).

We turn now to the last of the three major proximate determinants, post-partum infecundability, which, as discussed in section 2, is restricted in this analysis to lactational infecundability and does not take into account post-partum sexual abstinence. The regional contrast in the infecundability index (C_i) takes a different form from that observed for marriage or contraception. In the Americas the average effect is weak, accounting for only a 15 per cent reduction in fertility, while in Africa and Asia the average proportionate reduction is twice as great. In Africa and the Americas, there is remarkably little cross-country variation, the only notable exceptions being Haiti and Peru, where the fertility-reducing effect is particularly large by comparison with the regional mean, and Costa

Rica, where the effect is smaller. In Asia there is a much wider range. Lactational infecundability has little effect in Malaysia (largely because of the disinclination of the large Chinese population to breastfeed), in Fiji (largely attributable to the Indian component), in the two Arab countries and in the Philippines. Elsewhere, the reduction in fertility caused by breastfeeding is more pronounced, with the particularly marked effects in Bangladesh, Indonesia and Nepal far exceeding those found in any of the African countries.

The last column of table 7 shows the total fecundity rate (TF), which is estimated by dividing the observed total fertility rates by the product of the three indices. We defer discussion of the TF until section 5.

4 Substantive Results: Subgroup Variation in Indices

4.1 DIFFERENTIALS ACROSS SUBGROUPS

In this section we examine the relative fertility-reducing effects of the three proximate determinants across rural–urban and educational strata in each country. The rural–urban continuum is represented by a trichotomy (rural, other urban, major urban), and the principles underlying these distinctions are explained elsewhere (Lightbourne 1980). Because countries use different criteria to define rural and urban areas, it should be stressed that the cross-national comparability of results is limited and the relative magnitudes of the indices in different types of locality across countries cannot be interpreted with precision. The rural–urban results are shown in tables 10, 11 and 12, where the indices (table 10) and the components of the indices (tables 11 and 12) for residents of other urban and major urban areas are expressed as ratios of the indices for rural women. Ratios in parentheses are based on less than 200 respondents and are thus subject to sampling imprecision.

The most conspicuous feature of table 10 is the uniform nature of the influence of an urban setting on the three proximate determinants of fertility. The fertility-reducing impact of marriage and contraception is nearly always greater among women living in towns and small cities than for rural women, and greater still for those living in major urban centres. Conversely, the restraint on fertility exercised by lactation almost invariably weakens as the degree of urbanity increases.

With regard to the index of marriage (C_m), a roughly constant average association with urbanity is observed for all three regions. The impact on fertility is a little over 10 per cent greater in small urban localities and 15–19 per cent greater in major urban centres than in rural areas. This result is largely the consequence of later marriage for urban compared with rural residents (table 10). The only important exception to these generalizations is the group of English-speaking Caribbean countries, where no differences in C_m are observed across rural–urban strata. In only a few countries is there evidence that marital dissolution contributes appreciably to the rural–urban differences in C_m values (table 11). Haiti and the Dominican Republic stand out in this respect, and some other countries in the Americas also show differences in C_{cm} between residence groups.

The approximate uniformity of the effect of urbanity on the marriage index, remarkable in view of the variety of marriage institutions and stages of demographic transition represented by the 29 countries, is not paralleled in the case of the index of contraception (C_c). While the influence of residence on C_c is minor in the African countries, it is moderate in Asia and pronounced in the Americas (though again the English-speaking Caribbean countries show less differentiation than the Latin American states, except for Costa Rica).

The Asian region provides the more interesting country-specific differences. The fertility-reducing effects of contraception are relatively even across strata in Indonesia, Republic of Korea and Fiji, undoubtedly in part a testimony to the efforts of all three countries to make family planning services available in the rural areas. Conversely, the effect in the mid-1970s of contraception in the major urban centres of such countries as Jordan, Syria, Malaysia, the Philippines and Thailand was 20 per cent or more greater than its effect among the rural populations. In the two Arab states, the disparity probably reflects the limited availability of family planning supplies in rural areas. In Malaysia, the rural–urban differential is confounded by ethnicity and is difficult to interpret. Finally, in the Philippines and Thailand, strong government efforts to disseminate contraceptive knowledge and services in rural areas were in their infancy at the time of the survey. In the case of Thailand, subsequent surveys have documented a rapid spread of contraceptive practice in rural areas in the period 1975–80 (Knodel *et al* 1982). It is worth noting that where residence differences in the effects of contraception do exist, they are almost entirely due to levels of use rather than effectiveness of methods used (table 12). With few exceptions, the assumed method effectiveness varies by 5 per cent or less among the residential strata.

The erosion of the breastfeeding restraint with increasing urbanity is most marked in the Asian region. The most striking instances are to be found in the metropolises of Jakarta, Bangkok-Thonburi and Manila where, relative to the respective rural strata, the effects on fertility are reduced by 20–38 per cent. In Indonesia and Thailand there are also very large differences between the rural and other urban sector, indicating the great sensitivity of breastfeeding customs in these two countries to differences in environment. Female employment outside the home may be an important contributing factor. Ferry and Smith (1983) find that breastfeeding is substantially shorter in all three countries for those women working away from home. In the other Asian countries, the decline in the lactation impact associated with an urban status is typically of the order of 10 per cent.

In the Americas, differences in the index of infecundability (C_i) across rural–urban strata cannot match the extremes in Asia; nevertheless there are marked contrasts in Haiti and Peru, which are distinguished from other countries of the region by the persistence of prolonged breastfeeding in rural areas of about 17 months on average, compared to about 10 months in other countries. Appreciable differences of about 15 per cent between major urban and rural sectors may also be

Table 10 Residence differentials[a]: ratios of indices for other urban and major urban subgroups to rural index

Country	Marriage index			Contraception index			Infecundability index		
	Rural index	Other urban	Major urban	Rural index	Other urban	Major urban	Rural index	Other urban	Major urban
A Africa									
Ghana	1.00	0.95	0.91	1.00	0.97	0.94	1.00	1.09	1.15
Kenya	1.00	0.88	0.82	1.00	0.97	0.90	1.00	1.08	1.08
Lesotho	1.00	0.78	b	1.00	0.97	b	1.00	1.05	b
Senegal	1.00	0.82	0.81	1.00	0.99	0.99	1.00	1.05	1.06
Sudan (North)	1.00	0.95	0.84	1.00	0.95	0.88	1.00	1.03	1.04
Regional mean[c]	1.00	0.88	0.85	1.00	0.97	0.93	1.00	1.06	1.09
B Americas									
Colombia	1.00	0.86	0.72	1.00	0.73	0.64	1.00	1.05	1.08
Costa Rica	1.00	0.78	0.75	1.00	0.92	0.91	1.00	1.04	1.06
Dominican Rep.	1.00	0.80	0.80	1.00	0.81	0.74	1.00	1.06	1.15
Guyana	1.00	1.10	0.95	1.00	1.06	0.91	1.00	1.06	1.06
Haiti	1.00	(0.78)	0.82	1.00	(0.72)	0.91	1.00	(0.96)	1.19
Jamaica	1.00	1.04	0.96	1.00	0.94	0.85	1.00	1.21	1.03
Mexico	1.00	0.87	0.80	1.00	0.74	0.66	1.00	0.96	1.15
Panama	1.00	0.77	0.76	1.00	0.67	0.76	1.00	1.11	1.14
Paraguay	1.00	0.87	0.76	1.00	0.85	0.75	1.00	1.14	1.15
Peru	1.00	0.86	0.77	1.00	0.77	0.66	1.00	1.02	1.23
Trinidad and Tobago	1.00	0.99	1.03	1.00	0.99	0.92	1.00	1.11	1.04
Venezuela	1.00	0.83	0.75	1.00	0.76	0.60	1.00	1.02	1.17
Regional mean[c]	1.00	0.89	0.82	1.00	0.83	0.77	1.00	1.07	1.12
C Asia									
Bangladesh	1.00	0.94	(0.97)	1.00	0.92	(0.77)	1.00	1.09	(1.11)
Fiji	1.00	0.94	0.88	1.00	0.90	0.92	1.00	1.00	1.10
Indonesia	1.00	0.83	0.81	1.00	1.02	1.02	1.01	1.00	1.31
Jordan	1.00	0.88	0.82	1.00	0.82	0.75	1.00	1.22	1.09
Korea, Rep. of	1.00	0.96	0.84	1.00	0.96	0.96	1.00	1.05	1.06
Malaysia	1.00	0.85	0.77	1.00	0.87	0.80	1.00	1.11	1.09
Nepal	1.00	(0.83)	b	1.00	(0.76)	b	1.00	(1.11)	b
Pakistan	1.00	0.94	0.92	1.00	0.96	0.87	1.00	1.10	1.12
Philippines	1.00	0.77	0.76	1.00	0.84	0.81	1.00	1.08	1.20
Sri Lanka	1.00	0.84	0.89	1.00	0.98	0.86	1.00	1.08	1.16
Syria	1.00	0.92	0.82	1.00	0.80	0.66	1.00	1.02	1.05
Thailand	1.00	0.83	0.61	1.00	0.84	0.81	1.00	1.24	1.38
Regional mean[c]	1.00	0.87	0.78	1.00	0.89	0.81	1.00	1.12	1.19
Overall mean[c]	1.00	0.88	0.81	1.00	0.89	0.81	1.00	1.09	1.15

[a]'Major urban' and 'Other urban' distinguish between larger and smaller urban areas in each country, but are not comparable across countries. The criteria for the distinction between rural and urban are also specific to countries.
[b]In Lesotho and Nepal a major urban category is not defined, as no cities attain metropolitan status. Therefore all urban centres are included in the 'Other urban' category.
[c]Unweighted averages, based only on subgroups of more than 200 currently in union women (ie excluding values in parentheses).
NOTE: Parentheses denote subgroups with less than 200 currently in union women.

noted in Dominican Republic, Mexico, Panama, Paraguay and Venezuela.

Finally, among the five African countries, differences amount to less than 10 per cent, with the single exception of Ghana where the relatively sizeable metropolitan population of Accra and Tema records a reduction of 15 per cent in the C_i index compared to the rural population. Thus, although the long durations of lactation traditional in both Asian and African societies provide ample scope for a pronounced impact of urban residence, sharp differentials characterize the Asian experience much more than the African during the mid- and late-1970s.

Table 11 Residence differentals:[a] in components of the marriage index, the marriage index, the index of ever marriage and the index of current marriage;[b] ratios of indices for other urban and major urban subgroups to rural index

Country	Marriage index (C_m)			Ever-marriage index (C_{em})			Current marriage index (C_{cm})		
	Rural	Other urban	Major urban	Rural	Other urban	Major urban	Rural	Other urban	Major urban
A Africa									
Ghana	1.00	0.96	0.93	1.00	0.97	0.92	1.00	0.98	1.01
Kenya	1.00	0.92	0.88	1.00	0.97	0.89	1.00	0.95	0.99
Lesotho	1.00	0.79	c	1.00	0.85	c	1.00	0.93	c
Senegal	1.00	0.82	0.77	1.00	0.85	0.81	1.00	0.96	0.95
Sudan (North)	1.00	0.87	0.85	1.00	0.89	0.83	1.00	0.98	1.02
Regional mean[d]	1.00	0.87	0.86	1.00	0.91	0.86	1.00	0.96	1.00
B Americas									
Colombia	1.00	0.83	0.74	1.00	0.88	0.74	1.00	0.95	1.01
Costa Rica	1.00	0.77	0.72	1.00	0.80	0.76	1.00	0.95	0.95
Dominican Rep.	1.00	0.79	0.77	1.00	0.87	0.86	1.00	0.91	0.90
Guyana	1.00	1.15	0.99	1.00	1.15	1.02	1.00	1.00	0.98
Haiti	1.00	(0.82)	0.82	1.00	(0.92)	0.94	1.00	(0.89)	0.87
Jamaica	1.00	1.09	1.01	1.00	1.03	0.97	1.00	1.05	1.04
Mexico	1.00	0.86	0.79	1.00	0.89	0.82	1.00	0.96	0.96
Panama	1.00	0.78	0.75	1.00	0.82	0.80	1.00	0.95	0.93
Paraguay	1.00	0.86	0.77	1.00	0.86	0.78	1.00	0.99	0.99
Peru	1.00	0.86	0.74	1.00	0.89	0.74	1.00	0.96	1.00
Trinidad and Tobago	1.00	0.98	1.03	1.00	0.99	1.07	1.00	1.00	0.97
Venezuela	1.00	0.80	0.73	1.00	0.81	0.74	1.00	0.99	0.98
Regional mean[d]	1.00	0.89	0.82	1.00	0.91	0.85	1.00	0.97	0.96
C Asia									
Bangladesh	1.00	0.92	(0.95)	1.00	0.96	(0.94)	1.00	0.96	(1.01)
Fiji	1.00	0.94	0.88	1.00	0.94	0.90	1.00	1.00	0.98
Indonesia	1.00	0.83	0.82	1.00	0.81	0.81	1.00	1.02	1.01
Jordan	1.00	0.88	0.82	1.00	0.86	0.82	1.00	1.02	1.00
Korea, Rep. of	1.00	0.94	0.83	1.00	0.95	0.82	1.00	0.99	1.01
Malaysia	1.00	0.83	0.77	1.00	0.82	0.75	1.00	1.01	1.03
Nepal	1.00	(0.84)	c	1.00	(0.82)	c	1.00	(1.02)	c
Pakistan	1.00	0.94	0.91	1.00	0.94	0.90	1.00	1.00	1.01
Philippines	1.00	0.76	0.74	1.00	0.77	0.74	1.00	0.99	1.00
Sri Lanka	1.00	0.89	0.88	1.00	0.87	0.87	1.00	1.02	1.01
Syria	1.00	0.93	0.84	1.00	0.93	0.83	1.00	1.01	1.01
Thailand	1.00	0.86	0.57	1.00	0.86	0.57	1.00	0.99	1.01
Regional mean[d]	1.00	0.88	0.81	1.00	0.88	0.80	1.00	1.00	1.01
Overall mean[d]	1.00	0.88	0.82	1.00	0.90	0.83	1.00	0.98	0.99

[a]See footnote [a], table 10.
[b]See footnote [a], table 8.
[c]See footnote [b], table 10.
[d]See footnote [c], table 10.
NOTE: Parentheses denote subgroups with less than 200 currently in union women.

We turn now to consider relative differences in the estimated fertility-reducing effects of the proximate determinants among women of varying levels of educational attainment. The latter variable is represented by four categories: no schooling, 1–3 years, 4–6 years and 7 or more years of schooling. For most countries, the two intermediate categories correspond to lower and upper primary level education and the last to secondary or higher levels. Because of international variability in educational systems, comparability across countries is

Table 12 Residence differentials:[a] in components of the index of contraception, the mean proportion using and the mean method effectiveness;[b] ratios of values for other urban and major urban subgroups to rural value

Country	Proportion using			Method effectiveness		
	Rural	Other urban	Major urban	Rural	Other urban	Major urban
A Africa						
Ghana	1.00	1.46	1.64	1.00	1.00	1.03
Kenya	1.00	1.29	3.00	1.00	1.07	1.08
Lesotho	1.00	1.78	c	1.00	1.06	c
Senegal	1.00	1.27	1.59	1.00	1.11	1.20
Sudan (North)	1.00	3.28	7.72	1.00	1.06	1.05
Regional mean[d]	1.00	1.81	3.49	1.00	1.06	1.09
B Americas						
Colombia	1.00	1.97	2.30	1.00	1.02	1.01
Costa Rica	1.00	1.13	1.17	1.00	0.98	0.97
Dominican Rep.	1.00	1.91	2.31	1.00	1.02	1.02
Guyana	1.00	0.82	1.22	1.00	0.94	0.92
Haiti	1.00	(2.62)	1.57	1.00	(1.06)	1.07
Jamaica	1.00	1.08	1.37	1.00	0.98	0.97
Mexico	1.00	2.62	3.19	1.00	1.03	1.04
Panama	1.00	1.49	1.45	1.00	1.02	1.01
Paraguay	1.00	1.57	1.86	1.00	0.99	0.98
Peru	1.00	3.57	5.01	1.00	1.05	1.06
Trinidad and Tobago	1.00	1.00	1.10	1.00	1.00	1.01
Venezuela	1.00	1.81	2.35	1.00	1.02	0.99
Regional mean[d]	1.00	1.72	2.08	1.00	1.00	1.01
C Asia						
Bangladesh	1.00	2.29	(3.94)	1.00	1.04	(1.06)
Fiji	1.00	1.27	1.30	1.00	0.99	0.98
Indonesia	1.00	1.08	1.11	1.00	0.92	0.94
Jordan	1.00	3.55	4.79	1.00	0.98	0.97
Korea, Rep. of	1.00	1.18	1.28	1.00	0.98	0.98
Malaysia	1.00	1.48	1.73	1.00	1.01	1.03
Nepal	1.00	(7.25)	c	1.00	(1.02)	c
Pakistan	1.00	2.93	6.24	1.00	0.97	0.94
Philippines	1.00	1.56	1.69	1.00	1.04	1.05
Sri Lanka	1.00	1.20	1.53	1.00	0.99	1.01
Syria	1.00	5.78	9.58	1.00	0.99	0.97
Thailand	1.00	1.45	1.61	1.00	1.00	1.01
Regional mean[d]	1.00	2.16	3.09	1.00	0.99	0.99
Overall mean[d]	1.00	1.92	2.68	1.00	1.01	1.01

[a]See footnote [a], table 10.
[b]See footnote [a], table 9.
[c]See footnote [b], table 10.
[d]See footnote [c], table 10.
NOTE: Parentheses denote subgroups with less than 200 currently in union women.

problematic, though less so than for rural–urban residence.

The results are displayed in tables 13, 14 and 15 in terms of the ratios of the indices for the 1–3, 4–6 and 7 or more years of schooling groups to those for the no schooling group. The latter represents only a small minority of women in several of the Latin American and Caribbean countries, but inspection of the results reveals no erratic values.

The general expectation is that the fertility-reducing effect of marriage and contraception will increase with education, but that the opposite relationship will hold for post-partum infecundability. For contraception and infecundability, this expectation is fulfilled; with few

Table 13 Education differentials:[a] ratios of indices for three schooling groups to index for the no schooling group

Country	Marriage index				Contraception index				Infecundability index			
	No sch.	1–3 yr	4–6 yr	7+ yr	No sch.	1–3 yr	4–6 yr	7+ yr	No sch.	1–3 yr	4–6 yr	7+ yr
A Africa												
Ghana	1.00	(0.89)	0.93	0.87	1.00	(0.95)	0.96	0.89	1.00	(1.10)	1.09	1.14
Kenya	1.00	0.99	0.95	0.81	1.00	0.98	0.96	0.84	1.00	1.05	1.05	1.13
Lesotho	1.00	0.99	0.99	0.78	1.00	0.99	0.97	0.94	1.00	1.03	1.02	1.04
Senegal	1.00	(0.98)	(0.82)	(0.56)	1.00	(0.60)	(1.01)	(1.01)	1.00	(1.10)	(1.10)	(1.04)
Sudan (North)	1.00	0.90	0.85	(0.72)	1.00	0.92	0.90	(0.73)	1.00	0.99	0.99	(1.02)
Regional mean[c]	1.00	0.96	0.93	0.82	1.00	0.96	0.95	0.89	1.00	1.02	1.04	1.10
B Americas												
Colombia	1.00	0.88	0.77	0.59	1.00	0.91	0.73	0.56	1.00	1.02	1.06	1.12
Costa Rica	1.00	1.15	1.04	0.86	1.00	0.95	0.88	0.96	1.00	1.02	1.08	1.09
Dominican Rep.	1.00	0.97	0.88	0.59	1.00	0.94	0.81	0.67	1.00	1.03	1.05	1.12
Guyana	(1.00)	(1.11)	1.03	0.85	(1.00)	(0.96)	0.96	0.92	(1.00)	(1.14)	1.10	1.13
Haiti	1.00	0.90	(0.83)	(0.70)	1.00	0.87	(0.82)	(0.73)	1.00	1.09	(1.15)	(1.24)
Jamaica	(1.00)	(1.22)	1.08	1.01	(1.00)	(0.78)	0.78	0.70	(1.00)	(1.19)	1.13	1.18
Mexico	1.00	0.95	0.82	0.63	1.00	0.90	0.76	0.57	1.00	1.04	1.09	1.19
Panama	(1.00)	1.00	0.90	0.66	(1.00)	1.06	0.82	0.72	(1.00)	0.97	1.04	1.21
Paraguay	(1.00)	0.91	0.80	0.66	(1.00)	0.97	0.84	0.69	(1.00)	1.02	1.09	1.18
Peru	1.00	0.97	0.85	0.60	1.00	0.90	0.73	0.64	1.00	1.05	1.14	1.26
Trinidad and Tobago	(1.00)	(1.00)	1.01	0.89	(1.00)	(0.61)	0.90	0.75	(1.00)	(0.97)	0.99	1.08
Venezuela	1.00	1.03	0.92	0.68	1.00	0.89	0.78	0.70	1.00	1.01	1.09	1.17
Regional mean[c]	1.00	0.97	0.92	0.73	1.00	0.93	0.82	0.72	1.00	1.03	1.08	1.16
C Asia												
Bangladesh	1.00	1.01	1.03	(0.86)	1.00	0.95	0.93	(0.68)	1.00	1.04	1.05	(1.27)
Fiji[b]	1.00	–	–	–	1.00	0.87	1.07	1.10	1.00	1.09	1.04	1.09
Indonesia[b]	1.00	–	–	–	1.00	0.90	0.88	0.84	1.00	1.02	1.05	1.33
Jordan	1.00	1.04	0.92	0.71	1.00	0.87	0.80	0.66	1.00	1.02	1.07	1.12
Korea, Rep. of	1.00	1.04	0.87	0.72	1.00	0.99	0.97	0.90	1.00	1.02	0.99	1.10
Malaysia	1.00	1.01	0.96	0.67	1.00	0.92	0.86	0.77	1.00	1.03	1.02	1.05
Nepal[b]	1.00	–	–	–	1.00	(0.96)	(0.93)	(0.85)	1.00	(0.97)	(1.14)	(1.07)
Pakistan	1.00	(0.94)	0.90	(0.58)	1.00	(0.92)	0.94	(0.91)	1.00	(1.03)	1.06	(1.24)
Philippines	1.00	1.16	1.07	0.77	1.00	0.92	0.82	0.68	1.00	1.01	1.06	1.19
Sri Lanka	1.00	–	–	–	1.00	0.95	0.89	0.84	1.00	1.00	1.01	1.11
Syria	1.00	(0.90)	0.89	0.66	1.00	(0.78)	0.77	0.64	1.00	(1.00)	1.01	1.07
Thailand[b]	1.00	–	–	–	1.00	1.00	0.98	0.85	1.00	1.04	0.99	1.27
Regional mean[c]	1.00	1.05	0.95	0.71	1.00	0.93	0.90	0.81	1.00	1.03	1.03	1.15
Overall mean[c]	1.00	0.99	0.93	0.74	1.00	0.94	0.87	0.78	1.00	1.03	1.05	1.15

[a]Groups are based on the number of years spent in formal education, with certificates, etc converted to years where necessary.
[b]The marriage index is missing for these countries because education was not obtained in the household interview.
[c]Unweighted averages, based only on subgroups of more than 200 currently in union women (ie excluding values in parentheses).
NOTE: Parentheses denote subgroups with less than 200 currently in union women.

exceptions, mostly attributable to unreliable estimates based on small numbers of women, the effect of contraception increases monotonically with ascending levels of education and the effect of lactational infecundability decreases.

The link between the contraceptive effect and educational attainment is weakest in Africa. Educational background has only a minimal effect on the index values, except for the small number of women in Kenya with a secondary or higher level of education and the even smaller equivalent group in North Sudan.

These results contrast vividly with those from the Americas. Large declines in C_c are recorded with successive increments in educational attainment, the net result being a very wide range in index values across the educational spectrum. For the region as a whole, the fertility-reducing effect of contraceptive practice is greater by 28 per cent among women with seven or more years of schooling than among those with no schooling. As might be expected, the gap is widest in countries where fertility decline and the spread of contraception is most recent, such as Peru and Mexico, but even in a country such as Panama with a long record of fertility decline there are still pronounced differences. Only Costa Rica, and to a lesser degree Guyana, are exceptional in the evenness of the contraceptive effect across educational strata.

On average, the Asian region shares one similarity with the Americas, the existence of an appreciable difference of 7 per cent in contraceptive effect between women of no schooling and of lower primary schooling, but there is more variability in this low threshold between countries. The differences are negligible or non-existent in Republic of Korea and Thailand (and Nepal)

Table 14 Education differentials:[a] in components of the marriage index, the marriage index, the index of ever marriage and the index of current marriage;[b] ratios of indices for other subgroups to no schooling index

Country	Marriage index (C_m)				Ever-marriage index (C_{em})				Current marriage index (C_{cm})			
	No sch.	1–3 yr	4–6 yr	7+ yr	No sch.	1–3 yr	4–6 yr	7+ yr	No sch.	1–3 yr	4–6 yr	7+ yr
A Africa												
Ghana	1.00	(0.85)	0.90	0.83	1.00	(0.97)	0.95	0.86	1.00	(0.87)	0.94	0.96
Kenya	1.00	0.95	0.89	0.78	1.00	0.97	0.88	0.78	1.00	0.98	1.00	1.01
Lesotho	1.00	0.95	1.01	0.80	1.00	0.99	0.99	0.79	1.00	0.97	1.02	1.01
Senegal	1.00	(1.00)	(0.80)	(0.58)	1.00	(1.00)	(0.83)	(0.65)	1.00	(1.00)	(0.97)	(0.89)
Sudan (North)	1.00	0.88	0.79	0.60	1.00	0.88	0.78	0.59	1.00	1.00	1.02	1.02
Regional mean[d]	1.00	0.93	0.90	0.80	1.00	0.94	0.90	0.81	1.00	0.98	1.00	0.99
B Americas												
Colombia	1.00	0.87	0.78	0.62	1.00	0.86	0.76	0.59	1.00	1.01	1.03	1.05
Costa Rica	1.00	1.22	1.11	0.88	1.00	1.17	1.04	0.83	1.00	1.04	1.06	1.06
Dominican Rep.	1.00	1.03	0.87	0.65	1.00	1.00	0.89	0.63	1.00	1.03	0.98	1.03
Guyana	(1.00)	(0.97)	0.86	0.73	(1.00)	(0.97)	0.93	0.80	(1.00)	(1.00)	0.93	0.91
Haiti	1.00	0.91	(0.83)	(0.78)	1.00	0.97	(0.89)	(0.79)	1.00	0.93	(0.94)	(0.98)
Jamaica	[e]	(0.79)	0.95	0.88	[e]	(0.89)	1.05	0.92	[e]	(0.88)	0.91	0.95
Mexico	1.00	0.95	0.81	0.62	1.00	0.93	0.80	0.62	1.00	1.02	1.00	1.00
Panama	(1.00)	1.00	0.88	0.64	(1.00)	1.01	0.92	0.70	(1.00)	0.99	0.96	0.93
Paraguay	(1.00)	0.96	0.84	0.70	(1.00)	0.93	0.80	0.63	(1.00)	1.02	1.05	1.12
Peru	1.00	0.97	0.88	0.61	1.00	0.98	0.88	0.61	1.00	0.99	1.00	1.01
Trinidad and Tobago	(1.00)	[f]	0.89	0.72	(1.00)	[f]	0.96	0.77	(1.00)	[f]	0.93	0.93
Venezuela	1.00	1.04	0.89	0.69	1.00	1.01	0.86	0.64	1.00	1.02	1.04	1.08
Regional mean[d]	1.00	0.99	0.88	0.69	1.00	0.98	0.88	0.68	1.00	1.01	1.00	1.01
C Asia												
Bangladesh	1.00	1.00	1.05	(0.88)	1.00	0.99	0.97	(0.86)	1.00	1.02	1.08	(1.02)
Fiji	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]
Indonesia	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]
Jordan	1.00	1.00	0.93	0.73	1.00	1.00	0.94	0.73	1.00	1.00	1.00	1.01
Korea, Rep. of	1.00	1.00	0.89	0.73	1.00	1.01	0.88	0.73	1.00	0.99	1.00	0.99
Malaysia	1.00	1.03	0.99	0.72	1.00	1.01	0.96	0.69	1.00	1.02	1.03	1.04
Nepal	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]
Pakistan	1.00	(0.95)	0.86	(0.57)	1.00	(0.95)	0.85	(0.56)	1.00	(1.00)	1.01	(1.02)
Philippines	1.00	1.17	1.08	0.76	1.00	1.16	1.07	0.75	1.00	1.01	1.01	1.01
Sri Lanka	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]
Syria	1.00	(0.91)	0.92	0.67	1.00	(0.90)	0.92	0.66	1.00	(1.00)	1.01	1.01
Thailand	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]
Regional mean[d]	1.00	1.04	0.96	0.72	1.00	1.03	0.94	0.71	1.00	1.01	1.02	1.01
Overall mean[d]	1.00	0.99	0.91	0.72	1.00	0.99	0.91	0.71	1.00	1.00	1.00	1.01

[a]See footnote [a], table 13.
[b]See footnote [a], table 8.
[c]See footnote [b], table 13.
[d]See footnote [c], table 13. Jamaica omitted from calculations.
[e]Because there are no respondents in certain age groups, the index cannot be computed. Indices for 1–3 years are shown, and 4–6 years and 7+ years values are ratios to 1–3 years.
[f]Because there are no respondents in certain age groups, the index cannot be computed.
NOTE: Parentheses denote subgroups with less than 200 currently in union women.

but marked in the Arab countries. Unlike the Americas, there tends to be little difference in contraceptive impact between the lower and upper primary groups, though the relative increase in impact with secondary education is of the same magnitude in both regions. The net result is that Asian education differentials are less sharply delineated than in the Americas. The average fertility-reducing impact of contraception among women with seven or more years of schooling is greater than for the no schooling group by only 19 per cent, in contrast to the 28 per cent difference in the Americas.

Once again examination of the components of the index of contraception reveals that subgroup differentials are overwhelmingly the consequence of levels of use rather than choice of methods (table 15). Almost always, the ratios of mean method effectiveness of the better educated to those with no schooling fall between 0.95 and 1.05. It is interesting that more often method effectiveness falls, rather than rises, with education, perhaps reflecting greater reliance on modern methods among the smaller subset of less educated women who contracept or perhaps the consequence of fuller reporting of traditional methods by the better educated. Sharper declines in use effectiveness across schooling

Table 15 Education differentials:[a] in components of the index of contraception, the mean proportion using and the mean method effectiveness;[b] ratios of values for other subgroups to no schooling value

Country	Proportion using				Method effectiveness			
	No sch.	1–3 yr	4–6 yr	7+ yr	No sch.	1–3 yr	4–6 yr	7+ yr
A Africa								
Ghana	1.00	(2.03)	1.68	3.03	1.00	(1.05)	1.02	1.04
Kenya	1.00	1.61	2.40	5.74	1.00	0.97	0.98	1.06
Lesotho	1.00	1.68	2.32	3.85	1.00	0.85	0.89	0.91
Senegal	1.00	(27.12)	(0.00)	(0.00)	1.00	(1.16)	–	–
Sudan (North)	1.00	6.10	10.91	21.32	1.00	1.00	1.00	1.00
Regional mean[c]	1.00	3.13	4.33	4.21	1.00	0.94	0.97	1.00
B Americas								
Colombia	1.00	1.50	2.19	2.93	1.00	1.00	1.00	0.98
Costa Rica	1.00	1.11	1.24	1.32	1.00	0.98	0.95	0.92
Dominican Rep.	1.00	1.30	2.04	2.82	1.00	0.98	0.97	0.97
Guyana	(1.00)	(1.16)	1.13	1.23	(1.00)	(0.97)	0.97	0.90
Haiti	1.00	1.94	2.73	3.00	1.00	1.08	1.05	1.06
Jamaica	(1.00)	(1.86)	2.23	2.74	(1.00)	(0.98)	0.94	0.90
Mexico	1.00	1.85	3.05	4.42	1.00	1.03	1.04	1.04
Panama	(1.00)	1.04	1.40	1.66	(1.00)	1.03	1.04	1.02
Paraguay	(1.00)	1.26	1.94	2.55	(1.00)	0.98	0.96	0.96
Peru	1.00	2.07	3.84	4.61	1.00	1.02	1.03	1.05
Trinidad and Tobago	(1.00)	(1.88)	1.46	1.76	(1.00)	(0.96)	1.01	1.00
Venezuela	1.00	1.28	1.67	2.01	1.00	0.98	0.97	0.96
Regional mean[c]	1.00	1.48	2.02	2.55	1.00	1.01	0.99	0.97
C Asia								
Bangladesh	1.00	1.96	2.27	(5.64)	1.00	0.97	0.98	(0.98)
Fiji	1.00	1.20	0.82	0.87	1.00	0.97	0.95	0.92
Indonesia	1.00	1.42	1.57	2.08	1.00	1.00	0.98	0.94
Jordan	1.00	2.48	3.14	4.15	1.00	0.96	0.98	0.98
Korea, Rep. of	1.00	1.07	1.26	1.75	1.00	1.00	0.99	0.95
Malaysia	1.00	1.42	1.74	2.38	1.00	1.02	1.00	1.00
Nepal	1.00	(5.25)	3.39	(6.27)	1.00	(0.88)	0.87	(0.96)
Pakistan	1.00	(3.13)	2.54	(6.14)	1.00	(1.10)	1.05	(0.98)
Philippines	1.00	2.16	3.48	5.43	1.00	0.95	0.97	1.00
Sri Lanka	1.00	1.36	1.75	2.19	1.00	0.98	0.96	0.93
Syria	1.00	(3.53)	3.84	4.78	1.00	(1.00)	0.99	0.99
Thailand	1.00	1.02	1.15	1.58	1.00	1.00	1.00	1.00
Regional mean[c]	1.00	1.56	2.14	2.80	1.00	0.98	0.99	0.97
Overall mean[c]	1.00	1.75	2.42	2.86	1.00	0.99	0.99	0.97

[a]See footnote [a], table 13.
[b]See footnote [a], table 9.
[c]See footnote [c], table 13.
NOTE: Parentheses denote subgroups with less than 200 currently in union women.

groups occur in Costa Rica and Fiji, countries with high levels of overall use. On balance, however, it is the lack of differentials in use effectiveness which is striking. This raises the question of how well the fixed method-specific effectiveness weights correspond with actual use effectiveness. One might expect the effectiveness of the use of particular methods to increase with education.

As observed earlier, the effect of lactational infecundability declines with increasing education. Discounting small categories, there are no appreciable exceptions to the monotonic nature of the trend across the educational spectrum. The potential increase in fertility represented by these differences amounts to an average of 10 per cent between lowest and highest educational strata in Africa (equal to six points in the absolute size of C_i) and to 15–16 per cent in the Americas and Asia (equal to 13 points in the absolute size of C_i in both cases). Naturally the relative magnitudes vary between countries, though it is the uniformity of the association that is more impressive than country-specific divergences. Again, on balance, traditional spacing behaviour is less affected by the attainment of non-traditional socio-economic characteristics in Africa than in Asia.

We come lastly to C_m, the index of marriage. This index cannot be defined for several of the Asian surveys where the educational status of single women was not ascertained. This is unfortunate because the results for the remaining Asian countries are interesting. Contrary to expectations, the average fertility-reducing effect of nuptiality in the Asian region is slightly less among the lower primary group than among the totally uneducated. This trait is particularly pronounced in the Philippines but is also clearly apparent in Jordan and Republic of Korea. In the Philippines and Republic of Korea the no schooling group is a small proportion of all women, especially at ages under 30, where relatively low proportions ever and currently married are most evident. Similar findings are not apparent in Africa and uncommon in the Americas, being largely confined to countries where totally uneducated women are a small, atypical minority.

In all three regions, the nuptiality effect is stronger among women with 4–6 years of schooling than among those with 1–3 years. Paradoxically in view of the results for the C_c index, this difference is more pronounced in Asia than in the other two regions. The regions are more similar at the upper end of the educational spectrum. Major differences in C_m between upper primary and secondary groups are registered in nearly all countries, reflecting the near-universal tendency in developing countries for better educated women to postpone marriage. This shift in marriage patterns distinguishes the secondary school or higher category from the other educational groups much more sharply than shifts in contraception or breastfeeding. These differentials in the fertility effect of nuptiality patterns are largely the consequence of patterns of first union, with patterns of union dissolution making a small, and typically countervailing, contribution (table 14). Even in the Caribbean region, where differentials in the index of current marriage are more pronounced, they are of secondary importance.

4.2 RELATIONSHIPS AMONG THE PROXIMATE DETERMINANTS

Examination of subgroup differentials in the indices suggests that the fertility impacts of the three determinants are correlated. The contributions of nuptiality and contraception tend to lie in the same direction and to be of equivalent magnitude, while the effect of lactation through post-partum infecundability works in the opposite direction and is generally of smaller magnitude. One method of summarizing these relationships is through linear regression of the indices on each other. In a regression of C_m on C_c, for example, the regression coefficient describes the relationship, the change in C_m for each unit change in C_c, and the proportion of variance explained indicates the extent to which the national or subgroup values as a body conform to or diverge from the summary of this relationship represented by the regression model. Thus both the nature of the relationship and the usefulness of summarizing across countries can be considered. The bivariate regression only partially answers questions about the net fertility impact of any pair of determinants, since under the model employed here three determinants, as well as omitted factors captured by group differences in TF, account for observed fertility levels. However, when the third index is entered into the regression as a control, the coefficient for the relationship of interest then reflects the net fertility consequence of that relationship.

It seems plausible that relationships among the proximate determinants should differ according to whether total fertility has shown an appreciable decline from traditional levels and whether this departure is recent or more established. Hence we introduce here a classification of countries by stage of fertility transition, as follows:

Early decline	Recent decline	No decline
Costa Rica	Colombia	Ghana
Panama	Dominican Republic	Kenya
Trinidad and Tobago	Guyana	Lesotho
Fiji	Haiti	Senegal
Korea, Rep. of	Jamaica	Sudan (North)
Malaysia	Mexico	Bangladesh
Sri Lanka	Paraguay	Jordan
	Peru	Nepal
	Venezuela	Pakistan
	Indonesia	Syria
	Philippines	
	Thailand	

Certainly the placement of specific countries within this classification is subject to debate, especially as the 'early' versus 'recent' distinction is vague. But we consider this distinction more useful than a classification by observed fertility level (the TFR, for example), as some countries showing no declines have moderate levels of fertility (Lesotho, North Sudan, Bangladesh) while others where reproductive behaviour had begun to change by the date of the survey (eg Mexico) nevertheless display quite high fertility. Note that this classification overlaps heavily with region: in particular, the no decline group includes all the African countries, plus the countries of West and South Asia, and the recent decline group is composed entirely of American and South-East Asian countries.

Regressions of the indices on each other are presented in table 16. For conciseness, the regression coefficient (Coeff.) and the proportion of variation explained (R^2) are shown. Scatter-plots corresponding to the bivariate regressions indicate that where the R^2 falls below 0.70 the observed variation is poorly explained.

Regressions using the country as the unit of analysis are shown in the first panel. One would expect the covariation of the indices across countries to resist simple summarization, as the proximate determinants will themselves be heavily determined by a large number of country characteristics not controlled in this analysis.

Table 16 Regression coefficients and proportion of variance explained, regressions of C indices on each other

Regression model		C_m regressed on C_c		C_m regressed on C_i		C_m regressed on C_c* C_i	C_c regressed on C_i		Number of cases
		Bivariate	Controlling C_i	Bivariate	Controlling C_c	Bivariate	Bivariate	Controlling C_m	
A Across countries[a]									
All countries	Coeff.	0.33	0.34	−0.41	0.04	0.52	−1.32	−0.78	29
	R^2	0.61	0.61	0.30	0.61	0.12	0.53	0.74	
B Across residence groups within countries[b]									
Region									
Africa	Coeff.	1.43	0.77	−1.92	−1.28	−0.34	−0.82	−0.38	14
	R^2	0.49	0.63	0.55	0.63	0.01	0.43	0.53	
Americas	Coeff.	0.65	0.38	−1.28	−0.61	1.07	−1.77	−0.86	35
	R^2	0.81	0.85	0.79	0.85	0.67	0.80	0.85	
Asia	Coeff.	0.66	0.28	−1.08	−0.84	0.31	−0.86	0.13	33
	R^2	0.55	0.83	0.77	0.83	0.04	0.39	0.55	
Fertility transition									
Early	Coeff.	0.88	0.29	−1.23	−0.88	1.36	−1.22	−1.09	21
	R^2	0.57	0.63	0.62	0.63	0.36	0.82	0.82	
Recent	Coeff.	0.69	0.29	−1.14	−0.79	0.72	−1.19	0.15	35
	R^2	0.74	0.90	0.84	0.90	0.27	0.60	0.74	
No change	Coeff.	0.59	0.26	−1.70	−1.25	0.57	−1.76	−0.92	26
	R^2	0.49	0.66	0.61	0.66	0.17	0.47	0.54	
All countries	Coeff.	0.68	0.30	−1.22	−0.84	0.73	−1.26	−0.49	82
	R^2	0.63	0.78	0.72	0.78	0.24	0.57	0.66	
C Across educational groups within countries[c]									
Region									
Africa	Coeff.	1.22	1.14	−2.06	−0.21	2.02	−1.62	−0.56	15
	R^2	0.82	0.82	0.56	0.82	0.44	0.63	0.85	
Americas	Coeff.	0.90	0.39	−1.79	−1.11	1.52	−1.73	−0.88	38
	R^2	0.80	0.87	0.84	0.87	0.67	0.80	0.84	
Asia	Coeff.	0.82	0.42	−2.14	−1.22	1.27	−2.19	−1.54	24
	R^2	0.62	0.68	0.63	0.68	0.49	0.71	0.75	
Fertility transition									
Early	Coeff.	1.20	0.74	−1.54	−0.79	1.49	−1.01	−0.55	17
	R^2	0.60	0.66	0.57	0.66	0.31	0.58	0.68	
Recent	Coeff.	0.86	0.24	−1.90	−1.41	1.51	−2.02	−1.65	33
	R^2	0.80	0.85	0.85	0.85	0.72	0.88	0.89	
No change	Coeff.	0.90	0.60	−2.31	−1.00	1.30	−2.17	−0.84	27
	R^2	0.73	0.78	0.66	0.78	0.58	0.75	0.80	
All countries	Coeff.	0.90	0.49	−1.89	−0.99	1.46	−1.82	−1.03	77
	R^2	0.74	0.79	0.74	0.79	0.58	0.75	0.80	

[a]Regressions use logit transformation of the indices.
[b]The model is, eg $C_{mik} = a + bC_{cik} + C_i + e_{ik}$, where i=1, ..., 29 countries; k=1, ..., 3 residential subgroups.
[c]The model is, eg $C_{mij} = a + bC_{cij} + C_i + e_{ij}$, where i=1, ..., 29 countries, j=1, ..., 4 educational subgroups.

The R^2 values do suggest relatively weak cross-national relationships. The slopes indicate that unit differences in C_c and C_i are not matched by unit differences in C_m, but that a unit difference in C_i corresponds with somewhat more than a unit difference in C_c. Since the factors determining national differences in nuptiality are in all probability rather different from those influencing marital fertility behaviour (McDonald 1981), the weak correspondence between C_m and C_c or C_i is hardly surprising. One might have expected the two components of marital fertility to be more strongly linked, but here as well the bivariate regression explains barely half of the cross-national variation.

The regressions in panels B and C of table 16 follow in a more direct fashion the patterns suggested by the index differentials. Here the regressions summarize the associations between subgroup indices within countries. All the educational and residential subgroups indices from the 29 countries are brought together and then transformed into deviations from the mean index value for the country.[4] Regressions with the transformed indices are equivalent to regressions with untransformed indices

[4]The unweighted mean of the four education subgroup indices or the mean of the three residence subgroup indices is used in the transformation, *not* the national value. The coefficients shown in the table are equivalent to those which would be obtained from a regression which included 28 dummy variables for countries. With either approach, the coefficients pertain to variation *within* countries about the country mean. Note that the R^2 shown here, however, refers not to explained variation in the absolute values of the indices but rather variation in the transformed indices.

and 28 binary indicators representing countries. That is, the model is

$$Cx_{ij} = a + b\,Cy_{ij} + C_i + e_{ij} \qquad (9)$$

where x,y = m, c, i and $x \neq y$; i = 1, ..., 29 countries; j = 1, ..., three residential subgroups, 1, ..., four educational subgroups; C_i are binary indicators for each of the countries; a is an estimated coefficient, representing the grand mean of Cx; b is an estimated coefficient; and e_{ij} is the error term.

In this way country-specific effects on the absolute values of the indices are controlled for, and the analysis now focuses on the extent to which the levels of the indices co-vary systematically among educational and residential strata within countries.

The b coefficients are presented in table 16. Considering the educational strata first (panel C), the final row, showing the proportion of variance explained when educational strata in all countries are analysed, indicates that most of the relationships do conform to the simple model implied by the linear regression. The exception is the regression of C_m on C_c*C_i. As the other regressions demonstrate that the C_m–C_c and the C_m–C_i relationships take contrary directions, the relatively weak relationship between the fertility impact of nuptiality and the combined effect of the marital fertility factors follows naturally. The remaining relationships are impressive: a one unit change in C_c is accompanied by roughly a one unit change in C_m; the two determinants reinforce each other. One unit differences in C_i are met by roughly two unit differences in the opposite direction in both C_m and C_c. These three bivariate relationships are also shown in figures 1–3, which emphasize more dramatically their strength. Even when C_c or C_m is controlled for in the regression of the other on C_i, one unit changes in C_i are compensated by essentially equal changes in C_m or C_c. On balance, then, the observed negative association between educational status and fertility is the consequence of nuptiality and contraception effects of comparable size outweighing contrary lactation effects of half the size.

Differences among regions and countries classified by stage of fertility transition are evident. The relationships are stronger in the Americas and the recent transition group and weakest in Asia and the early transition group. As noted above, there is a large overlap between these classification systems. In the Americas and the recent transition group the universality of the contrary movement of C_m and C_c relative to C_i, as reflected in the R^2 values above 0.80, is especially noteworthy. In the recent transition group the nearly two-unit response of C_c to unit differences in C_i, even with a control on C_m, is evidence that when fertility transition is underway these two principal determinants of marital fertility behaviour

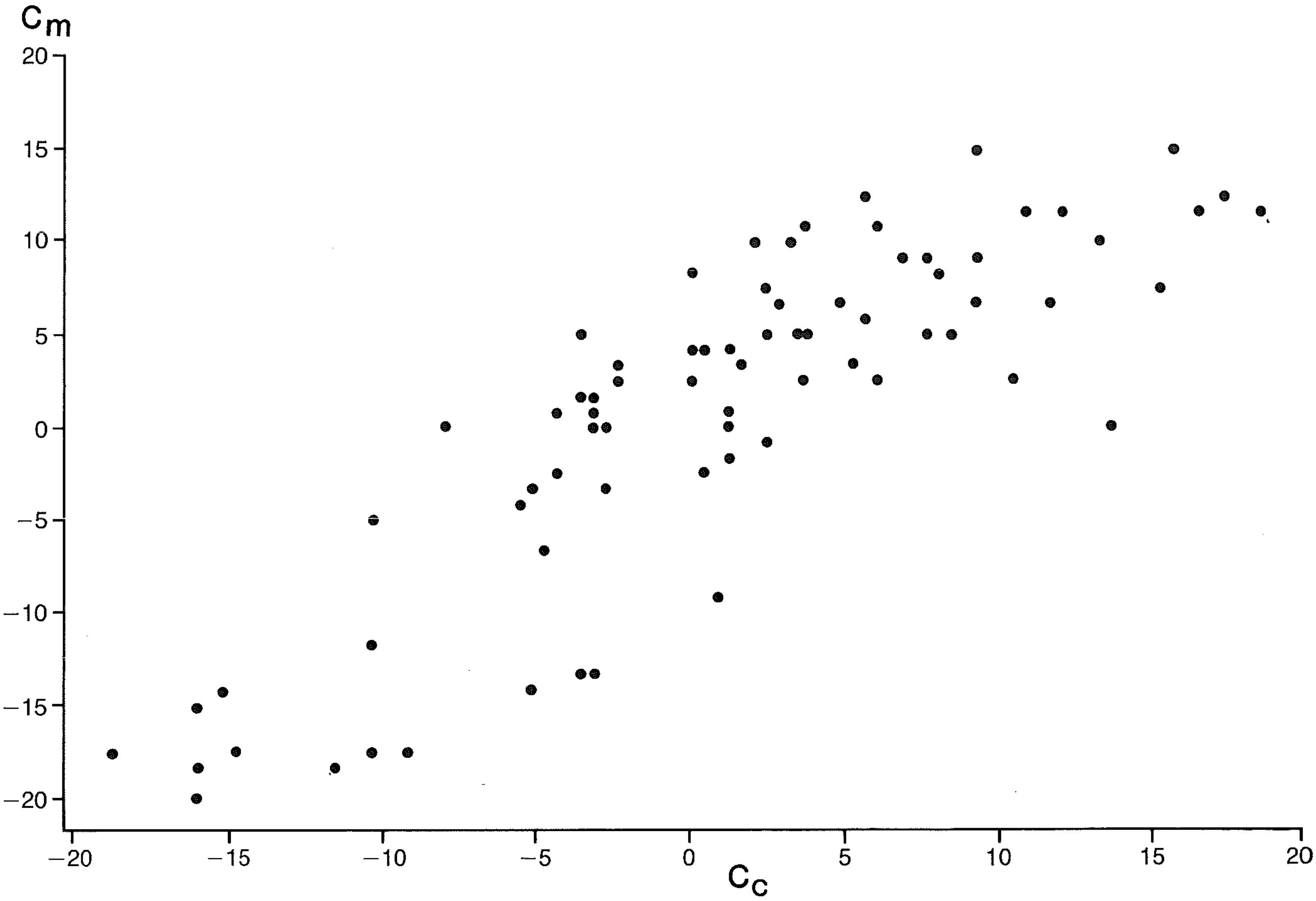

Figure 1 Educational subgroups: scattergram of C_m (y-axis) against C_c (x-axis), with each index measured as deviation from average index for country (N = 77)

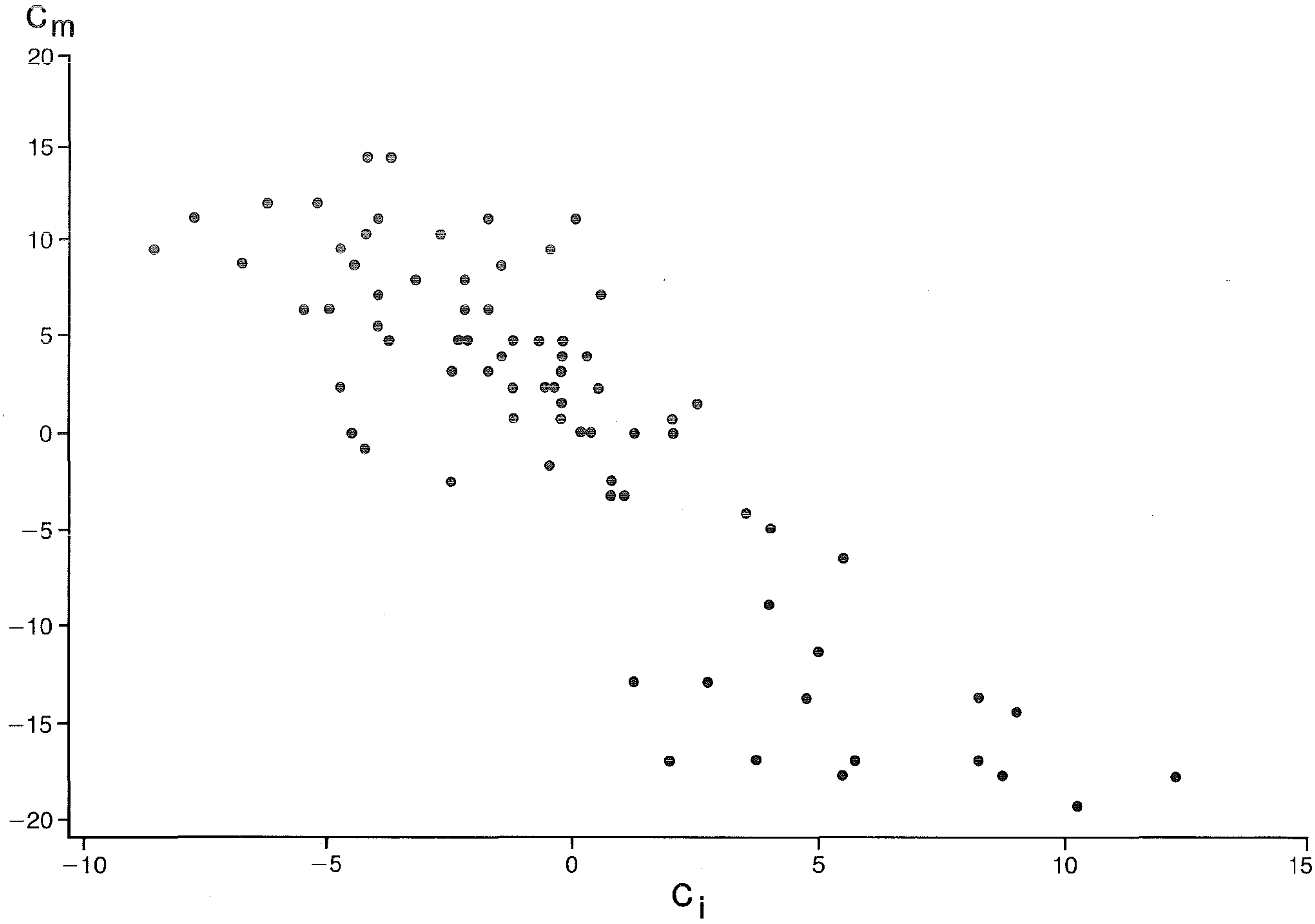

Figure 2 Scattergram of C_m (y-axis) against C_i (x-axis), with each index measured as deviation from average index for country (N=77)

tend to change in opposite directions, the change in C_c being much greater. In those countries where fertility changes began some time ago (early transition), however, the bivariate and net relationships between C_c and C_i are substantially weaker. As noted previously, in these countries educational differences are more the consequence of nuptiality effects than elsewhere, and contrasting styles of marital fertility behaviour are less evident.

The relationships among the residence subgroups (panel B) are for the most part weaker. Type of place of residence measures a broader and more complex set of factors than years of schooling in most countries, so this outcome is reasonable. When residence groups in all countries are considered (final two rows), the estimated regression slopes are about two-thirds the size of those for educational groups. One-unit changes in C_c are met by roughly two-third unit changes in C_m, while one-unit changes in C_i correspond to -1.2 unit changes in C_m and C_c. The R^2 figures indicate that the association between C_c and C_i is not particularly strong; this reflects the fact, noted earlier, that in a subset of countries (exemplified by Indonesia) C_c differs little across residential strata whereas C_i differs substantially.

Once again the relationships are strongest in the Americas and the countries where fertility had begun to decline in the five to ten years preceding the survey. In the Americas, the relationships closely resemble those estimated for educational subgroups. Here differentiation along either socio-economic dimension seems to distinguish contrasting styles of reproductive behaviour: the combination of relatively little use of contraception and relatively long durations of lactational amenorrhoea, and *vice versa*. In Africa and in the group where no important fertility decline is yet apparent, the covariation of the indices across residential strata is much less marked. Here the weaker relationship is in part due to the estimation of a *linear* relationship. Examination of the indices themselves (table 10) reveals that in this small subset of countries declines in C_m and C_c go together and correspond with higher values for C_i.

The overall strength of the relationships among the indices as summarized in table 16 is impressive. This is not surprising, as it is accepted that the proximate determinants respond to a related set of socio-economic and cultural factors. What this analysis succinctly summarizes is the extent to which the relationships represent reinforcing or compensating effects on fertility. It is especially noteworthy that variation in C_i is more than compensated for by variation in C_m and C_c, taken singly or jointly. Only with caution can these results be applied

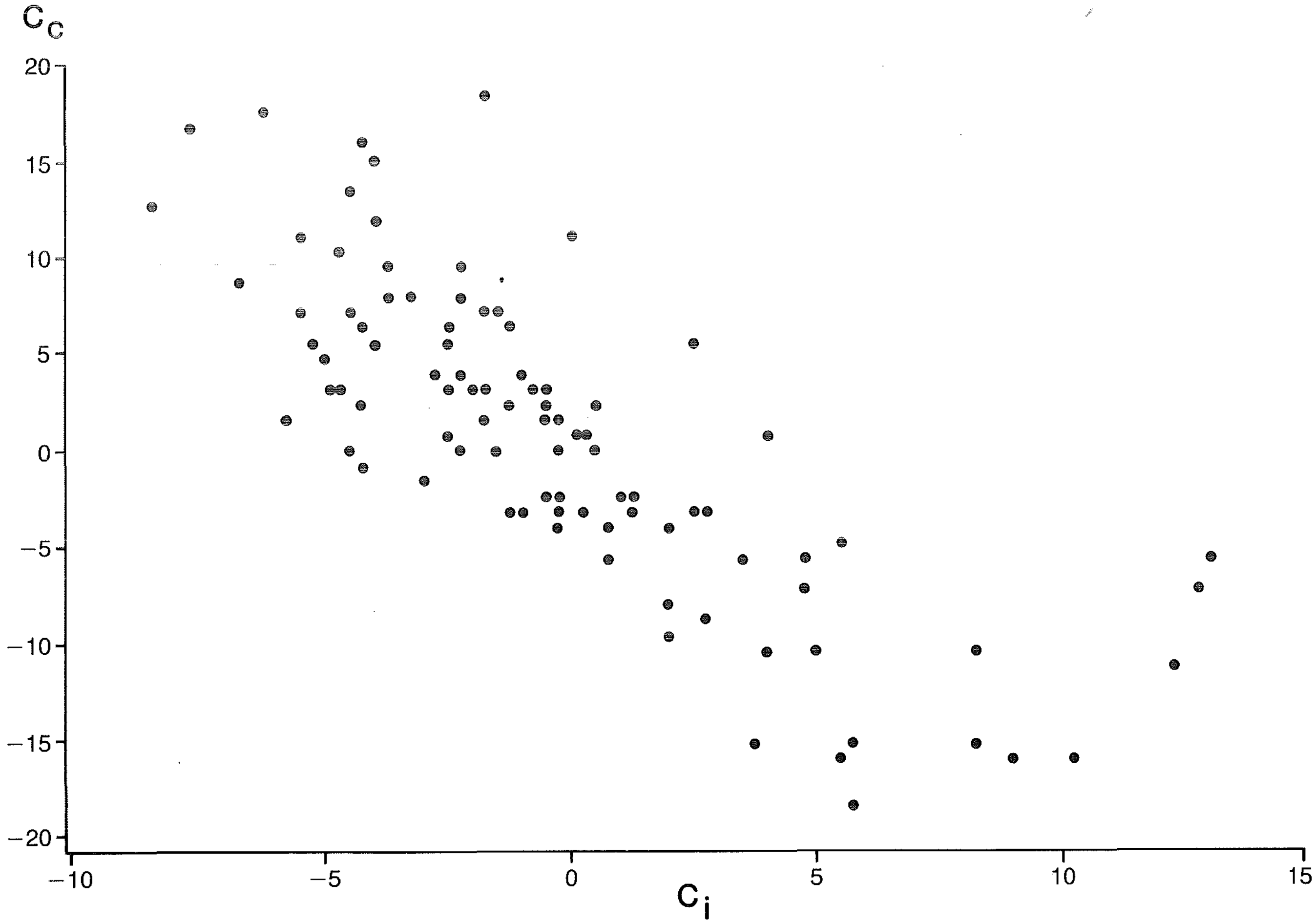

Figure 3 Educational subgroups: scattergram of C_c (y-axis) against C_i (x-axis), with each index measured as deviation from average index for country (N=94)

to temporal variation in fertility. There is now solid evidence that in many settings fertility rises in the early stages of modernization and economic development,[5] probably largely because of reduction in the length of time of breastfeeding and the relaxation of other traditional restraints on fertility. Hence the timing of changes in lactation, contraceptive and nuptiality behaviour may lead to periods in which lactation changes are not compensated for by one or both of the other two. But if level of educational attainment and urbanity are taken to reflect important dimensions of the modernizing process, then the powerful relationships observed here strongly imply that unanswered changes in C_i are short-lived and not the rule. This accords with the evidence from those few countries for which secular changes in lactation are documented (Malaysia, Taiwan, Thailand), where secular changes in either nuptiality or contraceptive use, or both, far outweighed the lactation changes.[6] It does not fit with observed experience to date to posit substantial breastfeeding changes when other proximate determinants are held constant. The evidence suggests that socio-economic factors affect the proximate determinants of fertility not singly but jointly, and that on balance the positive effects of social and economic development on age at first union and contraceptive use far outweigh any negative effects on duration of breastfeeding, from the standpoint of impact on fertility levels.

4.3 ACCOUNTING FOR THE DIFFERENCE BETWEEN OBSERVED AND POTENTIAL FERTILITY

The regression analysis summarizes associations among the proximate determinants across countries and across subgroups within countries. We now utilize the indices to address a separate set of questions: what is the relative contribution of each of the measured determinants to the generation of observed levels of fertility? Or, put differently, in terms of fertility-reducing impact, how do the three determinants rank? One means of answering these questions is through a simple decomposition of the difference between observed and potential fertility. The model specifies that observed fertility is the outcome of the joint impact of the three measured proximate determinants on an estimated total fecundity (TF). (Omitted determinants will influence the estimated TF but otherwise do not enter the picture.) Using a logarithmic

[5]For East Asia, see Coale *et al* (1982) and Freedman and Casterline (1982); for Central Asia, see Coale *et al* (1979); for Africa, see Romaniuk (1980); and for Latin America, see Collver (1965). See also Nag (1980).

[6]See DaVanzo and Haaga (1981), Knodel and Debavalya (1980).

transformation, the Bongaarts model may be expressed as:

$$\ln(TF) - \ln(TFR) = -\{\ln(C_i) + \ln(C_c) + \ln(C_m)\} \quad (10)$$

where ln denotes the natural logarithm transformation. The contribution of each determinant to the reduction of fertility from the TF to the TFR can then be calculated as, for example:

$$100 \ln(C_i)/\{\ln(C_i) + \ln(C_c) + \ln(C_m)\} \quad (11)$$

where equation (11) yields the percentage contribution of C_i. The percentage contributions calculated by (11) will sum to 100, the relative size of each directly reflecting the relative size of each index. Thus, this decomposition essentially produces a comparison of the relative magnitudes of the fertility-reducing impacts of the three determinants. The percentaging of the contributions is a form of standardization. This approach is convenient for comparison across countries and subgroups because absolute fertility levels and the difference between TF and TFR do not enter in. Note that ln(TF) − ln(TFR) is decomposed; the ratio of TF to TFR, not the difference, is the object of the decomposition.

The decomposition has been carried out for each country and subgroup individually. In table 17 the results are summarized for groupings of countries and for the educational and residential subgroups. Considering all countries first, the percentages in the first row of the table indicate that the average relative fertility-reducing impacts of the three determinants are roughly equal, with loss of union exposure of somewhat more importance and contraceptive use somewhat less. This simply reflects the near equivalence of the means shown at the foot of table 7. The comparisons of the education and residence strata are more revealing. The similar reductions in fertility for the 1–3 and 4–6 years of schooling strata are accomplished essentially by the same mechanisms on average, with slightly less reliance on contraception in the former group compensated for by slightly longer durations of post-partum infecundability. Equivalent reductions from the total fecundity rate for the other urban and rural women, on the other hand, are accomplished by very different means, the other urban women experiencing more loss of union exposure and use of contraception and the rural women relying much more heavily on extended post-partum infecundability. Similarly, comparable reductions in the Americas and Asia come about through markedly different combinations of contraceptive and breastfeeding behaviour.

Two further notable features of the table are the predominance of the contribution of post-partum infecundability where the fertility reduction is relatively small (women with no schooling, and the African and no decline countries) and the tendency for the nuptiality

Table 17 Percentage of overall reduction from total fecundity rate to observed total fertility rate which is due to each determinant[a]

Group	Percentage of reduction due to			Absolute reduction from TF to TFR
	Marriage	Contraception	Infecundability	
All countries	38	28	34	7.87
Residence				
Major urban	45	37	18	7.90
Other urban	41	32	27	7.87
Rural	35	23	42	7.61
Education				
No schooling	34	17	49	6.81
1–3 years	34	29	36	7.70
4–6 years	35	34	30	7.89
7+ years	46	39	14	8.74
Region				
Africa	34	7	59	6.10
Americas	41	41	18	8.27
Asia	36	23	41	8.21
Transition stage				
Early decline	41	41	18	8.64
Recent decline	41	35	24	8.39
No decline	32	11	57	6.70

[a]Calculated from the formula $\ln(TF) - \ln(TFR) = -\{\ln(C_i) + \ln(C_c) + \ln(C_m)\}$.
Hence the percentages refer to the ratio TF/TFR. (See text.) The figures shown here are means of the percentage reductions for individual countries in each group, ie the decomposition is carried out country by country and then a mean is computed. Groups with less than 200 currently in union women at the survey date are excluded from the calculation of the mean percentage.

and contraception contributions to be of roughly equal importance where the absolute size of the reduction from the TF to the TFR is large (8.4 or over, say), with the exception of Asia where the mean nuptiality contribution is larger than the contraception contribution and both are less than the mean lactation effect. Comparison of these means for heterogeneous groups of countries makes clear what country-by-country investigation emphasizes more strongly: similar reductions of fertility from unrestricted levels come about through varying mixes of the proximate determinants. It is beyond the province of this paper to attempt systematic explanation of this variation in the mix of proximate determinants. We suspect that both long-standing socio-cultural variables and more recent historical factors would need to be invoked.

5 The Total Fecundity Rate

The total fecundity rate (TF) is estimated by dividing the observed TFR by the product of the three indices. It represents the hypothetical level of fertility that would result if the three measured proximate determinants had no impact on fertility. If these three were the principal source of variation in observed fertility levels among populations, and if natural fecundity was roughly the same in most human population groups, then the estimated TFs would cluster around one value. Substantial variation in the TFs, on the contrary, indicates either that important proximate determinants have been omitted from the model, or that the measurement of the determinants has been in error, or that natural fecundity actually varies among population groups. Among the omitted proximate determinants, induced abortion is the most influential, as it is known to be a major source of fertility reduction in some populations. Due to data restrictions, it has not been included in this analysis. Other omitted factors include coital frequency, post-partum abstinence, temporary spousal separation, spontaneous foetal loss and primary and secondary sterility. Aspects of the included determinants which may not be properly accounted for are contraceptive use effectiveness (one element of C_c) and the amenorrhoeic effect of different styles of breastfeeding.

5.1 CROSS-NATIONAL VARIATION

In a study of 41 contemporary and historical populations, Bongaarts (1982) obtains an average TF of 15.3. By comparison, the average of the national-level TF rates in table 7 is 13.1. Most of this discrepancy is due to differences in measurement of the TFR and the indices. In this application, the TFR is based on within-union births only, C_m is based on within-union exposure over the five-year period (rather than union status at the survey date) and C_c is corrected for overlap between post-partum amenorrhoea and contraceptive use. When the components of the model are measured in the same fashion as in Bongaarts' analysis, the mean TF for the 29 countries is 14.5.

The amount of variation in the TFs within and between countries represents a more fundamental discrepancy between this application and that of Bongaarts. A large amount of variation implies only limited success of the model in accounting for observed levels of national fertility among the 29 countries. In a regression of observed TFRs on TFRs predicted from the model, Bongaarts explains 96 per cent of the variation in observed TFRs, whereas we explain only 70 per cent. The standard errors of the estimates (SEE) are 0.36 and 0.68. Measuring the components as Bongaarts does, 69 per cent of the variation in the TFRs is explained, with an SEE of 0.70. Arbitrarily eliminating those countries whose estimated TF falls outside the range 11.0–15.0, on the grounds that omission of other relevant proximate determinants or data problems are distorting the estimation in these outlying cases, still leaves the explained variance at 88 per cent, with an SEE of 0.38. As one test of the general validity of the model, our results are not nearly as reassuring as Bongaarts'.

Seventeen of the cases in Bongaarts' study are also included in this study. The sources of data for Bongaarts are given in Bongaarts and Kirmeyer (1981). C_c and C_i are based exclusively on WFS data.[7] In a majority of the seventeen countries C_m is also constructed from WFS data on marital status by age, but for several countries census or other survey data are chosen. The TFR is calculated from age-specific fertility rates which sometimes are obtained directly from the WFS survey estimates, sometimes represent adjustments of WFS survey estimates, and sometimes come from other sources. Regrettably, the criteria for choosing marital status data other than those from WFS for calculating C_m are not specified by the authors. Nor are the reasons for preferring a certain set of age-specific fertility rates always provided in the cited source (US Bureau of the Census 1980), when apparently other publications by the US Bureau of the Census also provide this information. When Bongaarts' data are used for this subset of the 41 populations in his study, the predicted TFRs explain 91 per cent of the variation in the observed TFRs (SEE of 0.41). For the same 17 countries we explain 81 per cent of the variation with our preferred measurements of the indices (SEE of 0.55) and 78 per cent (SEE of 0.62) constructing the indices in the same manner as Bongaarts. Restriction to (unadjusted) WFS data evidently weakens the overall fit of the model. Country-by-country comparison of the predicted and observed TFRs, along with the indices, reveals no consistent source for the improved fit in the Bongaarts application.

5.2 SUBNATIONAL VARIATION

National variation in estimated total fecundity can be the consequence of a variety of country-specific factors, including levels of omitted determinants (induced abortion, coital frequency) and features of the data collection (the reporting of fertility, union status,

[7]Nevertheless, our values of C_c and C_i sometimes differ from those presented by Bongaarts. In constructing C_c, for example, we calculate u as the mean of age-specific proportions using, whereas Bongaarts takes the proportion using among all women. In several countries — Costa Rica, Sri Lanka, Peru, Philippines — this affects C_c by two or three points.

contraceptive use and breastfeeding). However, these national characteristics do not impinge directly on comparisons across subgroups within countries, although similar factors may account for subgroup variation. In table 18 we consider subgroup differences in the TF.

In general, the TF declines as urbanity or education increases. This generalization applies best to the Americas, where the rural and no schooling women show the highest TF (ignoring those subgroups containing few respondents). There are two important excep-

Table 18 Comparison of estimated total fecundity rates (TF) for residental and educational subgroups[a]

Country	Residence			Years of schooling			
	Rural total fecundity rate	Difference[b] between rural TF and TF for:		No schooling total fecundity rate	Difference[c] between no schooling TF and TF for:		
		Other urban	Major urban		1–3 yr	4–6 yr	7+ yr
A Africa							
Ghana	12.90	−1.13	−2.37	12.70	(0.28)	0.33	−1.47
Kenya	14.53	−3.85	−2.39	13.57	1.36	0.78	1.99
Lesotho	11.62	−0.90	d	11.32	−0.99	0.40	0.51
Senegal	12.41	−0.71	0.46	12.32	(11.82)	(−1.27)	(−1.03)
Sudan (North)	11.84	−0.66	−0.39	11.37	0.83	0.55	(1.54)
Regional mean[e]	12.66	−1.45	−1.17	12.25	0.40	0.51	0.34
B Americas							
Colombia	14.37	−2.00	−1.83	13.06	0.77	−0.89	0.25
Costa Rica	15.84	−2.93	−3.40	17.84	−2.65	−4.56	−5.71
Dominican Rep.	14.13	−2.08	−2.57	12.42	1.01	0.32	−0.30
Guyana	10.65	−0.63	−1.85	(12.44)	(−1.46)	−2.79	−2.27
Haiti	13.81	(−2.91)	−4.16	13.24	−1.27	(−2.37)	(−3.52)
Jamaica	11.83	−0.08	−1.94	(11.53)	(−1.24)	0.04	−0.36
Mexico	14.01	0.37	0.27	13.51	0.73	0.63	−0.42
Panama	15.37	−1.31	−2.64	(16.72)	−0.61	−1.57	−4.44
Paraguay	13.81	−2.42	−3.27	(15.36)	−1.75	−3.47	−4.68
Peru	15.09	0.06	−1.97	14.69	0.10	−0.73	−1.35
Trinidad and Tobago	10.00	−0.97	−2.12	(9.19)	(2.73)	−0.04	−0.23
Venezuela	16.54	−3.42	−3.28	15.37	−0.17	−2.60	−4.62
Regional mean[e]	13.79	−1.40	−2.40	14.30	−0.43	−1.42	−2.19
C Asia							
Bangladesh	13.72	−0.07	(2.01)	13.54	0.57	1.68	(2.03)
Fiji	11.33	−1.19	−2.29	11.58	0.12	−0.44	−1.46
Indonesia	13.70	−1.40	−1.20	12.87	2.61	2.49	0.69
Jordan	15.51	1.09	−0.31	15.52	0.14	−0.78	−0.14
Korea, Rep. of	15.29	−2.81	−3.44	14.48	−1.27	−0.88	−2.41
Malaysia	10.79	1.42	0.24	10.23	0.44	0.85	1.24
Nepal	13.08	(−2.25)	d	13.03	−0.72	−0.15	−4.38
Pakistan	12.11	−0.07	0.50	12.17	(−0.50)	0.56	(−3.15)
Philippines	15.40	−0.78	−2.94	12.44	2.60	2.90	1.82
Sri Lanka	14.24	−1.12	−1.46	12.90	0.42	1.77	1.44
Syria	15.37	0.14	−1.26	15.13	(1.14)	−1.40	0.52
Thailand	15.72	−2.53	−3.56	14.86	−0.13	0.95	−2.95
Regional mean[e]	13.85	−0.66	−1.57	13.23	0.61	0.70	−0.14
Overall mean[e]	13.62	−1.11	−1.89	13.34	0.14	−0.23	−1.06

[a]Results for subgroups with less than 200 currently in union women are shown in parentheses.
[b]Rural TF minus TF for other groups.
[c]No schooling TF minus TF for other groups.
[d]In Lesotho and Nepal, a major urban category is not defined as no cities attain metropolitan status. All urban centres are therefore included in the 'other urban' category.
[e]Unweighted averages, based only on subgroups of more than 200 currently in union women (ie excluding values in parentheses).

tions to the general pattern of lower TF among the more modernized sectors. In many countries it is higher among women with one to three years of schooling than among the totally uneducated, especially in Africa and Asia; and in several African countries it is appreciably higher in the major urban centres than in the other urban locations. It is worth noting that a curvilinear relationship between fertility and education (ie an initial rise followed by declines across the educational spectrum), which is apparent in several countries in this study, appears to be the consequence of changes in behaviour which are pronatalist in effect but not fully accounted for by indices of the three main proximate determinants.

It is significant that in many countries variation in the TF accounts for more of the observed difference in the TFR between residence or schooling subgroups than one or more of the three main proximate determinants, according to decompositions we present elsewhere (Singh *et al* 1984).

It seems unlikely that potential fecundity differences would display the general pattern evident in table 18. It seems equally unlikely that the fertility effects of the important omitted proximate determinants, with the exception of induced abortion, move in the same direction as the TFs. Furthermore, one would expect that, in most societies, levels of pathological sterility and spontaneous foetal mortality would be lower in the modern sectors. It is possible to investigate directly the role of several of these factors, as WFS surveys contain information on the incidence of non-live births, coital frequency and levels of temporary spousal separations. Levels of primary and secondary sterility can also be estimated. Non-live births and spousal separations are almost certainly severely under-reported, and useful information on coital frequency is provided by only a few surveys. Estimation of levels of sterility is based on reported fertility performance in the absence of contraception, and therefore requires full reporting of both fertility and contraception. Hence these data are examined only for insight into the pattern of residential and educational differentials.

The relevant measures are presented in table 19. Non-live birthrates are shown in panels A and B including a few recently available WFS surveys (Cameroon, Ivory Coast, Tunisia and Yemen AR) not covered by the rest of this report. The rates in panel A refer to spontaneous foetal mortality, or, in those countries where the data do not permit spontaneous and induced losses to be distinguished, all non-live births. The rates in panel B are restricted to losses reported as induced abortions. The

Table 19 Measures of other proximate determinants, by residence and education

Country	Mean	Deviations from mean							No of responses
		Residence			Years of education				
		Rural	Other urban	Major urban	0	1–3	4–6	7+	
A Total spontaneous foetal loss rates[a]									
Africa									
Cameroon	0.56	−0.02	−0.12	0.32	−0.11	0.57	0.17	0.16	
Ghana	0.39	−0.03	0.03	0.07	−0.07	0.25	0.08	0.07	
Ivory Coast	0.90	−0.07	0.22	0.01	0.01	0.22	−0.26	−0.1	
Kenya[b]	0.60	0.0	−0.06	0.09	0.02	−0.1	0.3	−0.04	
Lesotho[b]	0.72	0.02	−0.18	–	0.11	−0.14	−0.06	−0.02	
Senegal[b]	1.05	−0.05	0.36	−0.07	0.01	0.01	0.07	0.24	
Tunisia	0.62	−0.02	−0.02	0.08	–	–	–	–	
Asia and Pacific									
Syria[b]	1.32	−0.21	0.08	0.44	−0.02	0.45	0.15	−0.28	
Yemen AR[b]	0.91	0.0	−0.03	–	0.0	−0.47	−0.91	−0.91	
Bangladesh	0.55	−0.01	0.19	−0.09	−0.05	0.13	0.37	0.11	
Korea, Rep. of	0.52	−0.01	0.05	−0.05	−0.14	−0.31	0.02	0.1	
Philippines	0.76	0.04	−0.13	0.0	−0.04	0.14	0.02	−0.09	
Americas									
Colombia	0.60	0.03	0.0	−0.07	0.18	0.05	−0.04	−0.14	
Paraguay[b]	0.58	0.02	0.02	−0.04	0.12	0.03	−0.03	0.03	
Peru	0.57	−0.04	0.02	0.1	−0.04	−0.03	0.11	0.0	
Venezuela[b]	0.58	0.1	0.02	−0.07	0.01	0.13	0.08	−0.09	
Costa Rica	0.63	0.11	0.04	−0.17	0.07	0.12	0.04	−0.18	
Mexico	0.72	−0.05	0.05	0.07	0.09	0.19	0.01	−0.19	
Panama	0.42	0.04	−0.02	−0.02	0.01	0.1	0.01	−0.03	
Guyana[b]	1.38	−0.01	−0.15	0.09	1.12	0.6	0.27	−0.15	
Haiti[b]	0.44	−0.07	0.21	0.13	−0.05	0.24	0.06	0.0	
Jamaica[b]	0.65	−0.02	0.03	−0.01	−0.02	−0.04	0.17	−0.05	

Table 19 — *continued*

Country	Mean	Deviations from mean							No of responses
		Residence			Years of education				
		Rural	Other urban	Major urban	0	1–3	4–6	7+	
B Total induced loss rates[a]									
Africa									
Cameroon	0.19	0.01	−0.01	−0.04	−0.01	−0.03	−0.02	0.09	
Ghana	0.06	−0.03	0.0	0.11	−0.04	−0.06	0.09	0.03	
Ivory Coast	0.11	−0.06	0.05	0.16	−0.06	0.05	0.42	0.72	
Tunisia	0.34	−0.24	0.1	0.47	–	–	–	–	
Asia and Pacific									
Bangladesh	0.02	0.0	0.0	0.01	−0.01	−0.01	0.03	0.45	
Korea, Rep. of	1.88	−0.64	0.22	0.67	−0.86	−0.33	−0.09	0.96	
Philippines	0.04	−0.01	0.02	0.0	−0.02	0.01	0.0	−0.01	
Americas									
Colombia	0.05	−0.02	0.01	−0.02	0.03	−0.02	0.01	0.01	
Peru	0.04	−0.02	0.01	0.04	−0.02	0.02	−0.01	0.01	
Costa Rica	0.02	0.0	0.01	0.01	0.0	0.01	0.0	0.0	
Mexico	0.06	−0.02	−0.01	0.01	−0.02	−0.02	0.0	0.02	
Panama	0.04	−0.03	−0.02	0.03	−0.04	−0.03	−0.03	0.02	
C Coital frequency: mean frequency of sexual relations per week[c]									
Ghana[d]	2.19	0.07	−0.17	−0.10	0.16	−0.32	−0.22	−0.23	
Colombia[e]	0.99	0.13	−0.10	0.00	−0.10	0.02	−0.07	0.16	
Philippines[e]	1.30	0.03	0.01	−0.18	0.17	0.04	−0.03	0.01	
D Spousal separation: percentage of currently in union, non-pregnant, fecund, non-abstaining, non-amenorrhoeic women with partner away[c]									
Ghana	0.5	−0.1	0.1	0.1	−0.1	−0.5	0.5	−0.1	
Kenya	0.8	0.0	−0.1	−0.5	−0.4	0.2	0.5	0.5	
Lesotho	6.6	0.1	−0.9	–	−4.1	0.1	0.4	0.4	
Philippines	5.6	−0.8	2.7	0.2	−3.7	−3.0	−0.7	2.7	
Syria	0.3	0.2	−0.2	−0.3	0.1	−0.3	0.0	−0.4	
E Secondary sterility: percentage of fertile women aged 30–49 reporting no live birth or pregnancy in the five years preceding the survey, confined to women continuously in union during the five years and with no contraceptive use reported in the open birth interval[f]									
Ghana	31.1	−1	2	2	−1	−2	7	6	1453
Kenya	27.1	−1	20	13	2	−6	−3	−4	2303
Lesotho	42.6	−1	9	–	4	2	−1	0	1133
Senegal	34.6	−1	4	0	0	–	6	–	1272
Sudan (North)	30.9	−1	2	10	0	−9	(1)	–	1257
Bangladesh	38.4	0	0	(1)	1	−1	−5	–	1753
Nepal	32.7	0	(16)	–	0	–	–	–	2258
Pakistan	34.4	−1	1	3	0	(−5)	3	(17)	1997

[a]Five times the summation of age-specific cohort-period rates, five-year age groups, aged 15–49, five-year period preceding survey. In ever-married samples, the age-specific rates are multiplied by the proportion ever married at the survey, obtained from the household survey.
[b]Spontaneous and induced losses.
[c]Standardized for marital duration (seven five-year categories).
[d]Frequency during 'usual' week.
[e]Frequency during previous week.
[f]Standardized for age at survey (four five-year categories).
NOTES: Source for panels A and B, Casterline and Ashurst (forthcoming).
Parentheses in panel E denote subgroups with less than 50 respondents. – denotes subgroups with less than 20 respondents.

rates are calculated for the five-year period preceding the survey in an identical manner to total fertility rates, and thus can be interpreted as the number of losses over a lifetime for a woman experiencing the age-specific rates in the five years preceding the survey. (All rates are restricted to losses occurring subsequent to the date of first union.) In those countries where spontaneous and induced losses can be distinguished, the spontaneous rates (panel A) show on balance weak and inconsistent associations with type of place of residence and educational attainment. In several countries the rates increase with urbanity or education (Senegal, Syria, Peru), but equally often the opposite holds (Colombia, Costa Rica). Thus, no strong conclusions emerge about the relationships between spontaneous loss and these two background variables. The probably severe under-reporting of spontaneous loss no doubt clouds the picture (see Casterline and Ashurst, forthcoming). With the notable exception of Republic of Korea, the induced abortion rates (panel B) are so low that it is difficult to draw any conclusions. The general rule appears to be an increase with urban residence and greater schooling, suggesting that the incidence of induced abortion is generally positively associated with urban residence and schooling. This pattern is consistent with the TF differentials. In Guyana and Syria, however, where induced abortions are not reported separately and spontaneous loss rates are relatively high, suggesting that a significant proportion of the foetal loss is induced, the picture is varied. In Syria the abortion rates increase with urbanity and schooling, but in Guyana they decline sharply with schooling.

Useful information on coital frequency is only provided for three of the 29 countries (panel C) and the data from Colombia and the Philippines are probably more trustworthy (Cleland *et al* forthcoming). In both countries coital frequency is lower in urban areas, a pattern which also applies in Ghana. Coital frequency also falls with education in the Philippines and Ghana, but in Colombia the best educated report the highest frequency. Negative associations of coital frequency with urbanity and schooling are consistent with the typical pattern of TF differentials.

In panel D we present data on prevalence of spousal separation for five countries. Only in Lesotho and the Philippines does the reported prevalence reach significant levels, and in the case of Lesotho we still suspect massive under-reporting.[8] With the exception of the relatively high level in other urban areas in the Philippines, the patterns according to type of place of residence are weak. A positive relationship with education is evident in both Lesotho and the Philippines, and in Ghana and Kenya as well, but the differences are slight in the latter two countries.

Finally, in panel E we consider subgroup differentials in secondary sterility. (The proportions of older women reporting no births throughout their reproductive career are too small to warrant any analysis of socio-economic differentials in primary sterility. See Vaessen 1984.) A behavioural measure of infecundability is selected. Attention is confined to women who have reported at least one pregnancy in their lifetime, have been continuously in union during the five years preceding the survey, report no use of contraception since their last live birth, and are aged 30–49 years at the survey date. Among these women, those who report no live birth during the five years preceding the survey and who are not currently pregnant are regarded as infecund. Because more fecund women are more likely to use contraception, this analysis is limited to eight countries in Africa and South Asia where contraception is rare. These populations are largely rural and uneducated, so that estimates for the urban and educated subgroups are based on small numbers of sample cases, and it is difficult to draw conclusions from these data. The patterns by years of schooling, in particular, show no interpretable regularities. Among the residence groups, there is a tendency for higher proportions of the urban women to show no birth or pregnancy in the reference period. This could indicate higher levels of secondary sterility among urban women, counter to expectations. We think it more likely, however, that the pattern reflects under-reporting of contraception by urban respondents.

The subgroup differences in estimated total fecundity may not stem from the omission of relevant proximate determinants but rather from inadequate measurement of the fertility impact of the three main proximate determinants. This could result from errors in the survey data (eg under-reporting of contraceptive use, inaccurate reporting of the union or birth history, inaccurate reporting of current breastfeeding status) or from incorrect assumptions underlying the construction of the indices. Most of these possibilities are not easily investigated, but one of the assumptions of the model can be straightforwardly assessed, namely that in the construction of C_i a fixed function relates the mean duration of breastfeeding to the mean duration of post-partum amenorrhoea. This assumption is questionable because the amenorrhoeic impact of lactation is known to be affected by the intensity of suckling (frequency and duration; see McNeilly 1977). Different styles of breastfeeding, different levels of supplementation of breastmilk and different patterns of weaning could well imply different relationships between length of time of breastfeeding and amenorrhoea in the various socio-economic subgroups. (We should note that the mean durations of breastfeeding used in calculating C_i refer to breastfeeding of the child without or with supplementation by other food products, that is 'full' and 'partial' breastfeeding.) In those eight countries where data on both breastfeeding and amenorrhoea are available, the stability of the relationship between the two can be assessed. In table 20 we compare the mean durations of amenorrhoea as reported, and as estimated from the duration of breastfeeding according to the functional form proposed by Bongaarts. The subgroup pattern of the ratio of these two varies somewhat erratically, in part because of small samples of urban and educated women. Where a distinct pattern does exist, the ratio more often increases with urbanity and, especially, education. That is, mean durations of breastfeeding correspond with relatively shorter mean durations of amenorrhoea among urban and

[8]There is evidence that spousal separation may be of considerable importance in Nepal, where 10 per cent of respondents report a period of separation in the closed birth interval (the corresponding figure for Lesotho is 12 per cent) and 18 per cent in the open birth interval. About one half of the absences in the open interval are of six months' or more duration.

Table 20 Duration of amenorrhoea, as estimated from current status data[a] on amenorrhoea and breastfeeding: socio-economic subgroups

Country	Estimated from data on[b]:	Residence				Years of schooling			
		National	Rural	Other urban	Major urban	0	1–3	4–6	7+
Ghana	Amen.	13.9	14.8	12.9	10.4	15.2	(13.2)	12.2	12.4
	BF	12.2	13.2	10.6	8.7	14.0	(11.1)	11.9	9.5
Kenya	Amen.	11.6	12.0	9.0	9.2	13.4	12.5	10.4	8.6
	BF	10.7	11.0	8.2	8.0	12.1	11.0	10.1	8.4
Lesotho	Amen.	10.4	10.4	9.7	–	10.0	11.0	10.7	9.7
	BF	12.7	12.8	10.8	–	14.1	12.6	13.0	11.9
Sudan (North)	Amen.	11.6	12.6	9.6	8.0	12.5	8.9	9.4	(5.9)
	BF	10.6	10.9	9.9	9.3	10.7	10.4	10.2	(8.8)
Haiti	Amen.	12.9	14.8	(6.6)	7.2	14.6	9.9	(8.5)	(5.1)
	BF	9.7	11.1	(6.4)	5.9	10.8	8.4	(6.4)	(4.7)
Bangladesh	Amen.	16.1	16.5	12.4	(11.0)	17.5	15.5	11.3	(7.8)
	BF	19.7	20.1	16.2	(15.3)	20.7	18.2	17.5	(11.5)
Philippines	Amen.	8.5	9.4	7.0	4.7	10.1	10.0	9.5	6.0
	BF	7.7	8.8	6.1	4.1	10.3	10.8	8.5	5.3
Syria	Amen.	7.7	8.6	6.7	6.1	8.6	(6.0)	6.0	5.2
	BF	7.2	7.6	6.9	5.9	7.6	(6.8)	6.6	5.7
Ratio of durations (BF/Amen.)									
Ghana		0.87	0.89	0.82	0.84	0.92	(0.84)	0.97	0.78
Kenya		0.92	0.92	0.91	0.88	0.90	0.88	0.97	0.97
Lesotho		1.22	1.23	1.12	–	1.41	1.15	1.22	1.22
Sudan (North)		0.91	0.87	1.03	1.16	0.86	1.17	1.08	(1.50)
Haiti		0.75	0.75	(0.96)	0.83	0.74	0.86	(0.75)	(0.92)
Bangladesh		1.23	1.22	1.31	(1.39)	1.18	1.17	1.54	(1.49)
Philippines		0.91	0.94	0.86	0.87	1.02	1.08	0.90	0.88
Syria		0.94	0.89	1.04	0.98	0.89	(1.13)	1.10	1.11

[a]Mean durations estimated using 'prevalence/incidence' method. See Mosley *et al* 1982. Duration of amenorrhoea estimated from duration of breastfeeding by equation given in footnote [d], table 5.
[b]Amen. denotes amenorrhoea; BF denotes breastfeeding.
NOTE: Parentheses denote subgroups with less than 200 currently in union women.

better educated women. One explanation for this pattern would be a tendency on the part of urban and better educated women to supplement the child's diet, and decrease the intensity of breastfeeding, at a relatively earlier point in the breastfeeding period. (For further evidence of this, see Singh and Ferry 1984.) Other factors which need not be related to the style of breastfeeding could also affect the timing of the return of menses relative to the weaning of the child. Whatever the explanation, the subgroup differentials in the relationship between breastfeeding and amenorrhoea evident in table 20 do not help resolve the TF differentials, as they imply that C_i overestimates the fertility impact of lactation for urban and educated women relative to rural and less educated women. The TF differentials, on the other hand, unless genuine, must be due to underestimation of the fertility impact of measured or unmeasured factors for the urban and educated.

The differentials in tables 19 and 20 provide evidence which is suggestive rather than conclusive. On the basis of these data and further knowledge about these societies, it seems unlikely that spontaneous foetal loss, coital frequency, spousal separation, secondary sterility or different styles of breastfeeding explain the estimated differentials in total fecundity. Indeed, socio-economic differentials in the probable impact of some of these factors run contrary to the TF differentials. Moreover, the TF differences seem too pronounced to be explained by factors which are, from the standpoint of fertility, largely non-volitional. We conclude that the differences in all likelihood reflect greater use of induced abortion and more effective contraception (either unreported use or higher efficiency of use) among the more urban and more educated women. Supporting this view are the age-specific subgroup differences in TF values, which are concentrated at ages 30–44, ie at ages where differentials in levels of volitional control of fertility are typically largest. Can the TF differences be eliminated by making plausible assumptions about subgroup differences in induced abortion and contraceptive use effectiveness? Suppose that the observed mean use effectiveness (e in equation 5), which is derived by assigning fixed effectiveness weights according to the method used, was in error such that the following corrections were required:

Rural:	−0.10	No schooling:	−0.10
Major urban:	+0.10	1–3 yr:	−0.05
		4–6 yr:	+0.05
		7+ yr:	+0.10

Table 21 Total induced abortion rates[a] required to equalize total fecundity rates across residential and educational subgroups, with use effectiveness adjusted[b]

Country	Residence			Years of schooling			
	Rural	Other urban	Major urban	0	1–3	4–6	7+
A Africa							
Ghana	0.50	1.69	2.68	0.50	−0.08	0.08	1.52
Kenya	0.50	4.63	2.17	0.50	−1.32	−0.43	−1.50
Lesotho	0.50	1.16	–	0.50	1.59	0.04	−0.19
Senegal	0.50	1.27	−0.24	0.50	−7.67	2.11	1.17
Sudan (North)	0.50	1.15	0.44	0.50	−0.62	−0.18	−1.03
B Americas							
Colombia	0.50	0.97	−0.07	0.50	−0.70	0.75	−0.54
Costa Rica	0.50	0.81	−0.11	0.50	0.25	1.64	0.54
Dominican Rep.	0.50	1.35	0.87	0.50	−1.05	0.22	−0.37
Guyana	0.50	0.76	0.89	0.50	1.42	3.49	1.39
Haiti	0.50	2.13	3.05	0.50	1.18	1.94	1.31
Jamaica	0.50	0.00	0.45	0.50	1.04	0.42	−0.21
Mexico	0.50	−0.26	−0.81	0.50	−0.75	−0.09	−0.53
Pakistan	0.50	0.43	0.04	0.50	−0.63	0.90	0.34
Paraguay	0.50	1.38	0.94	0.50	1.46	2.57	1.42
Peru	0.50	0.10	0.35	0.50	−0.07	0.94	−0.03
Trinidad and Tobago	0.50	0.51	0.59	0.50	−1.60	0.37	−0.35
Venezuela	0.50	1.78	0.17	0.50	−0.31	1.76	0.80
C Asia							
Bangladesh	0.50	0.42	−1.67	0.50	−0.25	−1.15	−1.44
Fiji	0.50	0.77	0.90	0.50	–	–	–
Indonesia	0.50	1.13	0.73	0.50	–	–	–
Jordan	0.50	−0.82	−0.21	0.50	−0.42	1.21	−0.69
Korea, Rep. of	0.50	1.96	1.59	0.50	0.96	0.84	0.93
Malaysia	0.50	−0.88	−0.57	0.50	−0.47	−0.34	−0.89
Nepal	0.50	2.16	–	0.50	–	–	–
Pakistan	0.50	0.53	−0.40	0.50	0.75	−0.13	2.46
Philippines	0.50	0.40	0.85	0.50	−2.32	−1.77	−1.16
Sri Lanka	0.50	0.76	0.44	0.50	–	–	–
Syria	0.50	0.13	0.18	0.50	−1.14	1.40	−0.68
Thailand	0.50	1.26	0.74	0.50	–	–	–

[a]Number of abortions expected during the reproductive career, according to age-specific abortion rates. The rate is calculated using the formula for C_a provided in Bongaarts (1978). The rate for rural women and those with no years of schooling is set at 0.50.
[b]Mean use-effectiveness levels adjusted as follows:

Rural:	−0.10	No schooling:	−0.10
Major urban:	+0.10	1–3 yr:	−0.05
		4–6 yr:	+0.05
		7+ yr:	+0.10

After recomputing C_c with these adjustments to mean use effectiveness, the total induced abortion rates (abortions per woman over the entire reproductive career) required to equalize the TFs across subgroups are as shown in table 21. The rural and no schooling women are assigned arbitrary rates of 0.50. Where the TF rises rather than declines across residential or educational strata, the estimated total induced abortion rates sometimes fall below zero, obviously an impossibility. (The educational subgroups in Kenya and the Philippines are the most extreme examples.) Most of the rates are between 0.0 and 2.0, which seems plausible.[9] It is interesting to note that the required rates for Republic of Korea fall below the reported (see panel B of table 19) when the rate for rural and uneducated women is set at 0.50.[10] The results support the argument that the analysis is deficient for many of these countries due to crude measurement of contraceptive effectiveness and lack of measurement of induced abortion.

[9]There are few acceptable data on levels of induced abortion in developing countries. Carrasco (1973) reports figures from metropolitan Latin America which imply total induced abortion rates near 1.0. See also Knodel *et al* (1982).

[10]Taking the reported total abortion rates for Republic of Korea and calculating an index of abortion, C_a, following Bongaarts' (1978) formula, we obtain the following set of TFs:

Residence				Schooling			
Total	Rural	Other urban	Major urban	0 yr	1–3 yr	4–6 yr	7+ yr
16.52	17.18	15.56	16.69	15.78	15.16	16.33	17.33

The range of TF values is narrowed, although it remains substantial. The TF tends to fall with urbanity, as before, but now it rises across years of schooling.

6 Summary

In this report, we have examined the effects on fertility of its three major proximate determinants: marriage; contraception; and post-partum infecundability. The model of Bongaarts was applied both at the national level and for residence and education subgroups of 29 WFS surveys. Using this large body of data, we have addressed both methodological and substantive issues.

In the methodological parts of the report, we attempted to assess the sensitivity of the estimates to alternative modes of constructing the components of the model. Among the alternative constructions examined were:

1 Total fertility rates based on all births or on legitimate, 'within-union' births only;
2 The index of marriage, C_m, based on current status data or on proportions of time spent within union over the five years preceding each survey;
3 C_m based on observed marital fertility rates of the 15–19 age group or on a fixed rate equivalent to 0.75 of the rate for the 20–24 age group;
4 Age-specific or non-age-specific constructions of the index of contraception, C_c;
5 C_c unadjusted and adjusted for overlap with post-partum infecundability, with the adjustment achieved by discounting users still breastfeeding a child under six months old;
6 Use of three different fecundity schedules in the construction of C_c: a standard self-reported schedule, country-specific self-reported schedules and a standard behavioural schedule;
7 Age-specific or non-age-specific constructions of the index of post-partum infecundability, C_i;
8 For C_i, estimation of the mean duration of post-partum amenorrhoea from the mean duration of breastfeeding or directly from information on amenorrhoea;
9 C_i based solely on breastfeeding/amenorrhoea data or taking into account reported durations of post-partum abstinence.

The main points of practical importance to emerge from the methodological part of the report were that alternatives 3, 4, 5, 7 and 8 produced closely similar results. In these instances, then, the more simple procedure appears robust and refinements bring few gains. Conversely, alternatives 1, 2, 6 and 9 yielded results that were appreciably different for some countries and especially for certain residence and education subgroups. In particular, we stress that the occurrence of births outside marriage can affect the C_m index and that post-partum abstinence, even if not on average prolonged, may influence the measure of C_i.

Our substantive analysis also yielded findings with methodological implications. In considering nuptiality and contraception, we presented results for components of the C_m index (exposure time lost because of postponement of first union, and time lost through union dissolution) and of the C_c index (prevalence of use, and method mix or use effectiveness). The resulting gains in understanding of fertility variation were modest. Only in a few countries or subgroups does time lost through dissolution represent an appreciable constraint on fertility. Similarly, with a few interesting exceptions, the use-effectiveness subindex varies little. The methodological lesson is that, for most analytic purposes, the overall indices C_m and C_c will suffice.

In a final section of the report, data on certain proximate determinants omitted from this application of the Bongaarts model (ie spontaneous foetal loss, induced abortion, coital frequency, temporary spousal separations and secondary sterility) were presented. Because of the very restricted availability of WFS data on some of these factors and because of obvious problems of under-reporting of others, these additional data added little to our ability to account for fertility variation which was unexplained by the three main proximate determinants.

In the substantive analysis, our objective was to identify the sources of national and subnational variation in fertility in a large number of developing countries at varying stages of fertility transition. Systematic analysis of national and subnational differences in fertility and a full set of proximate determinants for this range of societies and demographic settings have been made possible for the first time by the WFS programme.[11] Some of the important conclusions emerging from this analysis are the direct consequence of its unique scope.

Perhaps the most striking substantive findings concern the nature of the compensating effects at the aggregate level of the three main proximate determinants. It is very clear that, cross-sectionally, the fertility-increasing effect of shorter durations of post-partum infecundability among the more modern strata is almost always more than counterbalanced by the impact on fertility of nuptiality and contraceptive use. This suggests that the time-lags between declines in breastfeeding and compensating movements in contraception and nuptiality are normally short in the contemporary developing world. Thus alarm that radical declines in breastfeeding while marriage and contraception remain static will lead to substantial increases in fertility seems unwarranted. This is not to deny that there may be relatively brief historical

[11] R. Lesthaeghe *et al* (Compensating Changes in Intermediate Fertility Variables and the Onset of Marital Fertility Transition, *General Conference of the IUSSP, Manila 1981*, vol 1, Ordina, IUSSP) utilize WFS data for ten countries and touch on many of the same issues as this paper. The smaller number of countries, however, limits their ability to generalize.

periods in some countries during which declines in breastfeeding lead to large increases in fertility. This may be the case for Syria, Jordan and Kenya, where total fertility rates were well over seven births per woman in the late 1970s. Substantial increases persisting for a few decades may also have occurred earlier in the twentieth century in some parts of central and east Asia and in Latin America (see references in footnote 5). The existence of active institutional efforts to promote the adoption of contraception, and the higher levels of female schooling and resulting postponement of first marriage, diminish the likelihood of such long-term increases in contemporary developing countries.

The detailed analysis of residence and educational differentials in the proximate determinants revealed considerable regional and national diversity in the source of fertility differentials. In general, the negative associations between urbanity and fertility and between maternal schooling and fertility can be attributed to nuptiality and contraceptive effects of comparable size outweighing contrary lactation effects of half the size. In Africa, nuptiality, contraception and breastfeeding are relatively less affected by urbanity and schooling than in the other regions. The most pronounced impacts on contraceptive behaviour are observed in the Americas, while nuptiality and lactation appear to be equally strongly associated with residence and education in Asia and the Americas. An exception to the latter generalization is the somewhat more powerful effect of urbanity on lactation in Asia.

As both residence and schooling were treated as categorical variables in this analysis, we were able to identify those levels of urbanity and education at which substantial breaks from the behaviour of rural and uneducated women occur. For nuptiality, residence in urban areas, whether minor or major, is associated with significantly more lost union exposure, but quite high levels of educational attainment (seven or more years of schooling) are required before a comparable loss of union exposure is observed. On balance, there is no such unevenness in the impact of urbanity and schooling on contraceptive behaviour: those residing in minor urban locations and those with incomplete primary schooling achieve significant fertility reduction through contraception, and those in major urban locations and with more schooling achieve correspondingly greater reduction. Lactation behaviour resembles nuptiality: the sharp breaks occur with residence in any urban place and with the attainment of seven or more years of schooling.

Underlying these subnational patterns are major regional differences in levels of fertility and the measured proximate determinants. Equivalent differences of about eight children between estimated total fecundity and observed fertility in Asia and the Americas come about through markedly different combinations of contraceptive and breastfeeding behaviour, with breastfeeding of much greater importance in Asia and contraception in the Americas. The difference between total fecundity and observed fertility is on average about two births less in Africa, and it is disproportionately attributed to breastfeeding, contraception making virtually no contribution.

A final important finding is the limited extent to which observed variations in national or subnational fertility can be attributed solely to concomitant variations in the three proximate determinants, marriage, contraception and lactational infecundability. No doubt measurement errors are partly responsible, but WFS data are generally acknowledged to be of reasonably high quality, and it is therefore implausible to assign all 'unexplained' fertility variation to this source. Moreover, the subnational analyses reveal a systematic patterning in the residual or 'unexplained' element. In general, the more modernized subgroups have lower fertility than predicted by the model. We suggest that greater use of induced abortion, higher efficiency of use of contraception, and possibly unreported use among the better educated and more urban strata are the most likely reasons for this pattern. One important exception to this generalization of lower than predicted fertility as modernization increases concerns the difference between women with no schooling and those with 1–6 years of schooling (ie primary education). For a considerable number of Asian and African countries, the three indices do not capture antinatal influences which appear to operate among the totally uneducated category and are weaker for those with primary schooling. A similar possible relaxation of fertility restraints is also evident for several metropolitan populations in subsaharan Africa. Whatever the underlying mechanisms, the major methodological conclusion that emerges is that we have been unable to obtain as close a correspondence between observed and predicted fertility levels, at either the national or subnational level, as that obtained in previous cross-national analyses. It is probable that the role in determining fertility levels of other proximate determinants not included in this application of Bongaarts' model cannot be discounted in the way that has sometimes been suggested.

Major advances towards an explanation of fertility transition cannot be expected from the type of analysis presented here, though the detailed evidence should be a useful empirical underpinning to theoretical development. Certainly this investigation emphasizes the dangers of attributing fertility differentials or trends simply to volitional factors, such as parental demand for children. With the advent of WFS data on the proximate determinants, analysts are in a much stronger position than hitherto to interpret the nature and magnitude of differences in fertility.

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Appendix A — Measurement of the Components of the Model

1 Total fertility rate (TFR)

$$TFR = 5\Sigma f(a)$$

where the f(a) are age-specific fertility rates for the five-year period preceding the survey. The rates are calculated using births occurring within union only. Unions include formal and common-law unions and, in several Caribbean countries, visiting unions also.

The rates were calculated by the FERTRATE program developed at WFS headquarters.

2 Index of marriage (C_m)

$$C_m = \frac{TFR}{TMFR} = \frac{\Sigma f(a)}{\Sigma f(a)/m(a)} = \frac{\Sigma f(a)}{\Sigma g(a)}$$

where the m(a) are age-specific proportions of exposure time spent within union during the five years preceding the survey, and the g(a) are age-specific marital fertility rates, based on within-union births only. Following Bongaarts, g(a) for the age group 15–19 is calculated as 75 per cent of g(a) for the age group 20–24.

In those surveys where not all women aged 15–49 were eligible for interview, household survey information is utilized in the calculation of the proportion of total exposure time spent within union.

3 Index of contraception (C_c)

$$C_c = \frac{\Sigma tn(a)cc(a)}{\Sigma tn(a)} = \frac{\Sigma tn(a)[1 - \{u(a,m)e(m)/fec(a)\}]}{\Sigma tn(a)}$$

where tn(a) is a schedule of natural marital fertility, obtained as g(a)/cc(a), u(a,m) are age- and method-specific proportions of currently married women currently using contraception, e(m) is a set of method-specific effectiveness weights, and fec(a) is a schedule of age-specific proportions fecund.

Contraceptive users breastfeeding a child aged six months or less are not counted as users, on the assumption that such women are likely to be amenorrhoeic. Under Bongaarts' (1978) specification, the u(a) exclude amenorrhoeic women. Only a subset of WFS surveys provide direct information on amenorrhoea, so an indirect adjustment must be employed. Tabulations for several countries indicate that the point at which roughly half of those women breastfeeding are no longer amenorrhoeic ranges from 6 to 11 months. We choose the lowest value on the assumption that the joint status of breastfeeding and using will be selective of women no longer amenorrhoeic. The correction for overlap between use and amenorrhoea alters the value of C_c by 0.012 on average (mean absolute difference). (See table 3.)

The effectiveness weights are derived from Laing (1978):

Method	Use effectiveness
Sterilization	1.00
IUD	0.95
Pill	0.90
Other	0.70

Method 'not stated' is assigned a weight of zero.

The schedule of age-specific proportions fecund (fec(a)) is obtained as the simple mean of the proportions self-reported fecund from 28 WFS surveys (Vaessen 1984):

Age group	Proportion self-reported fecund
15–19	0.99
20–24	0.99
25–29	0.98
30–34	0.95
35–39	0.91
40–44	0.78
45–49	0.52

4 Index of post-partum infecundability (C_i)

$$C_i = \frac{\Sigma tf(a)ci(a)}{\Sigma tf(a)} = \frac{\Sigma tf(a)\left\{\frac{p(a)}{q(a) + i(a)}\right\}}{\Sigma tf(a)}$$

where tf(a) is an age schedule of total fecundity rates, calculated as tn(a)/ci(a); i(a) is an age schedule of estimated mean durations of post-partum amenorrhoea, estimated from the estimated mean duration of breastfeeding, B(a), as follows:

$$i(a) = 1.753 \exp\{0.1396B(a) - 0.001872B(A)^2\}$$

The B(a) are estimated from current status data on breastfeeding, using the 'prevalence/incidence' method (Mosley *et al* 1982) as follows:

$$B(a) = \frac{bf(a)}{brth(a)}$$

where bf(a) is the number of women currently breastfeeding and brth(a) the average number of births per month in the two-year period preceding the survey. To cope with small numbers of births and breastfeeding women for women classified by both age and educational attainment or current residence, the B(a) and i(a) are estimated for broad age groups: 15–24, 25–34 and 35–49.

The p(a) and q(a), which represent the length of the birth interval in months without the effects of lactational post-partum amenorrhoea and without the effects of lactational and non-lactational post-partum amenorrhoea, respectively, are set so as to reflect the variation in mean waiting time to conception (and foetal mortality also) with age. The schedules are derived from Hobcraft and Little's (1984) estimates of mean waiting times to conception in the 1975 Dominican Republic Fertility survey data:

Age group	p(a)	q(a)
15–19	18.5	17.0
20–24	17.0	15.5
25–29	20.0	18.5
30–34	20.0	18.5
35–39	23.0	21.5
40–44	38.0	36.5
45–49	94.0	92.5

Appendix B — Sources of Data

The indices are estimated entirely on the basis of WFS survey data for the countries. The tabulations required to provide the inputs to calculate the indices were carried out between March 1982 and February 1983, using the most recent version of the Standard Recode tapes available at the time. Sampling weights were applied throughout the tabulation process.

In Costa Rica and Panama, women of ages 20–49 were interviewed, and in Venezuela women of ages 15–44, rather than 15–49 as in the other countries. Data for the missing age groups have been imputed. In Costa Rica and Panama, the percentage currently using contraception at ages 15–19 has been estimated as:

$$\text{per cent using} = (A/27.8)13.2$$

where A is the mean of the percentages using for the six age groups 20–24 through 45–49 in Costa Rica and Panama, 27.8 is the same mean for the pooled set of national samples and subgroups for the other 27 countries, and 13.2 is the mean use at ages 15–19 for the pooled set of national samples and subgroups. The percentage using at ages 45–49 in Venezuela is estimated as:

$$\text{per cent using} = (B/28.7)20.2$$

where B is the mean of the percentages using for the six age groups 15–19 through 40–44 in Venezuela, 28.7 is the same mean for the pooled set of national samples and subgroups for the remaining 28 countries, and 20.2 is the mean use at ages 45–49 for the pooled set of samples.

The mean use-effectiveness weights for the missing age groups are estimated by a similar procedure.

Because the age-specific marital fertility rate for ages 15–19 is taken as 0.75 times the rate for ages 20–24 in all countries, this in itself presents no problem in Costa Rica and Panama. To obtain the age-specific fertility rate, however, we impute a marital fertility rate and multiply it by the observed proportions currently married (from the household survey). The marital fertility rate is imputed as:

$$\text{ASMFR}(15\text{–}19) = \text{ASMFR}(20\text{–}24)/0.376 \times 0.375$$

where ASMFR(20–24) is the observed rate for ages 20–24, and 0.376 and 0.375 are the mean rates at ages 20–24 and 15–19, respectively, for the other national samples. (We also experimented with fitting the Coale–Trussell marital fertility model to obtain estimated rates, but concluded that the above procedure more nearly reproduces observed patterns.) In Venezuela, the marital fertility rate at ages 45–49 is estimated as:

$$\text{ASMFR}(45\text{–}49) = \text{ASMFR}(40\text{–}44)/0.077 \times 0.024$$

where ASMFR(40–44) is the observed rate for ages 40–44, and 0.077 and 0.024 are the mean rates at ages 40–44 and 45–49, respectively, for the other national samples.

Because durations of breastfeeding for broad age groups are used in the calculations of C_i, no special imputation for the missing age groups in these three countries is required. Rather, we assume that the mean duration of breastfeeding for women aged 15–19 in Costa Rica and Panama is the same as for women aged 20–24, and similarly for women aged 45–49 and 40–44 in Venezuela.

In Guyana and Jamaica, women aged 15–19 who were full-time students were not eligible for interview. In Mexico, women aged 15–19 were eligible for interview only if they had never been in a union or if they had borne a child. These eligibility requirements complicate the estimation of proportion of time spent within union, and some imputation is required. Details are provided in Alam and Casterline (1984).

Appendix C — Listing of the Components of the Model

Country	TFR	TF	C_i	C_c	C_m	C_{em}	C_{cm}	u	e	Number of women
A National										
Africa										
Ghana	6.217	12.349	0.666	0.923	0.820	0.876	0.902	0.086	0.776	4436
Kenya	7.403	14.267	0.695	0.944	0.790	0.844	0.918	0.062	0.840	5708
Lesotho	5.275	11.524	0.645	0.958	0.741	0.834	0.887	0.047	0.778	3146
Senegal	6.896	12.392	0.661	0.980	0.859	0.909	0.950	0.022	0.735	3288
Sudan (North)	5.934	11.672	0.694	0.962	0.762	0.759	0.923	0.038	0.872	2858
Americas										
Colombia	4.269	13.239	0.846	0.633	0.602	0.646	0.873	0.382	0.848	2827
Costa Rica	3.172	14.263	0.908	0.432	0.567	0.617	0.899	0.587	0.862	2684
Dominican Rep.	5.388	13.173	0.852	0.697	0.689	0.775	0.817	0.307	0.891	1808
Guyana	4.748	10.087	0.890	0.722	0.732	0.767	0.906	0.307	0.884	3219
Haiti	5.150	12.732	0.726	0.862	0.646	0.736	0.842	0.171	0.751	1901
Jamaica	4.520	11.224	0.850	0.641	0.738	0.835	0.838	0.367	0.877	2286
Mexico	5.928	14.089	0.842	0.730	0.684	0.718	0.915	0.270	0.858	5640
Panama	3.841	14.380	0.850	0.508	0.618	0.697	0.861	0.517	0.909	2723
Paraguay	4.561	12.653	0.811	0.711	0.625	0.677	0.875	0.329	0.791	2610
Peru	5.355	14.660	0.769	0.755	0.629	0.649	0.908	0.281	0.772	5062
Trinidad and Tobago	3.176	8.973	0.887	0.569	0.701	0.717	0.903	0.478	0.811	3113
Venezuela	4.359	13.679	0.865	0.580	0.635	0.694	0.842	0.448	0.856	2280
Asia										
Bangladesh	5.964	13.747	0.524	0.930	0.889	0.952	0.902	0.078	0.817	5762
Fiji	4.140	10.731	0.834	0.672	0.688	0.688	0.951	0.366	0.889	4650
Indonesia	4.513	13.544	0.574	0.771	0.753	0.829	0.881	0.230	0.874	7884
Jordan	7.633	15.716	0.807	0.797	0.755	0.739	0.969	0.230	0.840	3458
Korea, Rep. of	4.235	13.511	0.697	0.753	0.597	0.593	0.970	0.291	0.849	5062
Malaysia	4.616	10.969	0.901	0.736	0.634	0.638	0.947	0.294	0.817	5805
Nepal	6.123	13.030	0.567	0.976	0.850	0.902	0.942	0.024	0.951	5501
Pakistan	6.238	12.155	0.657	0.960	0.813	0.827	0.953	0.052	0.827	4667
Philippines	5.120	14.902	0.769	0.739	0.605	0.583	0.965	0.300	0.790	8863
Sri Lanka	3.700	14.044	0.612	0.771	0.558	0.557	0.929	0.265	0.842	6160
Syria	7.456	15.269	0.786	0.836	0.743	0.731	0.970	0.182	0.836	4312
Thailand	4.555	15.226	0.662	0.688	0.657	0.675	0.932	0.296	0.915	3517
B Rural										
Africa										
Ghana	6.534	12.897	0.644	0.937	0.840	0.893	0.903	0.073	0.770	3012
Kenya	7.714	14.526	0.688	0.950	0.812	0.850	0.922	0.057	0.827	5064
Lesotho	5.728	11.616	0.643	0.959	0.800	0.849	0.892	0.045	0.774	2922
Senegal	7.306	12.408	0.650	0.984	0.921	0.971	0.963	0.019	0.700	2314
Sudan (North)	6.356	11.837	0.689	0.982	0.794	0.791	0.922	0.018	0.843	2090
Americas										
Colombia	6.230	14.374	0.820	0.777	0.680	0.720	0.897	0.229	0.837	1039
Costa Rica	4.108	15.843	0.888	0.450	0.649	0.696	0.921	0.544	0.875	1334
Dominican Rep.	7.067	14.131	0.810	0.800	0.771	0.831	0.868	0.197	0.878	863
Guyana	5.063	10.651	0.875	0.738	0.737	0.753	0.913	0.292	0.910	2067
Haiti	5.874	13.815	0.694	0.891	0.688	0.748	0.877	0.142	0.729	1354

Table —*continued*

Country	TFR	TF	C_i	C_c	C_m	C_{em}	C_{cm}	u	e	Number of women
Jamaica	5.064	11.835	0.848	0.682	0.741	0.835	0.822	0.324	0.890	1182
Mexico	7.374	14.007	0.789	0.879	0.759	0.784	0.938	0.129	0.834	2415
Panama	5.277	15.373	0.797	0.603	0.714	0.780	0.895	0.412	0.905	1202
Paraguay	5.791	13.820	0.783	0.783	0.684	0.737	0.879	0.248	0.799	1487
Peru	6.969	15.090	0.703	0.922	0.712	0.730	0.922	0.094	0.734	1836
Trinidad and Tobago	3.528	10.000	0.871	0.585	0.692	0.701	0.912	0.464	0.806	1247
Venezuela	7.438	16.537	0.791	0.752	0.757	0.838	0.852	0.254	0.850	417
Asia										
Bangladesh	6.035	13.725	0.521	0.939	0.899	0.957	0.905	0.069	0.809	5314
Fiji	4.510	11.328	0.807	0.695	0.710	0.706	0.954	0.333	0.894	2994
Indonesia	4.669	13.701	0.554	0.771	0.797	0.861	0.879	0.226	0.884	6632
Jordan	9.431	15.514	0.773	0.935	0.840	0.820	0.966	0.070	0.859	1035
Korea, Rep. of	4.988	15.289	0.663	0.777	0.633	0.633	0.973	0.257	0.858	2034
Malaysia	4.995	10.786	0.881	0.774	0.679	0.688	0.942	0.247	0.810	3992
Nepal	6.193	13.076	0.565	0.980	0.855	0.907	0.942	0.021	0.947	5214
Pakistan	6.297	12.114	0.639	0.980	0.830	0.845	0.952	0.029	0.850	3425
Philippines	5.904	15.404	0.740	0.782	0.663	0.635	0.967	0.251	0.775	6029
Sri Lanka	3.859	14.242	0.603	0.780	0.577	0.569	0.926	0.251	0.843	5021
Syria	9.006	15.366	0.777	0.959	0.787	0.774	0.966	0.044	0.851	2114
Thailand	4.886	15.715	0.638	0.706	0.690	0.712	0.932	0.275	0.914	3009
C Other urban										
Africa										
Ghana	5.965	11.764	0.704	0.905	0.795	0.871	0.886	0.106	0.768	702
Kenya	5.255	10.683	0.743	0.925	0.715	0.826	0.877	0.073	0.882	375
Lesotho	4.199	10.714	0.672	0.933	0.624	0.720	0.833	0.081	0.819	224
Senegal	5.912	11.698	0.684	0.976	0.757	0.823	0.926	0.024	0.777	483
Sudan (North)	5.589	11.179	0.707	0.933	0.758	0.702	0.908	0.059	0.889	458
Americas										
Colombia	3.552	12.378	0.862	0.570	0.584	0.632	0.848	0.450	0.852	1292
Costa Rica	2.493	12.611	0.921	0.425	0.504	0.560	0.878	0.616	0.854	525
Dominican Rep.	4.139	12.046	0.859	0.645	0.620	0.721	0.788	0.375	0.895	426
Guyana	5.620	10.021	0.885	0.779	0.814	0.867	0.915	0.240	0.858	247
Haiti	3.175	10.926	0.839	0.646	0.536	0.685	0.780	0.373	0.773	63
Jamaica	4.722	11.745	0.817	0.642	0.766	0.864	0.863	0.349	0.869	350
Mexico	5.427	14.376	0.875	0.653	0.660	0.699	0.900	0.339	0.860	1708
Panama	2.812	13.602	0.903	0.417	0.548	0.643	0.850	0.615	0.919	335
Paraguay	3.609	11.397	0.800	0.664	0.596	0.638	0.874	0.389	0.789	426
Peru	5.126	15.151	0.783	0.706	0.612	0.649	0.888	0.336	0.774	1890
Trinidad and Tobago	3.187	9.031	0.889	0.579	0.685	0.694	0.907	0.464	0.810	752
Venezuela	4.119	13.116	0.876	0.571	0.628	0.681	0.842	0.460	0.864	1403
Asia										
Bangladesh	5.634	13.651	0.567	0.863	0.844	0.916	0.871	0.159	0.843	340
Fiji	3.744	10.135	0.884	0.625	0.669	0.663	0.954	0.423	0.889	915
Indonesia	4.303	12.303	0.675	0.787	0.659	0.698	0.899	0.243	0.812	562
Jordan	7.712	16.607	0.810	0.771	0.744	0.708	0.981	0.250	0.841	1207
Korea, Rep. of	4.150	12.480	0.736	0.744	0.607	0.601	0.966	0.304	0.844	1508
Malaysia	4.464	12.212	0.939	0.675	0.577	0.565	0.950	0.364	0.816	867
Nepal	4.270	10.817	0.644	0.827	0.741	0.746	0.956	0.150	0.966	119
Pakistan	6.261	12.045	0.708	0.937	0.784	0.794	0.954	0.084	0.827	816
Philippines	4.002	14.620	0.815	0.660	0.509	0.486	0.959	0.393	0.805	1718
Sri Lanka	3.172	13.108	0.650	0.767	0.486	0.497	0.945	0.300	0.834	758
Syria	6.837	15.514	0.792	0.766	0.726	0.717	0.973	0.255	0.838	1476
Thailand	3.566	13.190	0.793	0.595	0.574	0.616	0.925	0.398	0.913	240

Table —*continued*

Country	TFR	TF	C_i	C_c	C_m	C_{em}	C_{cm}	u	e	Number of women
D Major urban										
Africa										
Ghana	5.269	10.525	0.740	0.883	0.767	0.821	0.913	0.119	0.796	722
Kenya	5.208	12.134	0.745	0.860	0.670	0.755	0.916	0.170	0.897	269
Senegal	6.377	12.868	0.688	0.970	0.743	0.785	0.919	0.030	0.841	491
Sudan (North)	4.715	11.450	0.714	0.863	0.669	0.655	0.945	0.139	0.882	309
Americas										
Colombia	2.711	12.572	0.881	0.499	0.491	0.529	0.903	0.526	0.849	496
Costa Rica	2.343	12.442	0.942	0.412	0.486	0.529	0.877	0.638	0.848	825
Dominican Rep.	3.892	11.563	0.928	0.590	0.615	0.717	0.778	0.453	0.899	519
Guyana	3.827	8.805	0.926	0.672	0.699	0.766	0.891	0.355	0.838	905
Haiti	3.618	9.658	0.823	0.807	0.564	0.703	0.763	0.224	0.783	484
Jamaica	3.555	9.887	0.871	0.581	0.710	0.812	0.853	0.444	0.866	754
Mexico	4.553	14.279	0.905	0.582	0.605	0.643	0.900	0.413	0.866	1517
Panama	2.866	12.535	0.909	0.464	0.542	0.626	0.836	0.598	0.909	1186
Paraguay	2.923	10.542	0.898	0.591	0.522	0.575	0.868	0.462	0.784	697
Peru	3.777	13.117	0.868	0.608	0.546	0.542	0.921	0.471	0.781	1335
Trinidad and Tobago	2.749	7.879	0.909	0.539	0.712	0.748	0.885	0.510	0.817	1111
Venezuela	3.148	13.258	0.927	0.454	0.565	0.621	0.837	0.597	0.842	460
Asia										
Bangladesh	5.697	15.733	0.578	0.721	0.869	0.896	0.914	0.273	0.861	108
Fiji	3.199	9.037	0.891	0.637	0.624	0.634	0.934	0.432	0.872	741
Indonesia	4.544	12.484	0.724	0.776	0.648	0.697	0.891	0.250	0.829	692
Jordan	6.272	15.201	0.843	0.706	0.693	0.676	0.965	0.338	0.835	1217
Korea, Rep. of	3.303	11.850	0.705	0.746	0.530	0.520	0.979	0.330	0.844	1520
Malaysia	3.444	11.027	0.961	0.622	0.522	0.515	0.969	0.428	0.837	946
Pakistan	5.856	12.610	0.713	0.855	0.762	0.758	0.962	0.179	0.799	428
Philippines	3.501	12.461	0.887	0.630	0.502	0.472	0.967	0.426	0.817	1115
Sri Lanka	3.078	12.789	0.697	0.672	0.514	0.495	0.935	0.383	0.849	380
Syria	4.717	14.114	0.817	0.632	0.647	0.641	0.975	0.422	0.828	722
Thailand	2.519	12.152	0.879	0.564	0.418	0.403	0.946	0.443	0.920	270
E No schooling										
Africa										
Ghana	6.645	12.702	0.629	0.956	0.871	0.945	0.922	0.054	0.759	2690
Kenya	7.559	13.569	0.669	0.968	0.860	0.950	0.920	0.036	0.831	3018
Lesotho	5.457	11.320	0.630	0.986	0.776	0.862	0.877	0.019	0.865	240
Senegal	7.142	12.316	0.654	0.986	0.899	0.951	0.956	0.015	0.704	2982
Sudan (North)	6.383	11.365	0.692	0.987	0.823	0.833	0.925	0.014	0.871	2319
Americas										
Colombia	6.335	13.048	0.813	0.784	0.762	0.830	0.852	0.206	0.854	441
Costa Rica	4.053	17.860	0.854	0.474	0.561	0.616	0.854	0.486	0.903	204
Dominican Rep.	6.688	12.421	0.815	0.812	0.813	0.891	0.805	0.185	0.913	287
Guyana	6.426	12.440	0.796	0.779	0.833	0.939	0.989	0.249	0.954	120
Haiti	5.695	13.238	0.700	0.905	0.680	0.762	0.859	0.126	0.728	1359
Jamaica	5.471	14.991	0.563	0.890	0.729	–	–	0.142	0.963	38
Mexico	7.715	13.515	0.790	0.892	0.810	0.887	0.910	0.113	0.831	1238
Panama	6.187	16.704	0.779	0.615	0.773	0.849	0.910	0.369	0.883	187
Paraguay	7.458	15.348	0.754	0.833	0.774	0.839	0.830	0.181	0.818	182
Peru	7.089	14.694	0.700	0.916	0.752	0.768	0.908	0.104	0.748	1545
Trinidad and Tobago	4.427	9.192	0.836	0.739	0.780	0.924	0.968	0.281	0.809	123
Venezuela	6.610	15.373	0.801	0.730	0.736	0.849	0.809	0.283	0.885	320

Table—*continued*

Country	TFR	TF	C_i	C_c	C_m	C_{em}	C_{cm}	u	e	Number of women
Asia										
Bangladesh	5.960	13.540	0.517	0.947	0.899	0.969	0.894	0.061	0.825	4410
Fiji	–	11.585	0.787	0.635	–	–	–	0.404	0.935	876
Indonesia	–	12.871	0.556	0.806	–	–	–	0.194	0.880	4748
Jordan	9.293	15.519	0.773	0.908	0.853	0.835	0.970	0.112	0.852	1713
Korea, Rep. of	5.653	14.484	0.682	0.792	0.723	0.711	0.975	0.227	0.865	995
Malaysia	5.254	10.229	0.885	0.824	0.705	0.706	0.929	0.202	0.814	1983
Nepal	–	13.032	0.564	0.980	–	–	–	0.020	0.969	5234
Pakistan	6.495	12.173	0.649	0.971	0.847	0.862	0.953	0.040	0.823	4072
Philippines	5.311	12.436	0.703	0.935	0.649	0.625	0.958	0.078	0.802	508
Sri Lanka	–	12.910	0.590	0.853	–	–	–	0.159	0.883	1299
Syria	8.782	15.132	0.779	0.921	0.809	0.798	0.969	0.095	0.841	2852
Thailand	–	14.868	0.654	0.703	–	–	–	0.265	0.914	681
F 1–3 years' schooling										
Africa										
Ghana	6.337	12.978	0.693	0.905	0.779	0.916	0.804	0.109	0.794	136
Kenya	8.425	14.927	0.700	0.948	0.851	0.920	0.902	0.058	0.807	674
Lesotho	4.976	10.335	0.645	0.973	0.767	0.849	0.849	0.032	0.738	376
Senegal	8.901	24.198	0.715	0.587	0.876	0.955	0.955	0.420	0.818	69
Sudan (North)	5.634	12.206	0.686	0.913	0.737	0.734	0.922	0.085	0.873	205
Americas										
Colombia	5.452	13.821	0.831	0.711	0.667	0.713	0.863	0.309	0.852	1065
Costa Rica	3.864	15.191	0.875	0.450	0.646	0.724	0.890	0.541	0.887	669
Dominican Rep.	6.757	13.429	0.840	0.763	0.786	0.888	0.830	0.241	0.896	691
Guyana	6.889	10.975	0.904	0.748	0.929	0.907	0.993	0.289	0.927	104
Haiti	4.442	11.987	0.764	0.790	0.614	0.740	0.801	0.243	0.788	280
Jamaica	5.492	10.298	0.867	0.690	0.892	0.894	0.882	0.265	0.941	73
Mexico	7.168	14.246	0.821	0.800	0.766	0.825	0.928	0.208	0.856	1900
Panama	6.140	16.115	0.756	0.650	0.775	0.859	0.896	0.384	0.912	394
Paraguay	5.909	13.611	0.769	0.806	0.701	0.784	0.849	0.228	0.803	803
Peru	6.533	14.797	0.732	0.826	0.730	0.752	0.902	0.216	0.761	1223
Trinidad and Tobago	3.385	11.960	0.809	0.449	0.779	–	–	0.530	0.775	62
Venezuela	6.040	15.202	0.808	0.647	0.761	0.862	0.828	0.362	0.867	358
Asia										
Bangladesh	6.191	14.107	0.539	0.895	0.910	0.955	0.911	0.119	0.798	487
Fiji	–	11.713	0.855	0.551	–	–	–	0.484	0.910	370
Indonesia	–	15.496	0.565	0.729	–	–	–	0.276	0.883	1195
Jordan	8.667	15.664	0.787	0.794	0.885	0.833	0.969	0.278	0.820	220
Korea, Rep. of	5.405	13.220	0.695	0.783	0.752	0.716	0.969	0.242	0.867	397
Malaysia	5.218	10.665	0.911	0.755	0.712	0.713	0.943	0.286	0.832	1068
Nepal	–	13.707	0.546	0.944	–	–	–	0.107	0.850	74
Pakistan	5.510	11.674	0.670	0.889	0.793	0.818	0.953	0.124	0.907	99
Philippines	6.883	15.043	0.707	0.861	0.752	0.727	0.964	0.169	0.765	1090
Sri Lanka	–	13.333	0.587	0.815	–	–	–	0.217	0.864	1097
Syria	6.714	16.269	0.782	0.723	0.730	0.721	0.973	0.334	0.839	158
Thailand	–	14.731	0.678	0.699	–	–	–	0.269	0.913	218
G 4–6 years' schooling										
Africa										
Ghana	6.584	13.032	0.682	0.919	0.806	0.900	0.870	0.090	0.771	322
Kenya	7.637	14.355	0.705	0.927	0.814	0.840	0.922	0.087	0.812	1033
Lesotho	5.557	11.718	0.641	0.961	0.770	0.853	0.894	0.044	0.774	1727
Senegal	5.821	11.045	0.717	1.000	0.735	0.792	0.923	0.000	–	155
Sudan (North)	5.098	11.914	0.687	0.891	0.700	0.650	0.940	0.152	0.875	214

Table—*continued*

Country	TFR	TF	C_i	C_c	C_m	C_{em}	C_{cm}	u	e	Number of women
Americas										
Colombia	3.515	12.175	0.860	0.575	0.585	0.627	0.880	0.452	0.853	836
Costa Rica	2.998	13.287	0.922	0.419	0.584	0.643	0.906	0.601	0.861	1124
Dominican Rep.	5.093	12.747	0.852	0.655	0.716	0.791	0.787	0.378	0.890	492
Guyana	5.410	9.651	0.872	0.748	0.859	0.871	0.922	0.282	0.930	754
Haiti	3.648	10.860	0.802	0.742	0.565	0.677	0.806	0.343	0.764	156
Jamaica	5.177	11.572	0.821	0.693	0.787	0.939	0.800	0.317	0.907	395
Mexico	5.457	14.147	0.860	0.678	0.662	0.714	0.913	0.344	0.860	1551
Panama	4.328	14.666	0.810	0.525	0.695	0.781	0.869	0.517	0.920	1074
Paraguay	4.250	11.889	0.818	0.703	0.622	0.671	0.871	0.351	0.786	1074
Peru	4.807	13.974	0.798	0.671	0.642	0.672	0.910	0.401	0.771	1170
Trinidad and Tobago	3.963	9.162	0.829	0.663	0.787	0.886	0.903	0.411	0.816	386
Venezuela	4.350	12.769	0.876	0.572	0.680	0.732	0.839	0.472	0.855	974
Asia										
Bangladesh	6.711	15.221	0.542	0.878	0.927	0.940	0.965	0.138	0.810	670
Fiji	–	11.147	0.818	0.679	–	–	–	0.330	0.889	1366
Indonesia	–	15.369	0.582	0.711	–	–	–	0.303	0.867	1456
Jordan	6.988	14.743	0.825	0.731	0.786	0.782	0.967	0.353	0.838	731
Korea, Rep. of	4.440	13.601	0.674	0.767	0.632	0.628	0.979	0.285	0.860	2172
Malaysia	4.760	11.082	0.903	0.705	0.674	0.681	0.954	0.351	0.814	2001
Nepal	–	12.878	0.642	0.910	–	–	–	0.069	0.841	107
Pakistan	6.091	12.735	0.687	0.916	0.760	0.733	0.964	0.101	0.861	237
Philippines	6.084	15.341	0.745	0.765	0.696	0.670	0.968	0.273	0.779	4296
Sri Lanka	–	14.678	0.596	0.756	–	–	–	0.279	0.851	1718
Syria	5.556	13.730	0.791	0.713	0.718	0.731	0.974	0.363	0.828	769
Thailand	–	15.799	0.645	0.685	–	–	–	0.304	0.915	2376
H 7+ years' schooling										
Africa										
Ghana	5.199	11.229	0.715	0.851	0.761	0.817	0.887	0.163	0.788	1288
Kenya	6.642	15.573	0.759	0.811	0.693	0.740	0.925	0.208	0.877	985
Lesotho	4.335	11.827	0.657	0.926	0.603	0.681	0.886	0.074	0.789	804
Senegal	3.870	11.282	0.678	1.000	0.506	0.619	0.850	0.000	–	82
Sudan (North)	3.907	12.876	0.706	0.721	0.596	0.487	0.946	0.298	0.869	120
Americas										
Colombia	2.385	13.315	0.909	0.440	0.447	0.492	0.891	0.604	0.834	485
Costa Rica	2.506	12.132	0.936	0.456	0.483	0.514	0.906	0.642	0.832	687
Dominican Rep.	2.874	12.122	0.914	0.543	0.478	0.565	0.830	0.522	0.881	338
Guyana	4.614	10.170	0.896	0.716	0.708	0.751	0.898	0.307	0.862	2241
Haiti	2.651	9.725	0.870	0.660	0.475	0.604	0.845	0.377	0.769	109
Jamaica	4.378	11.177	0.858	0.621	0.735	0.825	0.842	0.390	0.869	1780
Mexico	3.211	13.099	0.940	0.512	0.510	0.550	0.914	0.498	0.864	951
Panama	2.636	12.275	0.946	0.444	0.512	0.590	0.842	0.611	0.902	1068
Paraguay	2.819	10.680	0.889	0.579	0.513	0.527	0.927	0.461	0.786	551
Peru	3.109	13.344	0.880	0.590	0.448	0.466	0.919	0.482	0.787	1125
Trinidad and Tobago	3.094	8.968	0.899	0.555	0.692	0.714	0.899	0.495	0.812	2541
Venezuela	2.565	10.748	0.939	0.511	0.497	0.543	0.874	0.568	0.846	628
Asia										
Bangladesh	5.096	15.552	0.659	0.646	0.769	0.838	0.911	0.343	0.806	196
Fiji	–	10.125	0.855	0.696	–	–	–	0.351	0.857	2038
Indonesia	–	13.541	0.742	0.678	–	–	–	0.403	0.828	485
Jordan	4.853	15.374	0.870	0.598	0.607	0.607	0.976	0.466	0.836	793
Korea, Rep. of	3.332	12.065	0.747	0.709	0.521	0.522	0.970	0.396	0.822	1498

Table —*continued*

Country	TFR	TF	C_i	C_c	C_m	C_{em}	C_{cm}	u	e	Number of women
Malaysia	3.186	11.469	0.927	0.637	0.470	0.485	0.968	0.481	0.814	753
Nepal	–	8.501	0.600	0.834	–	–	–	0.128	0.933	71
Pakistan	3.147	9.022	0.804	0.881	0.492	0.483	0.970	0.244	0.806	167
Philippines	3.842	14.264	0.839	0.638	0.503	0.471	0.967	0.426	0.803	2962
Sri Lanka	–	14.340	0.654	0.717	–	–	–	0.349	0.818	2044
Syria	4.066	15.658	0.832	0.587	0.531	0.524	0.983	0.452	0.836	533
Thailand	–	11.923	0.830	0.597	–	–	–	0.417	0.912	242

NOTE: The TFR, TF, C_i, C_c and C_m are computed as described in appendix A.

C_{em} is a weighted average of proportions ever in union by five-year age groups as of the survey date. The weights are age-specific within-union fertility for the five years preceding the survey. C_{cm} is computed as C_m/C_{em}, where C_m is a weighted average of proportions currently in union by five-year age groups as of the survey date. The weights are age-specific within-union fertility for the five years preceding the survey. Note that the C_m used to derive C_{cm} is not the C_m presented here.

u is the mean of the age-specific proportions currently using contraception, seven five-year age groups. Women breastfeeding a child aged six months or less are always counted as non-users. e is the mean method effectiveness of the current users, calculated on the basis of the effectiveness weights given in appendix A. Note that the C_c presented here is not derived from the u and e presented; it is constructed from age-specific measures.

Number of women is the number of currently in union respondents.