WORLD FERTILITY SURVEY

TECHNICAL BULLETINS

SEPTEMBER 1982 NO. 10

Sampling Errors of Fertility Rates from the WFS

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The World Fertility Survey is an international research programme whose purpose is to assess the current state of human fertility throughout the world. This is being done principally through promoting and supporting nationally representative, internationally comparable, and scientifically designed and conducted sample surveys of fertility behaviour in as many countries as possible.

The WFS is being undertaken, with the collaboration of the United Nations, by the International Statistical Institute in cooperation with the International Union for the Scientific Study of Population. Financial support is provided principally by the United Nations Fund for Population Activities and the United States Agency for International Development.

This paper is one of a series of Technical Bulletins recommended by the WFS Technical Advisory Committee to supplement the document *Strategies for the Analysis of WFS Data* and which deal with specific methodological problems of analysis beyond the Country Report No. 1. Their circulation is restricted to people involved in the analysis of WFS data, to the WFS depositary libraries and to certain other libraries. Further information and a list of these libraries may be obtained by writing to the Information Office, International Statistical Institute, 428 Prinses Beatrixlaan, Voorburg, The Hague, Netherlands.

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Washington, DC

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Contents

Acknowledgements

A number of World Fertility Survey staff have contributed to this study. Initial computations were carried out by Pippa Simpson in 1977. Subsequently the WFS fertility rate program was written by Anh Thu Dinh, and computations presented here are based on a modified version of this program. The author wishes to acknowledge useful discussions with Iqbal Alam and Alan Sunter on the subject of this paper.

1 Introduction

A major objective of surveys in the World Fertility Survey (WFS) programme is to calculate fertility rates for the population and major subgroups of the country of the survey. An important question arising from this process is the precision with which the rates are estimated from survey data. There are two broad categories of errors which lead to imprecision, *non-sampling errors* caused by defects in the implementation of the sample design and response errors associated with the interviewing process, and *sampling errors* which result from limiting the enquiry to a sample of the population. For census-type information and large household surveys, the sampling error is generally small, and non-sampling errors are the major source of imprecision. However for WFS surveys, with sample sizes in the range of 4000 to 10 000 women, sampling error can be an important component of the total error of estimates, particularly when attention is directed to subgroups of the population. The WFS has a policy of presenting sampling errors for key variables in its First Country Reports, and has developed a computer package, CLUSTERS, to facilitate the calculations. A general discussion of sampling designs and sampling errors in WFS surveys is given in Verma, Scott and O'Muircheartaigh (1980). Sampling errors of fertility rates are the primary focus of this paper.

Sampling errors are of course necessary to make statistical inferences about population fertility rates on the basis of estimates obtained from the sample. They also provide a basis for determining the size of sample at the design stage, and for deciding the time interval over which births should be accumulated in calculating the rates at the analysis stage. For example, quick estimates of current fertility are often derived from a count of births in the year before the survey was conducted. This may be satisfactory for household surveys, but our calculations suggest that it leads to an unacceptably high sampling error for WFS surveys. An obvious strategy for reducing the error is to accumulate births over an interval of more than a year. The effects of increasing the interval will be explored in this investigation.

In this study attention is restricted to *current* fertility rates, by which we mean rates based on births within five years of the survey date. However, the analytical results on the sampling errors of current rates can also be expected to apply broadly to rates in the past. In this respect we expect the study of sampling errors to differ from that of non-sampling errors, which involve more directly dating errors which depend on the period at which events occur relative to the interview date.

The following major objectives of the study can be identified.

1 *To describe the computation of sampling errors of fertility rates from complex surveys.* A computer package developed by WFS (CLUSTERS; see Verma and Pearce 1978) was used to calculate the sampling errors. However the computations are not entirely straightforward and require some discussion.
2 *To present sampling errors for current fertility rates from five WFS surveys.* The countries included in the study – Colombia, Kenya, Nepal, Pakistan and Sri Lanka – were not a random selection but cover a fairly wide range of fertility levels and sample designs. In particular two of the countries (Colombia and Kenya) interviewed all women in a particular age range, whereas the other three conducted a screening household interview to identify ever-married women and restricted the detailed individual interview to these women. The degree of clustering in the sample, which has an important impact on sampling errors, varied considerably from Nepal (with 46 primary

sampling units selected) to Kenya (with 931 primary sampling units selected). Also in all countries except Nepal, which had a very small urban sample, separate sampling errors were calculated for urban and rural domains. Details of sampling designs are given in the respective First Country Reports, and in summary form in Verma, Scott and O'Muircheartaigh (1980).

3 *To assess the effect of varying the length of exposure on fertility rates and their sampling errors.* To achieve this, rates and associated sampling errors were calculated based on period of one, two, three, four and five years up to the interview date.

4 *To assess the effects of stratification and clustering of the sample on sampling errors of fertility rates.* As in all national surveys of the type considered here, individuals are not selected by simple random sampling but by complex sampling designs with two or more area stages and stratification at each stage. Also in some countries unequal probabilities of selection were applied in different strata of the population. To assess the effect on sampling errors of the sample design, design effects (DEFTS) were calculated which estimate the increase in standard error resulting from selecting the individuals by the chosen design rather than by simple random sampling with the same sample size (see, for example, Kish 1965, section 8.2).

5 *To analyse deviations from a simple binomial model for fertility rate standard errors.* Suppose we write a population rate $r = b/e$, where b represents cumulative births and e represents cumulative exposure. A simple model assumes that b has a binomial distribution with index e, and hence has variance $p(1-p)/e$, which is estimated by $r(1-r)/e$. This expression can be used as a simple rule of thumb for predicting sampling errors.

The binomial model is reasonable if (a) the individuals are selected by simple random sampling; (b) each individual contributes the same period of exposure to the denominator of the rate; and (c) the exposure period is short, so that women contribute at most one birth to the numerator of the rate. To analyse the size of deviations from the basic model, the observed standard errors are decomposed in the form

$$se_{obs} = se_{bin} \times deft \times bcf$$

where se_{obs} is the observed standard error, se_{bin} is the standard error from the binomial model, deft is the design effect and the remaining factor, bcf, is called the birth correlation factor, and represents deviations from the binomial model not attributable to clustering and stratification in the probabilities p_i in the population. The birth correlation factors are the subject of a separate analysis here.

A final, secondary objective is to assess an approximate method for calculating the sampling error of all women rates which are calculated from two files of data, one giving information from the individual interviews administered to ever-married women, and one giving information from household schedules. This problem is described in chapter 3 in more detail.

2 Current Fertility Rates in the Study

A detailed account of fertility measures calculated from WFS surveys is given in Verma (1980). In this chapter we define the current fertility rates calculated in the present study. All the rates have the general form

$$\text{rate} = \Sigma \text{ births} / \Sigma \text{ exposure},$$

where the denominator is an accumulation of periods of exposure of women to the risk of childbearing, and the numerator is number of births reported within these periods. In the case of unequally weighted sample designs, each individual's births and exposure are multiplied by the sample weight, which is inversely proportional to the probability of selection into the sample and also allows for non-response, as explained in chapter 3.

Initially a reference period for current fertility of one to five years before the survey date is chosen, and births and exposure are confined to this period. Various types of fertility rate can then be defined, depending on the sample base of women included and the definition of exposure within the reference period.

General rates include in the sample base women of childbearing age (taken as 15–50 in most surveys[1]) at the date of interview. If all such women (single and married) are included, and exposure is taken as the entire reference period, the resulting rate is called the *general all women fertility rate* (GAWFR). If, on the other hand, exposure for each individual is restricted to that part of the reference period which occurred after her first marriage, we call the resulting rate a *general since marriage fertility rate* (GSMFR). Single women clearly contribute no exposure to this rate, and hence the sample base is effectively restricted to ever-married women. Finally, if exposure is further refined to include only parts of the reference period spent within marriages, the resulting rate is called a *general within marriage fertility rate* (GWMFR). This measure requires reasonably accurate reporting of births and marriages to be analytically useful.

General fertility rates involve a mixture of cohorts of women who are at different stages of their lives during the reference period. More useful rates for analysis are obtained by classifying fertility by cohort or by the age or marital duration of the women at the time of exposure.

Birth cohorts are defined here by five-year age groups at the date of interview, coded $1 = 15–19$, $2 = 20–24, \ldots, 7 = 45–49$ years. If rates are calculated separately for each birth cohort, we obtain *birth cohort-specific fertility rates.* As with general fertility rates, three types can be distinguished. If all women are included and exposure is unrestricted, we obtain *birth cohort all women fertility rates* (BCAWFR). If exposure is restricted to periods after marriage, we obtain *birth cohort since marriage fertility rates* (BCSMFR), or *birth cohort within marriage fertility rates* (BCWMFR), according to the definition of exposure.

Marriage cohorts are defined by five-year groups of years since first marriage, coded $1 = 1–4$, $2 = 5–9, \ldots, 7 = 30–34$ years. Marital rates can be calculated separately for each marriage cohort, leading to *marriage cohort since marriage fertility rates* (MCSMFR), or *marriage cohort within marriage fertility rates* (MCWMFR), according to the definition of exposure.

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[1] The Sri Lanka results, however, are based on ever-married women between the ages of 12 and 50.

In cohort-specific rates fertility is classified by the respondent's age or marital duration *at the date of interview*. Alternatively, in age or duration-specific rates, fertility is classified by the respondent's age or marital duration *at the time of birth or exposure*. Consider, for example, a respondent aged exactly 23 years at the date of interview, and suppose that rates are calculated over a four-year reference period before the survey. For a birth cohort-specific rate, all births and exposure in the reference period are classified with the 20–24 cohort. For an age-specific rate, births and exposure for the last three years are included in the 20–24 age group, and births and exposure in the fourth year before the survey are included in the 15–19 age group, since for that year the respondent was 19 years old.

Classification by age at the time of exposure leads to *age-specific all women fertility rates* (ASAWFR), *age-specific since first marriage fertility rates* (ASSMFR) or *age-specific within marriage fertility rates* (ASWMFR), according to the definition of exposure. Classification by years since marriage at the time of exposure leads to *duration-specific marital fertility rates*, after marriage (DSMFR) or *duration-specific within marriage fertility rates* (DSWMFR).

Finally, the summation of age or cohort-specific rates leads to a set of *total* rates, which unlike general fertility rates are standardized with respect to the age structure of the population. Sampling errors for these rates cannot be calculated in CLUSTERS, and an approximate method is suggested in chapter 5.

Age-specific and cohort-specific rates are shown for all the countries included here. For Colombia and Kenya these rates involve all women, married and single. For Sri Lanka marital fertility rates were calculated with exposure restricted to within marriage. For Nepal and Pakistan marital rates were calculated with exposure restricted to periods since first marriage; for these countries the more refined definition of exposure within marriage would not be advisable because the accuracy of reporting of dates of marriages is suspect. Thus rates for different countries have different interpretations and are not comparable, although in the analysis their standard errors will sometimes be averaged to obtain summary information.

3 Calculation of Sampling Errors

3.1 MEASURES OF SAMPLING ERRORS

WFS surveys are based on probability sample designs, where each possible sample has a known probability of selection and all units of the population have a positive probability of selection. These designs have the important property that sampling errors can be estimated from the results of the sample actually selected.

Three measures of sampling error will be used, the variance, the standard error and the relative error, defined as the standard error expressed as a percentage of the rate. If non-sampling errors are ignored, then under mild assumptions approximate confidence intervals for the rates can be calculated in the usual way. For example, an interval of two standard errors above and below the sample rate covers the population rate in approximately 95 out of 100 repeated samples.

The computer package CLUSTERS calculates standard errors of ratio statistics of the form

$$\hat{r} = \Sigma w_i y_i / \Sigma w_i x_i, \tag{3.1}$$

where y_i and x_i are the values of two variables Y and X for individual i, the summation is over the sample or a subgroup of the sample, and w_i is the sample weight for individual i.

The following information is required for each individual to calculate the sampling error of $\hat{r}$.

1 The primary sampling unit (PSU) to which the individual belongs. These units are defined at the first sampling stage, and in WFS samples are generally based on census enumeration districts, subdivided into smaller areas where necessary.
2 The stratum to which the PSU belongs. The PSUs are usually explicitly stratified by factors such as region and urbanity, and then implicitly stratified by systematic sampling from an ordered list. For sampling error computations, operational strata are formed by pairing adjacent PSUs, giving two PSUs in each stratum. The resulting estimates of sampling error are strictly speaking biased, although the magnitude of the bias is thought to be small.
3 The sampling weight for each individual. This is inversely proportional to the product of the probability of selection and the proportion of sampled units in the PSU who respond. The weights are normalized to sum to the number of units in the sample.
4 Values of y and x for each individual. In fact the weighted aggregates of y and x in each PSU are sufficient in calculations. Given this information, the sampling variance of $\hat{r}$ is calculated from the within stratum variation of weighted aggregates of y and x in each PSU. The calculation is based on the well-known Taylor Series approximation to the variance of a product, as described in the CLUSTERS manual.

3.2 SAMPLING ERRORS OF FERTILITY RATES

The general and cohort-specific fertility rates described in chapter 2 take the form (3.1), with x_i the months of exposure for individual i within the reference period and y_i the number of births. These quantities are calculated for each individual for reference periods of 1–5 years before the survey and for the appropriate definition of exposure. The calcu-

lations require the date of births and (for marital rates) marriages, recorded in years and months. Years of these events are available for virtually all cases in the surveys considered. Months, however, are not always stated, and where necessary have been imputed by an editing program which determines an interval for each event consistent with the data and selects a month at random within this interval. The effect of this imputation procedure on the sampling variance is expected to be small.

Sampling errors of cohort-specific rates are obtained by restricting calculations to each cohort separately. Sampling errors of age and duration-specific rates are not immediately calculable by splitting the sample into subgroups, since, as noted in chapter 2, individuals can contribute births and exposure to two subclasses. The difficulty is overcome by representing each individual by two records, one for each age or duration group to which she belonged in the five years prior to the survey. Each record contains the index of the age or duration class, and values of births (y_i) and exposure (x_i) accumulated in the part of the reference period when the individual was in that age or duration class. Sampling information is duplicated in both records.

If this *split individual file* is used with the age or duration index defining subclasses, then correct sampling errors for age or duration-specific rates are obtained. Note that the apparent doubling of the sample size by the creation of the split individual file is only superficial. Each woman still contributes births and exposure at most once to each age group, and when she contributes to two groups, her exposure, which is the real measure of sample size, is split between the two.

A final computational issue concerns the calculation of sampling errors for all women (single and married) rates in countries where a household schedule was administered to identify eligible women (that is, ever-married women between certain ages) and only those women (or a subset of them) were subsequently interviewed. It is then practically convenient to calculate an all women rate $\hat{f}$ as the product

$$\hat{f} = \hat{f}_m \cdot \hat{p} \tag{3.2}$$

where $\hat{f}_m$ is the fertility rate for interviewed women and $\hat{p}$ is the proportion of all women in the group who were eligible for interview. The advantage is that $\hat{f}_m$ and $\hat{p}$ can be calculated without merging the individual and household files, an operation which can be laborious, particularly if a subsample of eligible women are interviewed.

The sampling error of $\hat{f}$ can be calculated directly if a merged file is available. The question arises whether the variance can be estimated without merging the household and individual information. An approximate method is to expand the variance of $\hat{f}$ in the form

$$\text{var } \hat{f} = \text{var } (\hat{f}_m \hat{p}) \simeq \hat{p}^2 \text{ var } \hat{f}_m^2 + \hat{f}_m^2 \text{ var } \hat{p} + 2\hat{f}_m \hat{p} \text{ cov } (\hat{f}_m, \hat{p}) \tag{3.3}$$

If $\hat{f}_m$ and $\hat{p}$ are approximately uncorrelated, then the last term in this equation vanishes. Dividing by $\hat{f}^2$, we obtain the simple expression

$$\text{relvar } (\hat{f}) \simeq \text{relvar } (\hat{f}_m) + \text{relvar } (\hat{p}) \tag{3.4}$$

That is, the estimated relative variance of $\hat{f}$ can be obtained by adding the estimated relative variances of $\hat{f}_m$ and $\hat{p}$. The validity of this approximation is studied by estimating each term in (3.4) for fertility rates in Colombia and Kenya. The results of this exercise are presented in section 5.8.

4 A Simple Model for Sampling Errors of Fertility Rates

A detailed model for sampling errors of birth rates should model births in an interval as a stochastic process which takes into account the incidence of conceptions, the different types of pregnancy outcome, post-partum amenorrhoea, length of pregnancy and other factors. See, for example, Sheps and Menken (1973). Such models do not lead to simple formulae for the variance of fertility rates. The model we present is less realistic but does indicate two major influences which lead to deviations from the binomial variance noted in the introduction.

For simplicity we consider the case of all women cohort rates where exposure is unrestricted and each individual contributes the same number of years of exposure to the rate. The rate takes the form

$$\hat{r} = \sum_{i=1}^{n} \sum_{j=1}^{m} b_{ij}/nm,$$

where n is the number of women in the base and b_{ij} is the number of births to individual i in year j, for j = 1 to m.

Suppose that b_{ij} has a Bernouilli distribution with probability p_i. That is, we assume that the probability of two births in the same year is negligibly small. Then b_{ij} has mean and variance

$$E(b_{ij}|i) = p_i, \text{ var } (b_{ij}|i) = p_i(1 - p_i).$$

The births b_{ij} and b_{ik} to the same individual in different years are correlated. In particular, the correlation between births in successive years is negative, since a birth in year j reduces the probability of a birth in year j + 1. To model this correlation, we write the covariance of b_{ij} and b_{ik} as

$$\text{cov } (b_{ij}, b_{ik}|i) = p_i(1 - p_i)\rho_{jk},$$

where ρ_{jk} is the correlation. One possibility is to assume that ρ_{jk} depends only on the interval $|k - j|$ between the years. For example

$$\rho_{jk} = (-\lambda)^{|k-j|} \tag{4.1}$$

for $0 \leqslant \lambda < 1$. Finally heterogeneity between individuals is modelled by assuming p_i has a distribution with mean and variance

$$E(p_i) = p, \text{ var } p_i = Kp(1 - p).$$

The parameter K lies between zero and one, the value zero implying all individuals have the same probability p of a birth (homogeneity) and the value one implying that a proportion p of individuals conceive with probability one and the remainder conceive with probability zero.

The marginal correlation of b_{ij} and b_{ik} under this model is

$$\text{corr } (b_{ij}, b_{ik}) = (1 - K)\rho_{jk} + K.$$

For small $|k - j|$, ρ_{jk} is negative and the correlation combines negative correlation between births for a given individual with positive correlation induced by heterogeneity between individuals. For large $|k - j|$ the model loses its plausibility since the probability p_i can no longer be assumed constant for the range of years considered.

The observed correlations between births in successive years could be used to estimate the parameters of this model. However here we concentrate on the implied distribution of $\hat{r}$. The mean and variance of $\hat{r}$ are

$$E(\hat{r}) = p$$

$$\text{var}(\hat{r}) = \frac{p(1-p)}{nm}\left\{1 + (m-1)K + \frac{1-K}{m}\sum_{\substack{j=1 \\ j\neq k}}^{m}\sum_{k=1}^{m}\rho_{jk}\right\} \tag{4.2}$$

Note that for $m = 1$ equation (4.2) reduces to the binomial variance $p(1-p)/n$, which is not affected by heterogeneity of the probabilities p_i in the population. For $m > 1$ the variance is binomial with index mn if $K = 0$ (the population is homogeneous) and $\rho_{jk} = 0$ for $j \neq k$ (correlation between successive births is ignored). One would expect the summation in equation (4.2) to be negative in practice. For example, substituting equation (4.1) gives

$$\text{var}\,\hat{r} = \frac{p(1-p)}{nm}\left\{1 + (m-1)k + 2(1-K)\left[\frac{m-1}{m}(-\lambda) + \frac{m-2}{m}(-\lambda)^2 + \ldots\frac{2}{m}(-\lambda)^{m-1}\right]\right\}$$

and for positive λ the expression in square brackets is negative. For a relatively homogenerous population, K is small and the variance of r for $m > 1$ may be less than binomial. For a heterogeneous population the variance of r for $m > 1$ is above binomial and the negative influence of the correlations ρ_{jk} is correspondingly smaller.

For age-specific rates and marital rates individuals contribute different exposures to the rate, and the model variance can be viewed as a mixture of variances (4.2) for different values of m. Also the model does not reflect clustering and stratification of the p_i values in the population which are necessary to include the effects of sample design on the variance. Despite these limitations, the model does illustrate the conflicting impacts of heterogeneity and correlation between individual births on the variance of rates. To assess these effects empirically, the observed standard error is decomposed into three components

$$se_{obs} = se_{bin} \times \text{deft} \times \text{bcf},$$

where se_{bin} is the binomial standard error with index equal to years of exposure, deft is the design effect and bcf is the residual component reflecting departures from the binomial model not attributable to clustering and stratification of the p_i values in the population.

5 Results

5.1 INTRODUCTION

The results of the sampling error computations are presented in appendix A. For each domain (urban, rural and total), rates and their standard errors are presented in the first columns in the form of births per thousand years of exposure. Cumulated years of exposure are presented in the next column. This is a more useful measure of sample size than the number of individuals in the base, particularly for age-specific rates where women contribute varying periods of exposure to the rate. The next two columns give the design effect (DEFT) and the rate of homogeneity (ROH), defined by the formula

$$\text{deft}^2 = 1 + \text{Roh}\,(\bar{b} - 1)$$

where $\bar{b}$ is the average number of respondents in each primary sampling unit. Roh is a measure of the effects of clustering and stratification which is less sensitive to the average cluster size $\bar{b}$ than deft (Kish 1965). The last column gives the birth correlation factor (BCF), as defined earlier.

The first five rows of the tables refer to general fertility rates, and subsequent rows to age or cohort-specific rates as indicated in the table title. Note that the general fertility rates and their standard errors are the same whether calculated from the individual file (for cohort rates) or the split individual file (for age rates). However the design effects of general fertility rates calculated from the split individual file are incorrect, and correct effects are obtained from the tables of cohort rates.

5.2 VARIATION IN THE RATES BY REFERENCE PERIOD

The first point to note from the appendix tables is that cohort rates are more variable between reference periods than age rates, particularly for the extreme age groups. For the 15–19 age group the cohort rates decline as exposure increases and for the oldest age groups the cohort rates increase with period of exposure. This finding is predictable, and reflects the fact that biological age is a more important determinant of fertility than cohort for these age groups. More stable cohort rates could be obtained by varying the age group limits so that the midpoint age of the cohort at the time of the event is the same for each exposure period. For example, the 20–24 cohort is replaced by the $20\frac{1}{2}$–$24\frac{1}{2}$ cohort for births occurring in the last year, the 21–25 cohort for births in the last two years, and so on. Since the primary focus of this study is sampling error we did not undertake this refinement.

Rates for longer reference periods are highly correlated since births and exposure are cumulative. Thus the rates for the three, four and five-year reference periods tend to be similar. A more detailed analysis of the rates themselves is of interest, but from now on we concentrate on the sampling errors and related measures.

5.3 SAMPLING ERRORS OF AGE-SPECIFIC FERTILITY RATES

The sampling errors of age-specific, general and total fertility rates are summarized in tables 1–4. The sampling errors of cohort rates are similar to those of corresponding age rates, except for minor variations in the extreme age groups caused by the age distribution of the sampled women. They are not analysed in detail here.

Table 1 Per cent relative errors of age-specific fertility rates by population and reference period, averaged over five-year age groups 15–44

Population		One-year exposure (years)	Reference period (years)				
			1	2	3	4	5
Sri Lanka	Urban	1557	15.83	10.06	10.87	8.79	8.35
	Rural	4548	9.84	6.27	5.10	4.55	4.12
	Total	6105	8.85	5.64	4.65	4.11	3.73
Pakistan	Urban	1826	11.49	8.03	7.21	6.88	6.16
	Rural	2978	10.36	6.34	5.59	5.32	4.61
	Total	4802	7.23	5.19	4.59	4.35	3.79
Nepal	Total	5770	9.13	6.59	5.79	5.49	4.92
Colombia	Urban	2219	19.31	14.23	12.29	11.05	10.25
	Rural	3157	12.29	8.92	8.65	7.83	7.68
	Total	5376	10.25	7.45	7.03	6.32	6.11
Kenya	Urban	1608	16.54	15.27	12.99	12.65	12.87
	Rural	6412	6.20	4.84	3.95	3.72	3.19
	Total	8023	5.84	4.57	3.77	3.56	3.05
Mean over countries			8.26	5.89	5.16	4.77	4.32
Mean over urban/rural subgroups			12.73	9.25	8.33	7.60	7.15

NOTE: The means over countries are obtained by averaging the entries in lines 3, 6, 7, 10 and 13 in the table. The means over urban/rural subgroups are obtained by averaging lines 1, 2, 4, 5, 8, 9, 11 and 12 in the table. The means are simply descriptive summaries of the table and have no substantive meaning, given the heterogeneity of the groups averaged.

We present in the summary tables averaged relative errors, with standard errors expressed as percentages of the observed rate for the five-year period. Sample size is indicated by the cumulated years of exposure for the one-year reference period, which is equal to or slightly less than the number of women in the base. Table 1 gives relative errors cross-classified by population and reference period, averaged over the seven age groups 15–19, 20–24, . . , 40–44. The 45–49 group is excluded because the number of births for this group is negligible and hence the relative errors are unstable and of little interest.

The relative errors for the one-year reference period are large, ranging from 6 to 10 per cent (mean = 8.3 per cent) for the five total populations and from 6 to 20 per cent (mean = 12.7 per cent) for urban and rural subgroups. Increasing the reference period reduces the sampling error, as expected. Doubling the exposure period changes the relative error for countries from 8.3 to 5.9 per cent on average, a 41 per cent reduction. Redoubling the period from two to four years reduces the average relative error to 4.8 per cent, a further 23 per cent reduction. Thus increasing the reference period appears to be more effective in reducing variance for short reference periods than for long reference periods. Similar results are obtained for the data on urban and rural subgroups.

The variation of the relative errors over age groups is largely determined by differences in exposure, which depend on the age distribution of the sampled women. This in turn depends on the age structure of the population and the type of rate. For example, marital rates for the 15–19 age group will have large standard errors if the proportion married in that age group is small. The relationship between the relative error and age group is summarised in table 2, where the relative errors are averaged over the nine subpopulations (urban and rural subgroups for Sri Lanka, Pakistan, Colombia and Kenya, plus the

Table 2 Per cent relative errors of age-specific fertility rates, averaged over subpopulations

	Reference period (years)				
Age group	1	2	3	4	5
15–19	11.37	7.89	6.84	6.01	5.22
20–24	8.05	4.94	4.12	3.66	3.48
25–29	7.82	5.48	4.60	4.10	3.66
30–34	10.36	7.53	6.84	6.17	5.39
35–39	14.40	11.12	9.89	9.06	8.47
40–44	24.95	16.75	16.02	15.19	15.22

Table 3 Per cent relative errors of general fertility rates, based on 1–5 year reference periods

			Reference period (years)				
Population		One-year exposure	1	2	3	4	5
Sri Lanka	Urban	1557	5.1	4.0	3.6	3.5	3.0
	Rural	4548	3.3	2.3	1.9	1.7	1.6
	Total	6105	2.9	2.0	1.7	1.6	1.5
Pakistan	Urban	1826	4.1	2.7	2.6	2.1	1.9
	Rural	2978	3.9	2.3	2.0	2.0	1.8
	Total	4802	2.7	1.9	1.6	1.5	1.4
Nepal	Total	5770	5.5	4.5	3.9	3.6	3.3
Colombia	Urban	2219	7.4	5.7	5.2	4.8	4.5
	Rural	3157	7.1	4.7	5.1	4.7	4.4
	Total	5376	5.3	3.5	3.7	3.4	3.2
Kenya	Urban	1608	7.4	4.8	4.3	4.1	3.8
	Rural	6412	2.7	1.9	1.7	1.5	1.5
	Total	8023	2.5	1.8	1.6	1.5	1.4
Mean over countries			3.78	2.74	2.50	2.32	2.16
Mean over urban/rural subgroups			5.06	3.55	3.30	3.11	2.81

population of Nepal). The table shows that for the populations in this study the relative errors are smallest for the 20–24 and 25–29 age groups. Overall, the results suggest that reference periods of at least three years are desirable to detect differences in age-specific fertility rates between subgroups of the sample.

Relative errors for the general fertility rates are displayed in table 3. They are naturally smaller than the relative errors for age-specific rates, with population values ranging from 2.5 per cent in Kenya to 5.5 per cent in Nepal for a one-year reference period. The general rates are of limited substantive interest, and we concentrate attention on an age-standardized measure of fertility, the total fertility rate, defined as the sum of the age-specific fertility rates multiplied by the grouping interval, five years.

The total fertility rate is a linear combination of age-specific rates, and hence the sampling variance can be calculated in terms of the variances and covariances of its

Table 4 Estimated per cent relative errors of total fertility rates, based on 1–5 year reference periods

Population		One-year exposure	TFR	Reference period (years) 1	2	3	4	5
Sri Lanka	Urban	1557	6.81	6.9	4.7	3.7	3.3	2.7
	Rural	6548	7.07	3.9	2.4	1.9	1.7	2.7
	Total	6105	7.02	3.5	2.1	1.7	1.5	1.4
Pakistan	Urban	1826	7.74	4.1	2.7	2.4	2.0	1.7
	Rural	2978	7.32	3.5	2.3	1.8	1.9	1.7
	Total	4802	7.43	2.8	1.8	1.6	1.5	1.3
Nepal	Total	5770	6.62	5.8	4.7	4.0	3.8	3.4
Colombia	Urban	2219	3.21	7.1	5.6	5.2	4.8	4.6
	Rural	3157	5.61	6.9	4.4	4.8	4.5	4.3
	Total	5376	4.62	5.2	3.3	3.6	3.3	3.2
Kenya	Urban	1608	5.95	8.1	5.6	5.1	5.0	4.9
	Rural	6412	8.36	2.6	1.9	1.7	1.5	1.5
	Total	8023	8.15	2.5	1.8	1.6	1.5	1.5
Mean over countries				4.0	2.8	2.5	2.3	2.2
Mean over urban/rural subgroups				5.4	3.7	3.3	3.1	2.9

components. However, covariances cannot be calculated in CLUSTERS, and for the present study a simpler, approximate procedure was adopted. The simple random sampling (SRS) variance of the TFR can be calculated as the sum of the SRS variances of the age-specific rates (multiplied by 25), since the covariances terms are zero (ignoring finite population corrections). The variance of the TFR is estimated by multiplying its estimated SRS variance by the design effect of the general fertility rate. This procedure tends to slightly overestimate the true sampling variance since one would expect the design effect of the TFR to be smaller than that of the GFR. Relative errors obtained from this procedure are displayed in table 4. For a one-year reference period, the total fertility rates for countries have relative errors ranging from 2.5 to 5.8 per cent (mean = 4 per cent). Doubling the reference period reduces the errors by 30 per cent on average, and re-doubling to four years reduces them by a further 18 per cent on average. In general the relative errors of total fertility rates (using the above approximation) are 5–10 per cent higher than the relative errors of general fertility rates.

A two per cent relative error for a total fertility rate of five leads to a 95 per cent confidence interval of 4.8–5.2. If we adopt this as a standard for gauging precision for country rates, then it is attained with two years of exposure for Pakistan and Kenya, three years of exposure for Sri Lanka, and is *not* attained with five years of exposure in Nepal and Colombia, which have relative errors of over 3 per cent for this interval. Thus sample sizes for these countries are too low to achieve this level of precision without an excessively long reference period.

The relative errors of total fertility rates for urban and rural subgroups are somewhat higher, averaging from 5.4 to 2.9 per cent as the reference period is increased from one to five years. To detect with 95 per cent confidence a difference of half a birth in urban/rural rates which average five births requires errors of not more than 3.5–4.0 per cent

for either rate. This standard is obtained at two years of exposure for Pakistan, three years of exposure for Sri Lanka, and not obtained with five years of exposure by Colombia and Kenya (which have all women rates).

Thus it should be noted that power to detect differentials in total fertility rates can be considerably increased by extending the reference period, but remains quite modest for WFS size samples. Differences in fertility are perhaps more readily detected by more specific individual level measures than by the total fertility rate.

5.4 DECOMPOSITION OF THE SAMPLING ERROR

The sampling errors described above are clearly highly related to the rates themselves and the exposure years on which they are based. A more analytical approach to the data is to determine the extent to which the standard errors depart from the sample binomial standard error based on years of exposure. Thus each estimated standard error is decomposed into the product

$$se_{bin} \times deft \times bcf,$$

where se_{bin} is the estimated binomial standard error, deft is the design effect and the residual component is called the birth correlation factor, for reasons explained in chapter 4. If deft = bcf = 1, then the binomial formula accurately predicts the variance.

5.5 ANALYSIS OF DESIGN EFFECTS

The sample designs for urban and rural sectors of the surveys analysed here were radically different. Thus for the analysis of design effects it was decided to restrict attention to the nine non-overlapping population groups, consisting of urban and rural sectors of Sri Lanka, Pakistan, Colombia and Kenya, and the total population of Nepal, which was not split because of the small urban sample size.

Averaged over these groups, the general fertility rates had a mean design effect of 1.40, the age-specific fertility rates had a mean design effect of 1.14, and the cohort-specific fertility rates had a mean design effect of 1.14. The lower values for the age and cohort-specific rates reflect the reduction in cluster sizes when rates are restricted to groups which cut across clusters.

Variation of design effects across reference period, subpopulation and age group can be seen in table 5. The pattern of variation is similar for all three types of rates, although the degree of variation is greatest for the general rates where the design effects are larger. The design effects appear to increase with reference period for the first three years, and then level off for the third, fourth and fifth year. Thus the increase in effective sample size gained by increase in the period of exposure appears to be offset somewhat by an increase in the design effect.

As expected there are large variations in the mean design effect by subpopulation. For age-specific rates, mean design effects range from 1.40 in Nepal to 1.02–1.03 in Pakistan and the urban sample of Colombia. The high design effect in Nepal is to be expected, since it was a highly clustered sample; the effects for Kenya and the rural sample in Colombia are surprisingly high for a measure of fertility, suggesting considerable heterogeneity in fertility rates between clusters.

The design effects of age and cohort rates by age group are less variable, and display no obvious pattern.

Table 5 Average design effects of age-specific rates

	General rates	Age rates	Cohort rates
A Reference period (years)			
1	1.284	1.067	1.090
2	1.372	1.116	1.136
3	1.448	1.163	1.169
4	1.457	1.175	1.158
5	1.425	1.170	1.155
B Subpopulation			
Sri Lanka, rural	1.140	1.085	1.128
Sri Lanka, urban	1.161	1.078	1.044
Nepal	2.684	1.404	1.457
Pakistan, rural	1.102	1.016	1.051
Pakistan, urban	.990	1.027	1.025
Colombia, rural	1.733	1.243	1.170
Colombia, urban	1.175	1.028	1.035
Kenya, rural	1.228	1.198	1.163
Kenya, urban	1.362	1.174	1.204
C Age group			
15–19	–	1.192	1.146
20–24	–	1.155	1.150
25–29	–	1.139	1.141
30–34	–	1.103	1.105
35–39	–	1.166	1.198
40–44	–	1.076	1.110

To relate the variations in mean design effects to underlying variation and to gain some idea of statistical significance, the three-way tables of the design effects for age and cohort rates, classified by age group, population and reference period, were subjected to analysis of variance. The results appear in table 6. A standard three-way analysis of variance is not appropriate, since design effects for different reference periods are not statistically independent. Thus a repeated measure analysis of variance was performed, with grouping factors age and subpopulation and 'trial factor' period. The resulting ANOVA tables give two decompositions of sums of squares, (i) the two-way ANOVA of design effects averaged over period, and (ii) the ANOVA of contrasts in the design effects between periods. The BMDP2V analysis of variance program was used to perform the calculations; further details of the technique can be found in the BMDP manual (BMDP 1979).

Variations of the design effects by age and subpopulation are analysed in the first three rows of table 6, panels A and B. The mean square for the age × population interaction is .049 for age rates and .074 for cohort rates, corresponding to standard errors of .22 and .27 respectively. Thus there is a large variation in the design effects after the additive effects of age and population are removed.

The F tests for the main effects of age and population are based on a comparison of their mean squares with the interaction mean square for both age and cohort rates, the differences between populations are highly significant and the differences between age groups are not significant. Thus there is no evidence that the design effects vary significantly with age group.

The remaining rows in table 6 analyse the differences in design effects between periods.

Table 6 Analysis of variance of design effects

	Source	Sum of squares	df	Mean square	F	Tail probability
A Age rates						
	Age	.4039	5	.0808	1.7	.167
(i) Averaged	Population	4.0034	8	.5004	10.3	.000
over periods	Error (= age × popn)	1.9458	40	.0486		
	Total (corrected)	6.3531	53	.1199		
(ii) Between periods	Period	.4612	4	.1153	11.2	.000
	Period × age	.3070	20	.0154	1.5	.092
	Period × population	.5597	32	.0175	1.7	.018
	Error (= period × age × popn)	1.6502	160	.0103		
	Total	2.9781	216	.0138		
B Cohort rates						
	Age	.2501	5	.0500	0.7	.646
(i) Averaged	Population	4.4329	8	.5541	7.5	.000
over periods	Error (= age × popn)	2.9722	40	.0743		
	Total (corrected)	7.6552	53	.1444		
	Period	.2087	4	.0522	6.2	.000
(ii) Between periods	Period × age	.2422	20	.0121	1.4	.111
	Period × population	.4781	32	.0149	1.8	.011
	Error (= period × age × popn)	1.3468	160	.0084		
	Total	2.2758	216	.0154		

The differences in design effects between periods do not appear to be attributable to random fluctuations ($F_{4, 160} = 11.2$ for age rates, 6.2 for cohort rates). There also appears to be some evidence that differences in design effects between periods are not constant over populations, that is, that an interaction between period and population is present. ($F_{32, 160} = 1.7$, for age or cohort rates).

This reflects the fact that period variation among populations with large design effects (Nepal and Kenya) is greater than variance among populations with low design effects; in other words, it is to some extent an artifact of the scale in which effects are measured. An analysis of log design effects may reduce the interaction, but this was not pursued here.

5.6 ANALYSIS OF BIRTH CORRELATION FACTORS

Birth Correlation Factors are analysed in the same way as design effects, with results displayed in tables 7 and 8.

The average birth correlation factor for the nine subpopulations was 1.05 for general fertility rates, 0.99 for age rates and 0.99 for cohort rates. Thus if birth correlation factors are ignored, the result is on average to underestimate the standard errors of general rates by about five per cent, and overestimate the standard errors of age or cohort rates by about one per cent.

The means in table 7 and the associated analysis of variance in table 8 indicate significant

Table 7 Average birth correlation factors by reference period, subpopulation and age group

	General rates	Age rates	Cohort rates
A Reference period (years)			
1	1.016	1.023	1.015
2	0.977	0.967	0.947
3	1.027	0.974	0.967
4	1.087	0.994	0.998
5	1.132	1.010	1.024
B Subpopulation			
Sri Lanka, rural	1.010	0.970	0.922
Sri Lanka, urban	1.044	0.948	0.922
Nepal	0.981	0.973	0.953
Pakistan, rural	0.991	0.959	0.941
Pakistan, urban	1.039	0.987	0.972
Colombia, rural	1.133	1.047	1.095
Colombia, urban	1.103	1.043	1.071
Kenya, rural	1.041	0.976	0.981
Kenya, urban	1.088	1.042	1.055
C Age group			
15–19	–	0.975	0.978
20–24	–	0.955	0.956
25–29	–	0.969	0.949
30–34	–	0.998	0.982
35–39	–	1.031	1.026
40–44	–	1.034	1.050

Table 8 Analysis of variance of birth correlation factors

	Source	Sum of squares	df	Mean square	F	Tail probability
A Age rates						
	Age	0.2317	5	0.0463	7.2	0.000
(i) Averaged over	Population	0.3952	8	0.0494	7.7	0.000
period	Error (= age × popn)	0.2571	40	0.0064		
	Total		53	0.0167		
	Period	0.1223	4	0.0306	27.4	0.000
(ii) Between periods	Period × age	0.1075	20	0.0054	4.8	0.000
	Period × population	0.1585	32	0.0050	4.4	0.000
	Error (= Period × age × popn)	0.1783	160	0.0011		
	Total		216	0.0026		
B Cohort rates						
	Age	0.3610	5	0.0722	5.1	0.001
(i) Averaged over	Population	1.0617	8	0.1328	9.3	0.000
periods	Error (= age × popn)	0.5692	40	0.0039		
	Total	1.9919	53	0.0376		
	Period	0.2273	4	0.0568	42.7	0.000
(ii) Between periods	Period × age	0.1340	20	0.0067	5.0	0.000
	Period × population	0.3869	32	0.0121	9.1	0.000
	Error (= period × age × popn)	0.2134	160	0.0013		
	Total	0.9616	216	0.0045		

variations in the birth correlation factors between periods, age groups and subpopulations. The means by reference period have a u shaped pattern – above one for one year and five-year periods, and below one for two, three and four-year periods. The average birth correlation factors classified by subpopulation suggest lower values for marital rates than for all women rates. (The mean for the rural domain in Kenya is exceptional in this regard.) This observation, together with the fact that birth correlation factors are uniformly higher for general rates than for age or cohort rates, implies that the birth correlation factor is positively related with the degree of heterogeneity of the population. This relationship was predicted from the model presented in chapter 4.

Table 7, panel C indicates a positive relationship between the birth correlation factor and age, for the age groups considered. This pattern also appears plausible in terms of the model in chapter 4. That is, in the young age groups where birth rates are high, the negative correlation between births in successive years tends to reduce the variance to below binomial. In older age groups the effect of the negative correlation can be expected to be weaker, and also the women may be somewhat more heterogeneous because of variation in marital status and fecundity. These factors lead to larger birth correlation factors.

The analyses of variance in table 8 suggest that the variations described above are not attributable solely to random variation. They also show that the birth correlation factors are considerably less variable than the design effects; the interaction mean squares are 0.0064 for age rates and 0.0039 for cohort rates, compared with 0.049 and 0.074 from the design effects analysis of the previous section. Finally there are significant interactions between age and period and between population and period, which reflect the fact that the differences by age and by population are negligible for rates calculated over a one year period, and only emerge as the reference period is increased.

5.7 APPROXIMATE SAMPLING ERRORS FROM HOUSEHOLD AND INDIVIDUAL FILES

In section 3.2 an approximate method was described for estimating sampling errors for all women rates ($\hat{r}$) calculated in the form

$$\hat{r} = \hat{r}_m \cdot \hat{p}$$

where $\hat{r}_m$ is a rate for ever-married women and $\hat{p}$ is a proportion ever married, and $\hat{r}_m$ and $\hat{p}$ are based on different files of information. The relative variance of $\hat{r}$ is estimated as the sum of the relative variances of $\hat{r}_m$ and $\hat{p}$.

Although designed for countries where the individual interview is restricted to ever-married women, the method can be readily tested on countries where all women are interviewed, since no merging of files is necessary to estimate the variance of $\hat{r}$ directly. Thus the method was tested on four samples where all women were interviewed, the urban and rural samples of Colombia and Kenya.

In addition to all women fertility rates and their sampling errors, the following three statistics and their sampling errors were calculated:

$\hat{r}_m$ = fertility rate restricted to women ever married at interview date

$\hat{p}$ = the proportion ever married at interview date

$\hat{r}$ = fertility rate for all women, with the fertility of women not married at date of interview set to zero.

Note that $\hat{r}$ is not quite equal to the all women fertility rate analysed earlier, since the

fertility of never-married women is excluded. This modification is necessary so that $\hat{r} = \hat{r}_m \hat{p}$, and the rate $\hat{r}$ corresponds to the estimate that would be obtained from ever-married samples. The fact that the rate has little substantive value in Kenya and Colombia is not important for our methodological exercise.

Two estimates of the standard error of $\hat{r}$ are then obtained.

(1) se_{obs}, the standard error of $\hat{r}$ calculated directly.
(2) se_{pred}, the standard error of $\hat{r}$ calculated from $\hat{r}_m$ and $\hat{p}$ and their standard errors, using equation (3.4).

To compare se_{obs} and se_{pred}, the ratio se_{obs}/se_{pred} was calculated for each rate calculated. Values of unity indicate that the approximate method works well. Averaged values of se_{obs}/se_{pred} are presented in table 9, and analyses of variance of the ratios are given in table 10.

The average value of se_{obs}/se_{pred} over all age groups, populations and reference periods is 0.998 for age rates and 0.999 for cohort rates. The subgroup means in table 9 all deviate only slightly from unity. The analyses of variance do not indicate systematic fluctuations in the ratios by age, population or reference period. Variation by reference period is small, but variations by age group and subpopulation is more marked.

Table 11 shows values of se_{obs}/se_{pred} averaged over reference period, classified by age group and subpopulation. For older age groups (where $\hat{r}$ and $\hat{r}_m$ are close), the ratios are close to one. For the first two age groups they are more variable. The overall conclusion is that the approximate method is a satisfactory way of estimating the sampling error of rates without merging household and individual files.

Table 9 Average values of se_{obs}/se_{pred}, where se_{obs} is the observed standard error of the all women fertility rate and se_{pred} is the predicted standard error from equation (3.3)

	Age rates	Cohort rates
A Reference period (years)		
1	1.001	1.004
2	1.002	1.002
3	0.996	0.997
4	1.002	0.997
5	0.994	0.991
B Subpopulation		
Colombia, rural	1.024	0.988
Colombia, urban	1.005	1.009
Kenya, rural	0.993	0.995
Kenya, urban	0.974	1.001
C Age group		
15–19	0.994	1.022
20–24	0.986	0.986
25–29	1.028	0.988
30–34	0.981	0.985
35–39	0.997	0.987
40–44	1.007	1.014

Table 10 Analysis of variance of se_{obs}/se_{pred}, where se_{obs} and se_{pred} are as in table 9

	Source	Sum of squares	df	Mean square	F	Tail probability
A Age rates						
	Age	0.0291	5	0.0058	0.17	0.971
(i) Averaged over	Population	0.0402	3	0.0134	0.39	0.765
periods	Error (= age × popn)	0.5207	15	0.0347		
	Total (corrected)	0.5899	23	0.0256		
	Period	0.0013	4	0.0003	0.20	0.937
(ii)Between periods	Period × age	0.0153	20	0.0008	0.48	0.964
	Period × population	0.0126	12	0.0010	0.66	0.780
	Error (= period × age × popn)	0.0949	60	0.0016		
	Total	0.1240	96	0.0013		
B Cohort rates						
	Age	0.0253	5	0.0051	0.20	0.959
(i) Averaged over	Population	0.0074	3	0.0025	0.10	0.961
periods	Error (= age × popn)	0.3864	15	0.0258		
	Total (corrected)	0.4191	23	0.0182		
	Period	0.0023	4	0.0006	0.29	0.881
(ii) Between periods	Period × age	0.0143	20	0.0007	0.37	0.992
	Period × population	0.0227	12	0.0019	0.99	0.473
	Error (= period × age × popn)	0.1153	60	0.0019		
	Total	0.1546	96	0.0016		

Table 11 Values of se_{obs}/se_{pred}, averaged over reference period

	Age group					
	15–19	20–24	25–29	30–34	34–39	40–44
A Age rates						
Subpopulation						
Colombia, rural	0.996	1.126	1.092	0.904	1.006	1.021
Colombia, urban	1.039	0.992	0.997	1.004	0.994	1.005
Kenya, rural	1.127	0.824	0.995	1.011	0.996	1.002
Kenya, urban	0.815	1.001	1.030	1.005	0.992	1.000
B Cohort rates						
Subpopulation						
Colombia, rural	1.008	1.038	0.981	0.864	0.975	1.000
Colombia, urban	1.069	0.990	1.005	1.007	0.984	0.998
Kenya, rural	1.126	0.886	0.936	1.021	1.002	1.000
Kenya, urban	0.883	1.030	1.061	1.047	0.986	0.998

5.8 SUMMARY OF CONCLUSIONS

The main results from the analysis can be summarized as follows:

1 The sampling errors of age-specific and cohort-specific fertility rates based on five-year age groups and a one-year reference period are substantial. For example, the standard errors of age-specific rates range from 6 to 10 per cent of the mean for the five total populations considered, and from 6 to 20 per cent for urban and rural subgroups. Thus reference periods of one year lead to an unacceptably high level of sampling error.

2 Doubling the reference period reduces the standard errors of age-specific rates by an average of 41 per cent. Increasing the period to four years reduces them further by an average of 23 per cent. Thus increasing the reference period appears more effective for short reference periods than for long reference periods.

3 The sampling errors of general and total fertility rates are rather smaller than those of age or cohort-specific rates, ranging from 2.5 to 6 per cent for the five populations considered, for a one-year reference period. Increasing the reference period has a smaller impact on the standard errors than for age or cohort-specific rates. Increasing the period to two years leads to an average 30 per cent reduction in standard error, and from two years to four years a further 18 per cent reduction.

4 The average design effect for the nine subpopulations analysed was 1.4 for general fertility rates and 1.14 for age or cohort-specific fertility rates. The design effects of rates increased with period of exposure, and displayed a wide variation over the subpopulations analysed.

5 The birth correlation factors were much less variable than the design effects, and averaged close to one for age and cohort-specific rates, and slightly above one (1.05) for general fertility rates. The factors were positively related to age and were higher for all women rates than for marital rates.

6 In view of conclusions (4) and (5), we infer that the simple binomial standard error with index equal to accumulated years of exposure is not an adequate predictor of the sampling error of fertility rates. However, if a satisfactory estimate of the design effect can be obtained, then the expression obtained by multiplying the binomial standard error by the design effect will not lead to serious errors.

7 The approximate method of chapter 3 for estimating the sampling errors of all women rates calculated as a product of ever-married rates and the proportion ever married was found to work well for the urban and rural populations of Colombia and Kenya.

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Appendix A - Data Tables: Sampling Errors of Fertility Rates

Note The appendix tables are explained in section 5.1.

ROH is unstable for small cluster sizes and is suppressed in CLUSTERS if the mean cluster size is less than six.

Table A1 Colombia: age-specific and cohort-specific all women rates (total sample, rural domain and urban domain)

COLOMBIA ALL WOMEN AGE SPECIFIC RATES. TOTAL SAMPLE

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	134.1	6.73	5376.	1.420	.067	1.020
2	135.4	4.50	10752.	1.323	.042	1.031
3	131.0	4.73	16128.	1.651	.084	1.078
4	130.0	4.34	21504.	1.691	.081	1.119
5	127.6	4.02	26872.	1.713	.077	1.153
AGE 15-19						
1	75.7	9.74	1401.	1.346	****	1.024
2	93.1	7.48	2685.	1.256	****	1.062
3	96.4	6.79	3900.	1.274	****	1.128
4	98.8	5.99	5038.	1.240	****	1.149
5	98.1	5.05	6118.	1.160	.069	1.145
AGE 20-24						
1	215.0	12.76	991.	.955	****	1.024
2	229.5	10.36	1948.	1.073	****	1.013
3	222.1	8.81	2863.	1.109	****	1.023
4	224.6	8.56	3740.	1.197	****	1.048
5	227.3	8.56	4579.	1.284	****	1.076
AGE 25-29						
1	234.3	16.23	824.	1.067	****	1.031
2	217.9	10.36	1588.	1.014	****	.986
3	215.2	10.62	2305.	1.219	****	1.018
4	220.5	9.83	2962.	1.224	****	1.054
5	218.6	8.95	3577.	1.206	****	1.074
AGE 30-34						
1	158.6	15.08	586.	.991	****	1.009
2	168.8	12.04	1191.	1.101	****	1.007
3	167.5	11.50	1797.	1.236	****	1.056
4	167.4	10.03	2396.	1.192	****	1.103
5	168.4	9.05	2976.	1.163	****	1.134
AGE 35-39						
1	132.8	15.10	587.	1.053	****	1.024
2	127.3	11.82	1139.	1.172	****	1.021
3	124.5	10.94	1663.	1.286	****	1.051
4	128.2	9.22	2161.	1.208	****	1.061
5	128.1	9.74	2646.	1.348	****	1.112
AGE 40-44						
1	62.4	10.91	448.	.946	****	1.009
2	53.9	7.06	891.	.946	****	.987
3	54.5	6.84	1321.	1.081	****	1.013
4	55.8	6.40	1756.	1.156	****	1.010
5	61.4	6.56	2166.	1.219	****	1.043
AGE 45-49						
1	26.1	9.04	345.	.947	****	1.112
2	23.5	6.90	595.	1.035	****	1.072
3	22.2	6.71	765.	1.131	****	1.113
4	22.3	6.37	850.	1.139	****	1.104
5	21.7	6.21	875.	1.141	****	1.105

Table A1 (*cont.*)

COLOMBIA ALL WOMEN AGE SPECIFIC RATES. RURAL DOMAIN

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	159.3	10.71	3157.	1.607	.014	1.023
2	159.2	7.18	6314.	1.507	.010	1.035
3	154.4	7.76	9471.	1.927	.019	1.085
4	154.0	7.18	12628.	1.988	.018	1.124
5	151.9	6.69	15780.	2.022	.018	1.158
AGE 15-19						
1	92.3	15.21	812.	1.450	.041	1.033
2	113.2	11.70	1545.	1.359	.028	1.068
3	115.8	10.60	2229.	1.364	.026	1.147
4	116.4	9.31	2861.	1.341	.022	1.158
5	116.0	7.59	3466.	1.216	.012	1.148
AGE 20-24						
1	244.3	16.86	561.	.912	-.009	1.019
2	263.8	14.74	1114.	1.089	.009	1.025
3	254.0	12.89	1650.	1.172	.015	1.026
4	258.1	12.72	2169.	1.292	.025	1.048
5	260.8	12.87	2665.	1.409	.034	1.074
AGE 25-29						
1	285.6	24.95	469.	1.150	.021	1.040
2	258.8	15.59	896.	1.086	.011	.981
3	260.5	17.28	1301.	1.411	.052	1.006
4	269.7	15.89	1676.	1.412	.047	1.038
5	267.3	14.55	2035.	1.406	.043	1.055
AGE 30-34						
1	179.7	21.15	362.	1.035	.006	1.012
2	192.2	17.22	734.	1.193	.031	.992
3	195.9	17.15	1103.	1.352	.052	1.061
4	198.7	14.89	1469.	1.297	.039	1.103
5	202.4	13.65	1823.	1.285	.035	1.129
AGE 35-39						
1	173.0	21.74	353.	1.047	.009	1.031
2	168.4	17.70	677.	1.221	.040	1.008
3	162.6	17.16	978.	1.402	.070	1.038
4	170.4	14.26	1262.	1.289	.044	1.045
5	169.7	15.66	1538.	1.499	.076	1.092
AGE 40-44						
1	82.6	16.32	266.	.952	-.011	1.017
2	64.7	9.85	541.	.941	-.011	.990
3	64.8	9.66	817.	1.132	.024	.991
4	67.0	9.37	1090.	1.244	.043	.995
5	75.6	9.95	1350.	1.341	.058	1.031
AGE 45-49						
1	42.2	14.97	213.	.976	-.007	1.115
2	32.8	10.81	366.	1.067	.022	1.087
3	30.0	10.21	467.	1.203	.072	1.076
4	30.5	9.74	524.	1.215	.076	1.067
5	29.5	9.45	543.	1.216	.077	1.070

Table A1 (*cont.*)

COLOMBIA ALL WOMEN AGE SPECIFIC RATES. URBAN DOMAIN

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	98.2	6.86	2219.	1.070	.023	1.015
2	101.6	5.33	4438.	1.157	.045	1.016
3	97.8	4.81	6657.	1.257	.067	1.051
4	95.8	4.42	8876.	1.297	.069	1.091
5	92.9	4.15	11092.	1.337	.073	1.126
AGE 15-19						
1	52.7	10.27	588.	1.110	****	1.005
2	65.8	8.35	1140.	1.091	****	1.042
3	70.6	7.80	1672.	1.157	****	1.076
4	75.8	7.33	2177.	1.152	****	1.122
5	74.7	6.90	2652.	1.195	****	1.131
AGE 20-24						
1	176.7	18.70	430.	.981	****	1.036
2	183.6	13.44	833.	1.016	****	.986
3	178.9	10.86	1213.	.987	****	1.000
4	178.3	9.90	1570.	.992	****	1.033
5	180.7	9.38	1915.	1.004	****	1.062
AGE 25-29						
1	166.3	18.93	355.	.943	****	1.015
2	164.8	13.35	692.	.970	****	.976
3	156.4	11.15	1004.	.970	****	1.003
4	156.4	10.46	1285.	1.003	****	1.029
5	154.4	9.36	1542.	.969	****	1.050
AGE 30-34						
1	124.6	21.07	225.	.952	****	1.005
2	131.2	16.57	457.	1.020	****	1.029
3	122.5	13.40	694.	1.051	****	1.024
4	117.7	12.22	926.	1.071	****	1.078
5	114.6	10.79	1152.	1.039	****	1.107
AGE 35-39						
1	72.4	18.43	235.	1.082	****	1.007
2	67.1	12.42	462.	1.024	****	1.042
3	70.1	10.58	685.	1.017	****	1.067
4	69.0	9.28	899.	1.029	****	1.067
5	70.4	8.98	1107.	1.040	****	1.123
AGE 40-44						
1	33.0	13.27	182.	1.000	****	1.002
2	37.1	9.88	350.	.990	****	.988
3	37.7	8.88	504.	.971	****	1.078
4	37.6	7.75	665.	1.003	****	1.048
5	38.0	7.16	816.	1.005	****	1.065
AGE 45-49						
1	.0	.00	131.	.000	****	.000
2	8.7	6.02	229.	.981	****	.998
3	10.1	7.31	298.	.978	****	1.292
4	9.2	6.70	326.	.981	****	1.293
5	9.0	6.58	333.	.981	****	1.294

Table A1 (*cont.*)

COLOMBIA ALL WOMAN COHORT-SPECIFIC RATES. TOTAL SAMPLE

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	134.1	6.73	5376.	1.430	.085	1.013
2	135.4	4.50	10752.	1.310	.058	1.041
3	131.0	4.73	16128.	1.586	.123	1.123
4	130.0	4.34	21504.	1.576	.121	1.201
5	127.6	4.02	26872.	1.561	.117	1.265
AGE 15-19						
1	55.5	8.71	1423.	1.397	****	1.027
2	53.8	5.59	2846.	1.211	****	1.092
3	44.7	4.51	4269.	1.180	****	1.208
4	35.8	3.65	5692.	1.190	****	1.245
5	29.5	3.09	7114.	1.217	****	1.265
AGE 20-24						
1	214.1	12.52	1051.	.978	****	1.012
2	218.8	9.27	2102.	1.006	****	1.022
3	201.7	7.95	3153.	1.034	****	1.076
4	189.3	7.03	4204.	1.023	****	1.137
5	173.8	6.25	5253.	1.022	****	1.170
AGE 25-29						
1	213.8	16.31	842.	1.138	****	1.014
2	220.9	10.92	1684.	1.083	****	.997
3	218.5	9.75	2526.	1.133	****	1.047
4	222.7	8.90	3368.	1.120	****	1.108
5	224.5	8.87	4209.	1.184	****	1.165
AGE 30-34						
1	182.0	14.12	599.	.895	****	1.001
2	178.6	10.14	1198.	.949	****	.966
3	182.5	9.50	1797.	.997	****	1.046
4	194.9	8.88	2396.	.990	****	1.108
5	200.1	8.18	2994.	.967	****	1.157
AGE 35-39						
1	138.2	15.88	579.	1.091	****	1.015
2	149.4	13.72	1158.	1.258	****	1.041
3	148.0	12.38	1737.	1.325	****	1.097
4	153.3	11.59	2316.	1.320	****	1.173
5	154.8	10.72	2894.	1.275	****	1.251
AGE 40-44						
1	81.9	13.39	476.	1.064	****	1.001
2	71.4	8.68	952.	1.046	****	.994
3	82.6	9.07	1428.	1.140	****	1.092
4	90.3	8.14	1904.	1.080	****	1.147
5	98.4	8.91	2379.	1.189	****	1.227
AGE 45-49						
1	22.2	7.68	406.	.948	****	1.109
2	19.7	5.41	812.	1.053	****	1.053
3	25.5	4.90	1218.	.960	****	1.131
4	31.4	5.46	1624.	1.085	****	1.163
5	38.9	6.10	2029.	1.150	****	1.235

Table A1 (*cont.*)

COLOMBIA ALL WOMAN COHORT-SPECIFIC RATES. RURAL DOMAIN

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	159.3	10.71	3157.	1.622	.018	1.014
2	159.2	7.18	6314.	1.494	.014	1.044
3	154.4	7.76	9471.	1.852	.027	1.129
4	154.0	7.18	12628.	1.853	.027	1.206
5	151.9	6.69	15781.	1.843	.027	1.270
AGE 15-19						
1	69.5	13.73	835.	1.505	.055	1.037
2	64.7	8.43	1670.	1.274	.027	1.099
3	55.5	7.01	2505.	1.234	.023	1.242
4	43.4	5.61	3340.	1.247	.024	1.276
5	35.9	4.83	4174.	1.282	.028	1.308
AGE 20-24						
1	241.5	17.08	588.	.967	-.004	1.001
2	256.8	12.34	1176.	.946	-.007	1.024
3	231.3	11.08	1764.	1.025	.003	1.077
4	215.6	9.53	2352.	1.000	-.000	1.124
5	198.7	8.62	2939.	1.006	.001	1.164
AGE 25-29						
1	260.2	24.57	492.	1.216	.037	1.022
2	255.1	15.83	984.	1.144	.024	.996
3	256.1	14.29	1476.	1.210	.035	1.040
4	264.7	12.88	1968.	1.161	.027	1.115
5	264.7	12.84	2459.	1.245	.042	1.159
AGE 30-34						
1	196.6	17.93	356.	.850	-.030	1.001
2	205.1	13.66	712.	.951	-.010	.949
3	215.4	13.64	1068.	1.057	.013	1.026
4	229.6	12.52	1424.	1.044	.010	1.076
5	238.3	11.52	1780.	1.030	.007	1.108
AGE 35-39						
1	191.4	24.09	350.	1.123	.029	1.020
2	191.4	21.24	700.	1.387	.102	1.030
3	186.7	19.18	1050.	1.465	.128	1.089
4	195.0	17.69	1400.	1.438	.118	1.162
5	196.7	16.29	1749.	1.402	.107	1.223
AGE 40-44						
1	104.7	20.61	277.	1.118	.036	1.002
2	90.3	13.35	554.	1.101	.031	.996
3	101.1	14.11	831.	1.230	.074	1.097
4	115.5	12.82	1108.	1.154	.048	1.157
5	128.6	14.32	1384.	1.289	.096	1.235
AGE 45-49						
1	34.8	12.32	259.	.974	-.008	1.111
2	27.0	8.24	518.	1.091	.030	1.060
3	34.8	7.34	777.	1.003	.001	1.114
4	42.5	8.47	1036.	1.165	.056	1.160
5	51.0	9.29	1295.	1.244	.086	1.222

Table A1 (*cont.*)

COLOMBIA ALL WOMAN COHORT-SPECIFIC RATES. URBAN DOMAIN

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	98.2	6.86	2219.	1.075	****	1.010
2	101.6	5.33	4438.	1.143	****	1.028
3	97.8	4.81	6657.	1.207	****	1.095
4	95.8	4.42	8876.	1.220	****	1.160
5	92.9	4.15	11092.	1.232	****	1.222
AGE 15-19						
1	35.7	8.64	588.	1.128	****	1.001
2	38.3	7.08	1176.	1.182	****	1.071
3	29.5	5.25	1764.	1.180	****	1.105
4	25.1	4.38	2352.	1.173	****	1.158
5	20.4	3.51	2939.	1.169	****	1.151
AGE 20-24						
1	179.3	17.58	463.	.957	****	1.030
2	170.6	12.68	926.	1.020	****	1.006
3	164.2	10.93	1389.	1.037	****	1.060
4	156.0	10.18	1852.	1.058	****	1.141
5	142.2	8.99	2314.	1.069	****	1.158
AGE 25-29						
1	148.6	18.33	350.	.963	****	1.001
2	172.9	14.14	700.	1.002	****	.987
3	165.7	11.63	1050.	.984	****	1.030
4	163.6	10.59	1400.	1.029	****	1.041
5	168.0	10.17	1750.	1.021	****	1.114
AGE 30-34						
1	160.5	23.56	243.	.998	****	1.003
2	139.9	15.93	486.	1.023	****	.990
3	134.4	13.66	729.	1.023	****	1.057
4	144.0	13.11	972.	1.027	****	1.133
5	144.1	12.11	1214.	1.005	****	1.196
AGE 35-39						
1	56.8	16.12	229.	1.052	****	1.002
2	85.1	13.76	458.	1.016	****	1.038
3	88.8	11.90	687.	1.029	****	1.066
4	89.5	10.79	916.	1.024	****	1.117
5	90.8	10.43	1145.	1.004	****	1.223
AGE 40-44						
1	50.3	15.24	199.	.982	****	1.002
2	45.2	9.93	398.	.974	****	.979
3	56.9	10.05	597.	.995	****	1.065
4	55.3	8.51	796.	.973	****	1.080
5	56.3	7.77	995.	.948	****	1.121
AGE 45-49						
1	.0	.00	147.	.000	****	.000
2	6.8	4.70	294.	.981	****	1.000
3	9.1	5.20	441.	.942	****	1.223
4	11.9	4.80	588.	.955	****	1.124
5	17.7	5.72	735.	.940	****	1.251

Table A2 Kenya: age-specific and cohort-specific all women rates (total sample, rural domain and urban domain)

KENYA ALL WOMEN AGE RATES. TOTAL SAMPLE

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	246.7	5.77	8023.	1.155	.005	1.038
2	235.2	4.08	16051.	1.256	.007	.970
3	234.3	3.66	24089.	1.338	.009	1.002
4	234.2	3.30	32141.	1.348	.008	1.036
5	227.3	3.15	40140.	1.416	.009	1.063
AGE 15-19						
1	173.5	11.23	1941.	1.283	.043	1.018
2	165.1	8.27	3764.	1.410	.058	.969
3	167.1	6.77	5511.	1.348	.043	.999
4	174.2	6.41	7163.	1.404	.046	1.019
5	174.5	5.67	8708.	1.366	.038	1.021
AGE 20-24						
1	353.4	14.42	1529.	1.136	.023	1.038
2	336.4	8.92	3054.	1.120	.018	.932
3	341.1	7.18	4565.	1.114	.015	.919
4	349.4	6.09	6077.	1.064	.007	.936
5	339.8	6.33	7599.	1.252	.029	.931
AGE 25-29						
1	355.9	15.60	1452.	1.167	.031	1.064
2	353.8	13.47	2819.	1.602	.123	.934
3	356.0	8.25	4106.	1.174	.027	.940
4	356.9	7.69	5238.	1.242	.036	.935
5	351.3	7.07	6228.	1.240	.033	.943
AGE 30-34						
1	304.8	15.87	941.	1.018	.005	1.039
2	288.8	11.39	1850.	1.148	.037	.942
3	294.2	12.37	2744.	1.510	.130	.942
4	293.5	10.70	3666.	1.508	.114	.943
5	293.4	8.35	4600.	1.312	.060	.948
AGE 35-39						
1	225.8	13.70	871.	.917	-.023	1.054
2	231.2	11.70	1715.	1.208	.060	.951
3	237.5	10.41	2504.	1.264	.071	.968
4	242.9	9.92	3197.	1.301	.078	1.005
5	241.1	8.98	3787.	1.269	.066	1.018
AGE 40-44						
1	142.3	14.31	562.	.919	****	1.057
2	146.7	12.14	1101.	1.163	.064	.979
3	149.7	9.27	1630.	1.063	.020	.987
4	157.3	9.58	2193.	1.195	.061	1.031
5	161.9	7.47	2782.	1.012	.003	1.057
AGE 45-49						
1	62.6	11.91	484.	1.078	****	1.004
2	59.5	8.64	846.	1.083	****	.981
3	58.9	7.80	1101.	1.037	****	1.060
4	65.5	7.69	1247.	1.010	****	1.087
5	67.0	7.36	1289.	.961	****	1.100

Table A2 (*cont.*)

KENYA ALL WOMEN AGE RATES. RURAL DOMAIN

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	249.5	6.23	6412.	1.111	.002	1.038
2	238.0	4.43	12837.	1.218	.003	.968
3	237.4	3.96	19255.	1.298	.004	.995
4	237.7	3.54	25673.	1.295	.004	1.029
5	231.6	3.39	32056.	1.361	.004	1.057
AGE 15-19						
1	174.1	12.76	1507.	1.292	.025	1.011
2	166.2	9.50	2879.	1.429	.035	.958
3	169.5	7.82	4175.	1.361	.026	.990
4	177.7	7.46	5366.	1.413	.027	1.012
5	179.3	6.60	6469.	1.367	.022	1.012
AGE 20-24						
1	359.5	15.51	1094.	1.028	.003	1.040
2	345.4	9.98	2199.	1.061	.005	.928
3	350.7	7.80	3298.	1.039	.003	.903
4	356.8	6.40	4424.	.974	-.002	.912
5	348.5	6.86	5574.	1.183	.012	.909
AGE 25-29						
1	369.2	17.47	1123.	1.132	.014	1.072
2	363.6	15.03	2189.	1.574	.065	.929
3	365.0	8.93	3200.	1.128	.011	.930
4	365.8	8.38	4114.	1.208	.017	.924
5	359.4	7.81	4921.	1.225	.017	.932
AGE 30-34						
1	309.9	17.46	781.	1.019	.003	1.035
2	293.0	12.35	1545.	1.138	.018	.937
3	297.6	13.29	2314.	1.506	.067	.928
4	298.7	11.44	3106.	1.491	.057	.934
5	298.9	8.81	3914.	1.283	.028	.938
AGE 35-39						
1	234.8	14.56	764.	.898	-.014	1.057
2	239.3	12.27	1507.	1.179	.025	.947
3	245.5	10.96	2195.	1.240	.032	.962
4	250.6	10.45	2803.	1.285	.036	.993
5	249.4	9.43	3320.	1.255	.030	1.001
AGE 40-44						
1	151.6	15.28	493.	.894	-.022	1.058
2	152.6	12.89	971.	1.141	.028	.979
3	156.2	9.75	1447.	1.037	.006	.985
4	164.3	10.02	1954.	1.168	.027	1.024
5	168.2	7.73	2495.	.988	-.001	1.045
AGE 45-49						
1	63.8	12.37	445.	1.064	.018	1.004
2	61.2	8.97	779.	1.067	.019	.979
3	60.7	8.12	1015.	1.021	.006	1.061
4	67.5	7.99	1151.	.994	-.002	1.087
5	69.1	7.63	1191.	.945	-.015	1.098

Table A2 (*cont.*)

KENYA ALL WOMEN AGE RATES. URBAN DOMAIN

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	226.5	14.56	1608.	1.347	.033	1.036
2	215.3	9.35	3227.	1.297	.024	.996
3	212.2	8.49	4844.	1.378	.028	1.049
4	209.6	8.14	6464.	1.479	.033	1.087
5	196.7	7.39	8081.	1.510	.032	1.107
AGE 15-19						
1	169.9	17.07	433.	.892	-.037	1.061
2	159.1	12.55	902.	.994	-.002	1.037
3	154.3	10.05	1373.	.977	-.006	1.055
4	156.7	8.92	1848.	1.000	-.000	1.055
5	150.6	7.65	2306.	.973	-.005	1.056
AGE 20-24						
1	326.3	36.78	434.	1.582	.252	1.033
2	295.3	18.38	848.	1.234	.077	.951
3	297.1	16.57	1260.	1.313	.095	.980
4	314.6	16.61	1654.	1.404	.114	1.036
5	297.9	15.28	2027.	1.467	.127	1.025
AGE 25-29						
1	276.1	28.76	328.	1.137	****	1.025
2	293.5	24.72	630.	1.418	****	.961
3	298.6	20.01	903.	1.302	.138	1.009
4	297.6	16.55	1116.	1.198	.082	1.009
5	295.8	13.81	1292.	1.083	.031	1.004
AGE 30-34						
1	259.6	24.88	158.	.668	****	1.070
2	249.6	25.73	301.	1.050	****	.983
3	259.5	26.82	429.	1.178	****	1.075
4	238.6	22.75	550.	1.213	****	1.032
5	233.3	22.68	668.	1.351	****	1.026
AGE 35-39						
1	102.8	33.50	104.	1.112	****	1.013
2	118.9	28.45	203.	1.230	****	1.018
3	131.1	26.59	303.	1.320	****	1.038
4	142.4	26.73	392.	1.333	****	1.136
5	133.1	24.18	468.	1.265	****	1.218
AGE 40-44						
1	22.7	18.98	69.	1.053	****	1.008
2	68.0	22.97	134.	1.090	****	.967
3	57.1	17.37	186.	1.073	****	.953
4	53.1	18.31	239.	1.131	****	1.116
5	63.2	21.79	290.	1.172	****	1.302
AGE 45-49						
1	36.1	35.61	36.	1.133	****	1.008
2	21.5	21.22	60.	1.138	****	.998
3	16.8	16.81	77.	1.139	****	1.006
4	15.4	15.49	84.	1.142	****	1.010
5	15.1	15.25	86.	1.145	****	1.010

Table A2 (*cont.*)

KENYA ALL WOMEN COHORT RATES. PERIOD	RATE	SE	EXPOSURE	TOTAL SAMPLE DEFT	ROH	BCF
ALL AGES						
1	246.7	5.77	8030.	1.170	.007	1.025
2	235.2	4.08	16060.	1.277	.011	.955
3	234.3	3.66	24090.	1.310	.013	1.024
4	234.2	3.30	32120.	1.282	.012	1.089
5	227.3	3.15	40139.	1.321	.013	1.140
AGE 15-19						
1	138.9	10.30	1932.	1.295	.053	1.011
2	106.5	6.83	3864.	1.388	.072	.992
3	90.8	5.58	5796.	1.380	.071	1.072
4	75.0	4.64	7728.	1.385	.072	1.118
5	62.6	4.07	9658.	1.445	.085	1.142
AGE 20-24						
1	347.3	16.36	1519.	1.316	.075	1.018
2	319.4	8.55	3038.	1.118	.026	.904
3	307.0	7.50	4557.	1.178	.040	.932
4	297.8	6.03	6076.	1.054	.011	.975
5	278.2	5.45	7593.	1.053	.011	1.006
AGE 25-29						
1	362.6	12.46	1502.	.967	-.007	1.039
2	360.5	10.22	3004.	1.328	.078	.878
3	356.1	7.62	4506.	1.199	.045	.891
4	366.3	6.08	6008.	1.057	.012	.925
5	353.3	5.63	7508.	1.089	.019	.937
AGE 30-34						
1	304.7	14.10	987.	.939	-.019	1.025
2	300.9	10.32	1974.	1.117	.040	.895
3	317.0	7.82	2961.	.975	-.008	.938
4	320.0	8.32	3948.	1.178	.063	.951
5	319.7	8.30	4933.	1.298	.111	.963
AGE 35-39						
1	240.8	17.08	895.	1.153	.058	1.037
2	249.7	11.90	1790.	1.273	.109	.914
3	265.1	11.16	2685.	1.336	.138	.981
4	269.2	9.73	3580.	1.308	.125	1.003
5	274.7	8.31	4474.	1.214	.083	1.026
AGE 40-44						
1	145.5	14.33	593.	.937	****	1.056
2	168.9	12.24	1186.	1.144	****	.983
3	188.8	12.36	1779.	1.334	****	.999
4	203.6	10.40	2372.	1.210	****	1.040
5	205.4	9.55	2964.	1.189	****	1.082
AGE 45-49						
1	88.9	10.69	602.	.921	****	1.000
2	80.4	7.16	1204.	.929	****	.984
3	86.7	6.16	1806.	.859	****	1.083
4	104.7	7.03	2408.	1.002	****	1.124
5	119.9	6.42	3009.	.921	****	1.177

Table A2 (*cont.*)

KENYA ALL WOMEN COHORT RATES. RURAL DOMAIN

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	249.5	6.23	6412.	1.125	.003	1.025
2	238.0	4.43	12824.	1.239	.005	.951
3	237.4	3.96	19236.	1.270	.006	1.016
4	237.7	3.54	25648.	1.233	.005	1.080
5	231.6	3.39	32051.	1.271	.006	1.132
AGE 15-19						
1	137.9	11.63	1535.	1.312	.031	1.007
2	106.1	7.65	3070.	1.400	.042	.983
3	90.0	6.24	4605.	1.389	.040	1.066
4	75.2	5.21	6140.	1.382	.040	1.121
5	62.7	4.57	7673.	1.442	.047	1.145
AGE 20-24						
1	356.8	18.31	1068.	1.231	.033	1.015
2	329.1	9.38	2136.	1.036	.005	.891
3	318.6	8.33	3204.	1.110	.015	.912
4	308.4	6.37	4272.	.952	-.006	.947
5	289.9	5.82	5339.	.958	-.005	.978
AGE 25-29						
1	375.0	13.88	1148.	.933	-.008	1.041
2	369.7	11.34	2296.	1.293	.040	.871
3	362.3	8.17	3444.	1.142	.018	.873
4	371.5	6.29	4592.	.980	-.002	.900
5	359.7	5.87	5739.	1.018	.002	.910
AGE 30-34						
1	311.8	15.43	808.	.924	-.013	1.025
2	308.3	11.20	1616.	1.097	.017	.889
3	325.1	8.34	2424.	.952	-.008	.921
4	328.3	8.96	3232.	1.157	.029	.938
5	327.2	9.07	4039.	1.294	.058	.949
AGE 35-39						
1	248.4	18.25	782.	1.136	.026	1.040
2	257.0	12.48	1564.	1.246	.049	.906
3	271.4	11.58	2346.	1.297	.061	.973
4	275.8	10.12	3128.	1.273	.055	.995
5	281.6	8.55	3909.	1.171	.033	1.015
AGE 40-44						
1	154.4	15.32	522.	.916	-.022	1.057
2	175.6	13.00	1044.	1.129	.039	.978
3	196.4	13.15	1566.	1.320	.104	.992
4	211.5	11.01	2088.	1.201	.062	1.026
5	213.9	10.12	2609.	1.185	.057	1.064
AGE 45-49						
1	91.1	11.18	549.	.910	-.023	1.000
2	82.3	7.48	1098.	.918	-.021	.982
3	89.6	6.46	1647.	.848	-.037	1.083
4	108.5	7.37	2196.	.992	-.002	1.119
5	123.7	6.66	2745.	.909	-.023	1.166

Table A2 (*cont.*)

KENYA ALL WOMEN COHORT RATES. URBAN DOMAIN

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	226.5	14.56	1618.	1.365	.044	1.025
2	215.3	9.35	3236.	1.308	.036	.989
3	212.2	8.49	4854.	1.347	.041	1.074
4	209.6	8.14	6472.	1.393	.048	1.155
5	196.7	7.39	8087.	1.396	.048	1.198
AGE 15-19						
1	145.6	13.19	397.	.720	****	1.035
2	109.1	10.94	794.	.942	****	1.050
3	96.3	9.42	1191.	.987	****	1.116
4	73.8	6.87	1588.	.956	****	1.095
5	62.3	6.16	1985.	1.013	****	1.121
AGE 20-24						
1	308.3	34.31	451.	1.530	****	1.031
2	279.2	18.91	902.	1.317	****	.961
3	258.8	14.86	1353.	1.238	****	1.008
4	254.4	14.51	1804.	1.309	****	1.081
5	229.8	12.30	2254.	1.261	****	1.101
AGE 25-29						
1	291.9	25.98	354.	1.053	****	1.021
2	307.8	20.90	708.	1.313	****	.918
3	320.4	20.11	1062.	1.422	****	.988
4	336.0	18.95	1416.	1.417	****	1.065
5	317.2	17.13	1769.	1.435	****	1.079
AGE 30-34						
1	245.9	31.45	179.	.946	****	1.033
2	239.7	21.77	358.	1.024	****	.942
3	249.8	20.54	537.	1.033	****	1.064
4	250.5	19.22	716.	1.136	****	1.045
5	257.3	16.88	895.	1.097	****	1.053
AGE 35-39						
1	142.0	32.71	113.	.992	****	1.004
2	155.1	36.78	226.	1.524	****	1.002
3	183.9	37.53	339.	1.657	****	1.076
4	184.3	29.88	452.	1.524	****	1.075
5	184.7	28.72	565.	1.607	****	1.094
AGE 40-44						
1	26.4	19.02	71.	.992	****	1.007
2	79.7	23.44	142.	.956	****	1.079
3	87.2	25.92	213.	1.298	****	1.033
4	98.5	26.61	284.	1.263	****	1.192
5	92.8	23.29	355.	1.163	****	1.300
AGE 45-49						
1	48.0	31.76	53.	1.071	****	1.010
2	43.8	20.93	106.	1.068	****	.986
3	31.3	14.35	159.	1.064	****	.976
4	33.4	17.13	212.	1.120	****	1.240
5	48.4	21.71	265.	1.089	****	1.512

Table A3 Nepal: age-specific and cohort-specific since marriage rates (total sample)

NEPAL AGE SPECIFIC RATES SINCE MARRIAGE. PERIOD	RATE	SE	EXPOSURE	TOTAL SAMPLE DEFT	ROH	BCF
ALL AGES						
1	227.5	12.13	5758.	2.130	.020	1.031
2	220.4	9.95	11330.	2.650	.030	.964
3	220.0	8.53	16705.	2.780	.030	.957
4	220.3	8.02	21898.	2.940	.031	.974
5	220.1	7.24	26816.	2.892	.028	.990
AGE 15-19						
1	203.4	17.13	780.	1.166	.015	1.019
2	201.7	15.44	1590.	1.603	.056	.957
3	204.3	13.46	2443.	1.734	.058	.952
4	202.7	13.04	3291.	1.949	.073	.955
5	208.1	11.09	4097.	1.820	.055	.961
AGE 20-24						
1	318.4	21.48	1226.	1.564	.040	1.032
2	309.6	13.66	2450.	1.598	.039	.915
3	308.3	9.51	3575.	1.427	.023	.863
4	305.7	8.10	4692.	1.413	.020	.852
5	303.2	7.63	5782.	1.475	.022	.856
AGE 25-29						
1	309.2	15.15	1131.	1.069	.004	1.031
2	297.0	12.26	2206.	1.382	.025	.912
3	298.0	9.55	3265.	1.347	.020	.886
4	299.5	8.72	4247.	1.405	.023	.883
5	296.5	7.52	5121.	1.333	.017	.884
AGE 30-34						
1	262.3	19.06	796.	1.151	.013	1.062
2	254.0	12.65	1574.	1.182	.014	.976
3	244.7	11.73	2281.	1.381	.031	.944
4	242.8	8.92	2968.	1.181	.012	.960
5	240.8	8.84	3694.	1.284	.018	.979
AGE 35-39						
1	183.6	21.54	759.	1.450	.047	1.057
2	165.9	12.47	1521.	1.301	.027	1.005
3	163.9	11.28	2304.	1.444	.038	1.013
4	163.0	11.38	3079.	1.665	.057	1.027
5	163.7	10.84	3807.	1.732	.061	1.044
AGE 40-44						
1	82.5	10.97	637.	1.004	.000	1.003
2	76.4	8.79	1213.	1.147	.014	1.005
3	82.1	8.42	1736.	1.266	.026	1.010
4	87.8	8.59	2254.	1.339	.031	1.076
5	82.7	7.31	2775.	1.302	.025	1.074
AGE 45-49						
1	29.5	8.66	400.	1.020	.004	1.003
2	34.4	9.47	666.	1.354	.074	.991
3	30.4	7.54	868.	1.310	.063	.988
4	29.3	6.36	979.	1.166	.032	1.012
5	29.5	6.40	1004.	1.187	.036	1.011

Table A3 (*cont.*)

NEPAL BIRTH COHORT RATES SINCE MARRIAGE. TOTAL SAMPLE

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	227.5	12.13	5770.	2.162	.026	1.017
2	220.4	9.95	11346.	2.727	.046	.938
3	220.0	8.53	16732.	2.833	.050	.940
4	220.3	8.02	21892.	2.899	.053	.988
5	220.1	7.24	26796.	2.798	.049	1.022
AGE 15-19						
1	160.0	16.21	609.	1.094	.013	.998
2	148.0	15.08	1091.	1.442	.068	.973
3	130.0	14.35	1464.	1.676	.115	.974
4	118.1	13.00	1738.	1.696	.119	.990
5	111.2	12.53	1909.	1.726	.125	1.009
AGE 20-24						
1	319.5	20.50	1196.	1.497	.044	1.016
2	300.7	14.33	2341.	1.736	.072	.871
3	291.5	10.24	3420.	1.584	.054	.832
4	277.3	10.30	4398.	1.758	.075	.868
5	270.8	9.39	5254.	1.725	.071	.888
AGE 25-29						
1	325.2	16.45	1140.	1.184	.015	1.001
2	306.8	10.95	2269.	1.338	.030	.845
3	309.1	9.17	3386.	1.428	.040	.809
4	310.4	7.61	4485.	1.335	.030	.825
5	307.7	6.58	5564.	1.256	.022	.847
AGE 30-34						
1	257.9	21.06	855.	1.357	.043	1.037
2	264.0	13.98	1710.	1.417	.052	.925
3	266.4	12.87	2564.	1.647	.088	.895
4	271.9	11.33	3415.	1.625	.085	.916
5	272.9	9.38	4258.	1.472	.060	.933
AGE 35-39						
1	214.2	20.44	736.	1.282	.039	1.054
2	207.4	15.24	1469.	1.492	.074	.966
3	210.4	13.56	2200.	1.613	.097	.967
4	213.7	11.18	2931.	1.492	.074	.990
5	216.3	10.12	3660.	1.465	.069	1.015
AGE 40-44						
1	94.0	12.92	719.	1.187	.024	1.000
2	102.5	9.74	1438.	1.237	.031	.984
3	111.1	8.12	2156.	1.206	.027	.995
4	123.2	8.36	2874.	1.277	.037	1.068
5	130.9	8.98	3589.	1.464	.067	1.090
AGE 45-49						
1	37.8	10.59	516.	1.260	.049	1.001
2	39.8	9.12	1030.	1.478	.099	1.013
3	44.9	7.60	1545.	1.373	.074	1.051
4	52.6	7.42	2060.	1.303	.059	1.158
5	53.6	6.40	2571.	1.272	.052	1.133

Table A4 Pakistan: age-specific and cohort-specific since marriage rates (total sample, rural domain and urban domain)

PAKISTAN AGE SPECIFIC RATES SINCE FIRST MARRIAGE, TOTAL SAMPLE

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	253.4	6.63	4802.	1.042	.005	1.014
2	239.0	4.58	9403.	1.085	.009	.960
3	242.6	4.02	13845.	1.126	.012	.980
4	249.0	3.82	18111.	1.184	.016	1.004
5	247.3	3.42	22073.	1.169	.015	1.008
AGE 15-19						
1	321.8	19.10	653.	1.028	****	1.016
2	314.9	11.21	1278.	.924	****	.934
3	314.6	9.34	1883.	.957	****	.912
4	308.9	8.44	2476.	.972	****	.935
5	309.0	7.03	3038.	.923	****	.909
AGE 20-24						
1	367.3	17.34	838.	1.037	****	1.004
2	342.0	9.90	1666.	.924	****	.922
3	341.0	9.13	2479.	1.050	****	.913
4	344.8	8.45	3342.	1.140	****	.902
5	337.3	7.48	4172.	1.138	****	.898
AGE 25-29						
1	339.7	17.23	947.	1.097	****	1.021
2	318.4	9.46	1878.	1.011	****	.870
3	320.2	8.34	2833.	1.061	****	.897
4	327.7	7.75	3694.	1.097	****	.915
5	326.8	6.53	4487.	1.049	****	.889
AGE 30-34						
1	272.4	16.95	763.	1.027	****	1.024
2	255.5	9.88	1508.	.963	****	.913
3	260.3	8.76	2165.	1.023	****	.908
4	266.6	8.68	2823.	1.110	****	.940
5	257.0	7.48	3432.	1.040	****	.964
AGE 35-39						
1	198.3	18.35	601.	1.111	****	1.015
2	170.9	11.63	1184.	1.052	****	1.011
3	176.7	9.69	1805.	1.094	****	.987
4	184.7	8.83	2397.	1.114	****	1.000
5	179.9	7.78	3001.	1.091	****	1.017
AGE 40-44						
1	66.1	10.69	604.	1.055	****	1.002
2	61.8	7.36	1190.	1.029	****	1.025
3	60.2	6.76	1740.	1.115	****	1.063
4	64.8	6.59	2277.	1.171	****	1.091
5	64.7	5.83	2764.	1.166	****	1.069
AGE 45-49						
1	5.6	4.11	338.	1.011	****	1.001
2	6.5	3.37	587.	1.022	****	.996
3	6.7	3.06	752.	1.038	****	.994
4	10.4	3.05	829.	.877	****	.987
5	10.4	3.05	829.	.877	****	.987

Table A4 (*cont.*)

PAKISTAN AGE SPECIFIC RATES SINCE FIRST MARRIAGE. RURAL DOMAIN

	PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES							
	1	254.2	8.15	2978.	1.010	.001	1.011
	2	236.7	5.68	5843.	1.073	.008	.952
	3	239.3	4.91	8599.	1.106	.010	.965
	4	244.5	4.79	11242.	1.192	.017	.991
	5	243.1	4.29	13697.	1.179	.015	.993
AGE 15-19							
	1	318.8	22.63	427.	.986	****	1.017
	2	312.0	12.91	840.	.871	****	.927
	3	305.8	10.95	1239.	.927	****	.902
	4	298.2	9.96	1627.	.937	****	.937
	5	298.9	8.21	1991.	.880	****	.909
AGE 20-24							
	1	359.3	20.34	523.	.968	****	1.002
	2	328.3	11.58	1039.	.877	****	.906
	3	328.0	10.54	1537.	.986	****	.893
	4	333.9	10.27	2058.	1.118	****	.884
	5	327.6	8.96	2558.	1.100	****	.878
AGE 25-29							
	1	332.5	21.68	568.	1.090	****	1.007
	2	314.6	11.58	1125.	.983	****	.851
	3	311.9	9.89	1699.	1.014	****	.868
	4	317.8	9.40	2218.	1.055	****	.901
	5	320.8	7.96	2700.	1.016	****	.872
AGE 30-34							
	1	277.1	21.40	462.	.998	****	1.030
	2	255.8	12.10	919.	.908	****	.926
	3	265.5	10.91	1318.	.993	****	.903
	4	267.6	10.78	1719.	1.084	****	.931
	5	256.0	9.35	2090.	1.017	****	.963
AGE 35-39							
	1	222.8	23.76	368.	1.076	****	1.018
	2	178.2	14.64	730.	1.019	****	1.014
	3	182.6	12.08	1117.	1.066	****	.980
	4	189.3	10.92	1490.	1.094	****	.984
	5	183.1	9.41	1873.	1.066	****	.988
AGE 40-44							
	1	72.1	13.45	389.	1.022	****	1.003
	2	65.9	9.19	758.	.996	****	1.024
	3	62.7	8.44	1101.	1.074	****	1.076
	4	66.9	8.18	1434.	1.124	****	1.103
	5	66.3	7.23	1735.	1.133	****	1.068
AGE 45-49							
	1	4.9	4.93	202.	.997	****	1.004
	2	5.7	4.07	351.	1.014	****	1.000
	3	6.7	3.85	450.	1.008	****	.995
	4	12.1	3.91	495.	.808	****	.983
	5	12.1	3.91	495.	.808	****	.983

Table A4 (*cont.*)

PAKISTAN AGE SPECIFIC RATES SINCE FIRST MARRIAGE, URBAN DOMAIN

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	251.3	10.50	1826.	1.014	.002	1.020
2	245.5	6.99	3564.	.989	-.001	.980
3	252.1	6.63	5224.	1.079	.007	1.023
4	262.0	5.46	6825.	.989	-.001	1.037
5	259.2	4.81	8326.	.960	-.003	1.043
AGE 15-19						
1	331.9	33.85	226.	1.069	****	1.011
2	324.6	22.44	431.	1.041	****	.956
3	345.2	17.37	626.	.967	****	.945
4	346.3	15.96	823.	1.035	****	.930
5	343.7	12.88	1018.	.958	****	.903
AGE 20-24						
1	390.9	32.58	312.	1.165	****	1.012
2	382.8	18.64	617.	.994	****	.958
3	379.2	18.05	926.	1.179	****	.960
4	376.1	13.62	1260.	1.057	****	.944
5	364.6	13.08	1593.	1.148	****	.945
AGE 25-29						
1	359.0	25.40	376.	.972	****	1.056
2	328.4	15.79	758.	1.007	****	.919
3	342.0	15.22	1131.	1.118	****	.965
4	354.0	12.88	1472.	1.098	****	.941
5	343.0	10.87	1778.	1.040	****	.928
AGE 30-34						
1	259.8	24.72	304.	.973	****	1.010
2	254.7	16.25	585.	1.024	****	.881
3	245.7	13.14	842.	.958	****	.925
4	263.6	13.33	1093.	1.038	****	.963
5	259.9	11.20	1328.	.958	****	.971
AGE 35-39						
1	131.2	20.12	236.	.911	****	1.005
2	150.7	16.23	464.	.976	****	1.002
3	160.0	13.87	694.	.985	****	1.012
4	171.6	13.31	915.	1.015	****	1.052
5	170.6	13.01	1131.	1.054	****	1.104
AGE 40-44						
1	46.9	12.85	213.	.885	****	1.004
2	48.7	9.69	431.	.905	****	1.032
3	53.0	9.38	642.	1.040	****	1.020
4	58.2	9.72	842.	1.138	****	1.058
5	60.0	8.72	1033.	1.096	****	1.076
AGE 45-49						
1	7.4	7.43	136.	1.009	****	1.004
2	8.5	5.92	235.	.989	****	1.000
3	6.6	4.57	302.	.982	****	.996
4	6.0	4.11	335.	.981	****	.997
5	6.0	4.11	335.	.981	****	.997

Table A4 (*cont.*)

PAKISTAN BIRTH COHORT RATES SINCE FIRST MARRIAGE. TOTAL SAMPLE

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	253.4	6.63	4808.	1.046	.006	1.010
2	239.0	4.58	9419.	1.104	.015	.944
3	242.6	4.02	13849.	1.131	.019	.976
4	249.0	3.82	18101.	1.155	.023	1.029
5	247.3	3.42	22061.	1.108	.016	1.063
AGE 15-19						
1	290.0	19.98	494.	.975	****	1.004
2	269.6	12.57	857.	.941	****	.881
3	263.5	11.29	1115.	.955	****	.896
4	247.9	10.43	1275.	.952	****	.906
5	239.3	10.27	1354.	.974	****	.909
AGE 20-24						
1	358.8	17.26	816.	1.019	****	1.009
2	345.3	11.68	1595.	1.071	****	.916
3	343.4	8.51	2322.	.979	****	.882
4	334.6	8.69	2990.	1.101	****	.915
5	330.5	7.27	3559.	1.023	****	.901
AGE 25-29						
1	360.7	18.85	917.	1.181	****	1.006
2	331.9	10.23	1821.	1.094	****	.847
3	330.1	8.63	2709.	1.121	****	.852
4	340.6	8.19	3581.	1.185	****	.873
5	334.3	7.66	4417.	1.203	****	.897
AGE 30-34						
1	301.6	17.20	821.	1.047	****	1.026
2	287.5	9.51	1642.	.972	****	.876
3	297.5	8.56	2461.	1.041	****	.892
4	307.6	7.89	3276.	1.040	****	.941
5	310.5	6.56	4063.	.974	****	.928
AGE 35-39						
1	207.1	18.45	626.	1.138	****	1.001
2	202.1	12.38	1251.	1.129	****	.966
3	214.9	10.96	1875.	1.192	****	.969
4	233.5	10.40	2500.	1.224	****	1.004
5	229.4	8.81	3107.	1.114	****	1.048
AGE 40-44						
1	115.4	15.55	614.	1.183	****	1.019
2	107.8	10.40	1228.	1.178	****	.997
3	117.7	8.35	1842.	1.114	****	.998
4	134.4	8.22	2456.	1.136	****	1.051
5	139.6	7.41	3056.	1.088	****	1.086
AGE 45-49						
1	7.5	3.86	505.	1.007	****	1.001
2	9.5	3.14	1010.	1.034	****	.995
3	18.1	3.92	1515.	1.071	****	1.069
4	28.6	4.48	2020.	1.102	****	1.096
5	35.6	4.25	2512.	1.093	****	1.052

Table A4 (*cont.*)

PAKISTAN BIRTH COHORT RATES SINCE FIRST MARRIAGE. RURAL DOMAIN

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	254.2	8.15	2978.	1.013	.002	1.008
2	236.7	5.68	5843.	1.090	.013	.937
3	239.3	4.91	8599.	1.118	.017	.955
4	244.5	4.79	11242.	1.167	.024	1.013
5	243.1	4.29	13697.	1.123	.018	1.042
AGE 15-19						
1	287.5	22.99	327.	.910	****	1.009
2	267.4	14.58	572.	.891	****	.884
3	258.9	13.20	749.	.920	****	.897
4	243.0	12.26	860.	.912	****	.919
5	234.2	12.03	914.	.930	****	.923
AGE 20-24						
1	349.0	20.25	510.	.951	****	1.009
2	332.4	13.87	1002.	1.021	****	.913
3	332.3	9.71	1466.	.917	****	.861
4	320.5	10.32	1894.	1.069	****	.900
5	317.5	8.41	2258.	.972	****	.883
AGE 25-29						
1	359.5	24.43	545.	1.188	****	1.001
2	332.1	13.02	1084.	1.104	****	.825
3	323.9	10.64	1615.	1.127	****	.811
4	336.1	10.53	2136.	1.220	****	.844
5	329.6	9.61	2636.	1.210	****	.867
AGE 30-34						
1	306.0	21.44	503.	1.024	****	1.019
2	285.2	11.45	1006.	.918	****	.876
3	294.4	10.33	1508.	1.006	****	.875
4	299.4	9.47	2007.	.994	****	.932
5	306.2	7.99	2489.	.947	****	.913
AGE 35-39						
1	219.4	23.69	383.	1.119	****	1.001
2	205.3	15.61	765.	1.105	****	.967
3	219.7	13.75	1147.	1.175	****	.957
4	236.8	13.30	1529.	1.234	****	.991
5	230.0	11.20	1900.	1.110	****	1.045
AGE 40-44						
1	125.0	19.51	392.	1.140	****	1.025
2	113.5	12.74	784.	1.138	****	.988
3	120.8	10.24	1176.	1.087	****	.991
4	137.8	10.06	1568.	1.111	****	1.040
5	142.0	8.91	1951.	1.061	****	1.063
AGE 45-49						
1	6.5	4.55	309.	.995	****	1.003
2	6.5	3.24	618.	1.008	****	.997
3	17.3	4.80	927.	1.015	****	1.106
4	28.3	5.52	1236.	1.063	****	1.101
5	35.1	5.25	1537.	1.091	****	1.024

Table A4 (*cont.*)

PAKISTAN BIRTH COHORT RATES SINCE FIRST MARRIAGE. URBAN DOMAIN

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	251.3	10.50	1826.	1.018	.003	1.016
2	245.5	6.99	3564.	1.006	.001	.964
3	252.1	6.63	5224.	1.070	.010	1.031
4	262.0	5.46	6825.	.956	-.006	1.073
5	259.2	4.81	8326.	.901	-.013	1.112
AGE 15-19						
1	298.8	40.14	167.	1.143	****	.992
2	277.4	24.32	281.	1.044	****	.872
3	280.8	20.78	356.	.978	****	.892
4	266.2	18.60	402.	.985	****	.857
5	258.6	18.69	425.	1.031	****	.854
AGE 20-24						
1	388.1	32.67	301.	1.154	****	1.009
2	384.6	20.97	580.	1.131	****	.918
3	378.0	17.56	831.	1.117	****	.934
4	378.9	15.34	1058.	1.098	****	.937
5	371.7	13.67	1254.	1.076	****	.931
AGE 25-29						
1	363.7	24.00	371.	.939	****	1.024
2	331.5	14.52	736.	.924	****	.906
3	346.4	13.98	1091.	1.026	****	.946
4	352.2	10.67	1440.	.902	****	.940
5	346.4	11.50	1773.	1.049	****	.970
AGE 30-34						
1	289.3	26.13	318.	.982	****	1.046
2	294.0	16.65	636.	1.052	****	.876
3	306.1	14.83	954.	1.059	****	.939
4	330.3	13.92	1271.	1.101	****	.959
5	322.6	10.93	1578.	.962	****	.965
AGE 35-39						
1	172.8	22.70	243.	.934	****	1.002
2	193.4	17.17	486.	.998	****	.960
3	201.7	15.46	729.	1.035	****	1.005
4	224.3	13.20	972.	.948	****	1.041
5	227.9	11.85	1207.	.925	****	1.061
AGE 40-44						
1	85.6	18.93	222.	1.006	****	1.002
2	90.1	15.08	444.	1.073	****	1.034
3	108.1	12.30	666.	1.001	****	1.021
4	123.9	12.35	888.	1.027	****	1.088
5	132.2	12.37	1105.	1.045	****	1.162
AGE 45-49						
1	10.2	7.36	196.	1.022	****	1.003
2	17.9	7.71	392.	1.161	****	.993
3	20.4	6.45	588.	1.127	****	.981
4	29.3	7.15	784.	1.090	****	1.088
5	36.9	6.73	975.	.992	****	1.124

Table A5 Sri Lanka: age-specific and cohort-specific within marriage rates (total sample, rural domain and urban domain)

SRI LANKA AGE SPECIFIC WITHIN MARRIAGE RATES. TOTAL SAMPLE

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	200.4	5.94	6105.	1.129	.024	1.027
2	192.2	4.08	12047.	1.161	.026	.979
3	197.8	3.43	17772.	1.162	.023	.988
4	202.6	3.20	23239.	1.199	.025	1.012
5	204.6	2.97	28481.	1.214	.025	1.024
AGE 15-19						
1	415.3	34.87	243.	1.065	****	1.035
2	375.6	18.97	509.	1.023	****	.864
3	365.5	16.17	811.	1.151	****	.831
4	347.4	13.40	1142.	1.125	****	.845
5	358.9	11.75	1520.	1.153	****	.828
AGE 20-24						
1	364.6	17.66	980.	1.099	****	1.045
2	355.2	10.05	1971.	1.060	****	.879
3	353.0	7.90	2949.	1.055	****	.851
4	351.7	6.60	3942.	1.032	****	.841
5	348.6	6.37	4895.	1.110	****	.843
AGE 25-29						
1	306.3	15.19	1281.	1.144	****	1.031
2	277.3	10.00	2515.	1.186	****	.944
3	281.8	7.76	3662.	1.133	****	.921
4	290.5	7.15	4790.	1.183	****	.921
5	286.8	6.42	5890.	1.176	****	.926
AGE 30-34						
1	211.1	16.24	1121.	1.286	****	1.036
2	197.6	10.70	2230.	1.312	****	.967
3	209.5	8.04	3319.	1.186	****	.960
4	208.8	7.30	4352.	1.217	****	.974
5	207.9	6.13	5377.	1.129	****	.981
AGE 35-39						
1	117.7	10.85	1021.	1.047	****	1.028
2	127.8	8.08	2009.	1.106	****	.981
3	131.1	6.98	2976.	1.165	****	.968
4	137.0	6.50	3911.	1.186	****	.997
5	134.7	5.72	4750.	1.134	****	1.018
AGE 40-44						
1	57.1	8.82	811.	1.081	****	1.001
2	46.9	5.69	1629.	1.072	****	1.013
3	46.9	4.84	2461.	1.111	****	1.022
4	46.7	4.24	3285.	1.087	****	1.060
5	51.5	4.04	4142.	1.124	****	1.047
AGE 45-49						
1	14.2	5.27	634.	1.122	****	1.000
2	13.2	4.37	1129.	1.175	****	1.097
3	15.3	4.51	1496.	1.201	****	1.183
4	15.6	4.17	1684.	1.191	****	1.160
5	15.1	4.04	1734.	1.190	****	1.158

Table A5 (*cont.*)

SRI LANKA AGE SPECIFIC WITHIN MARRIAGE RATES. RURAL DOMAIN

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	209.2	6.91	4548.	1.114	.020	1.029
2	198.5	4.67	8955.	1.135	.021	.976
3	202.9	3.89	13217.	1.131	.018	.983
4	205.7	3.61	17277.	1.169	.020	1.004
5	206.9	3.39	21180.	1.199	.023	1.016
AGE 15-19						
1	413.6	38.21	198.	1.049	****	1.040
2	379.4	20.59	418.	1.004	****	.864
3	369.2	17.46	660.	1.110	****	.838
4	345.7	14.74	922.	1.097	****	.858
5	353.6	12.94	1218.	1.126	****	.839
AGE 20-24						
1	367.4	19.63	730.	1.045	****	1.053
2	353.4	11.28	1462.	1.025	****	.880
3	347.8	8.93	2184.	1.029	****	.852
4	345.7	7.48	2928.	1.028	****	.828
5	343.4	7.32	3630.	1.126	****	.825
AGE 25-29						
1	316.2	17.73	933.	1.127	****	1.034
2	281.5	11.65	1826.	1.172	****	.945
3	284.2	9.00	2681.	1.123	****	.920
4	290.9	8.41	3499.	1.195	****	.917
5	286.0	7.46	4309.	1.177	****	.921
AGE 30-34						
1	225.0	19.55	812.	1.282	****	1.040
2	213.2	12.96	1612.	1.315	****	.966
3	226.7	9.51	2401.	1.174	****	.948
4	219.7	8.60	3151.	1.209	****	.964
5	216.9	7.35	3911.	1.143	****	.976
AGE 35-39						
1	132.7	12.55	781.	1.004	****	1.030
2	135.4	9.15	1534.	1.069	****	.980
3	137.1	7.90	2265.	1.134	****	.964
4	143.2	7.47	2965.	1.171	****	.992
5	140.1	6.60	3609.	1.122	****	1.018
AGE 40-44						
1	65.2	10.37	618.	1.043	****	1.001
2	54.6	6.74	1227.	1.027	****	1.012
3	52.5	5.59	1845.	1.054	****	1.021
4	51.9	4.94	2460.	1.038	****	1.064
5	56.5	4.65	3088.	1.065	****	1.051
AGE 45-49						
1	17.5	6.49	465.	1.066	****	1.001
2	16.2	5.37	827.	1.115	****	1.099
3	18.4	5.48	1101.	1.142	****	1.186
4	18.7	5.06	1241.	1.134	****	1.160
5	18.2	4.91	1278.	1.133	****	1.160

Table A5 (*cont.*)

SRI LANKA AGE SPECIFIC WITHIN MARRIAGE RATES. URBAN DOMAIN

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	160.8	9.88	1557.	1.047	.009	1.014
2	163.8	7.79	3093.	1.179	.032	.993
3	174.9	6.95	4553.	1.223	.035	1.009
4	188.3	6.83	5963.	1.283	.040	1.052
5	194.0	5.82	7275.	1.180	.023	1.064
AGE 15-19						
1	426.6	80.34	44.	1.064	****	1.009
2	349.2	46.88	88.	1.050	****	.876
3	341.1	42.31	144.	1.355	****	.790
4	358.1	30.38	211.	1.200	****	.767
5	391.3	27.10	292.	1.251	****	.758
AGE 20-24						
1	352.7	40.52	248.	1.322	****	1.009
2	363.0	21.79	513.	1.178	****	.871
3	376.0	16.30	769.	1.107	****	.843
4	378.6	12.69	1024.	.946	****	.885
5	372.1	11.52	1262.	.932	****	.908
AGE 25-29						
1	261.8	25.33	342.	1.044	****	1.021
2	258.5	17.02	680.	1.069	****	.948
3	271.2	13.26	970.	1.005	****	.924
4	288.4	10.71	1262.	.887	****	.947
5	290.0	11.04	1541.	1.004	****	.951
AGE 30-34						
1	156.8	22.35	314.	1.068	****	1.020
2	135.8	12.77	622.	.963	****	.965
3	142.4	11.82	937.	1.054	****	.982
4	165.9	11.89	1228.	1.122	****	.998
5	171.2	8.02	1490.	.828	****	.993
AGE 35-39						
1	43.2	13.72	240.	1.039	****	1.007
2	89.8	15.14	474.	1.171	****	.985
3	100.8	13.24	704.	1.174	****	.994
4	106.1	10.35	938.	1.015	****	1.014
5	107.8	8.84	1138.	.941	****	1.022
AGE 40-44						
1	15.9	8.08	192.	.895	****	1.001
2	9.2	4.22	399.	.879	****	1.004
3	20.4	7.31	611.	1.295	****	.987
4	21.9	5.93	825.	1.188	****	.979
5	27.8	6.50	1054.	1.295	****	.992
AGE 45-49						
1	.0	.00	171.	.000	****	.000
2	.0	.00	304.	.000	****	.000
3	1.5	1.50	393.	.768	****	1.000
4	1.3	1.34	441.	.768	****	1.005
5	1.3	1.30	453.	.768	****	1.000

Table A5 (*cont.*)

SRI LANKA BIRTH COHORT WITHIN MARRIAGE RATES. TOTAL SAMPLE

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	200.4	5.94	6100.	1.139	.032	1.018
2	192.2	4.08	12022.	1.178	.041	.964
3	197.8	3.43	17742.	1.161	.036	.988
4	202.6	3.20	23259.	1.174	.039	1.034
5	204.6	2.97	28543.	1.153	.034	1.079
AGE 15-19						
1	412.7	43.04	164.	1.124	****	.996
2	385.3	27.48	267.	1.120	****	.824
3	367.3	22.74	327.	1.147	****	.743
4	358.3	20.99	358.	1.137	****	.728
5	350.1	20.56	372.	1.134	****	.733
AGE 20-24						
1	371.3	17.71	891.	1.089	****	1.005
2	366.2	10.40	1654.	1.061	****	.827
3	365.0	8.82	2298.	1.083	****	.811
4	360.0	7.65	2838.	1.071	****	.793
5	364.7	7.14	3260.	1.069	****	.792
AGE 25-29						
1	318.9	16.22	1271.	1.209	****	1.026
2	298.3	10.48	2477.	1.270	****	.898
3	310.2	8.00	3598.	1.217	****	.852
4	317.2	6.63	4645.	1.128	****	.861
5	321.6	5.95	5609.	1.125	****	.848
AGE 30-34						
1	228.7	16.11	1115.	1.251	****	1.024
2	214.1	9.99	2224.	1.241	****	.925
3	229.8	8.00	3328.	1.178	****	.931
4	243.7	7.24	4409.	1.190	****	.941
5	245.7	6.67	5458.	1.175	****	.974
AGE 35-39						
1	133.4	12.26	1032.	1.130	****	1.025
2	154.9	8.59	2076.	1.110	****	.975
3	165.8	7.17	3126.	1.126	****	.957
4	174.3	6.51	4176.	1.115	****	.995
5	180.4	5.81	5215.	1.055	****	1.034
AGE 40-44						
1	66.8	9.34	815.	1.068	****	1.000
2	60.4	6.74	1651.	1.140	****	1.009
3	68.1	6.18	2495.	1.208	****	1.015
4	84.3	6.15	3355.	1.201	****	1.068
5	90.8	5.84	4210.	1.184	****	1.114
AGE 45-49						
1	13.9	4.63	796.	1.115	****	1.001
2	16.6	3.72	1613.	1.115	****	1.050
3	22.5	3.64	2451.	1.130	****	1.075
4	25.3	3.40	3285.	1.105	****	1.123
5	32.5	3.63	4136.	1.150	****	1.145

Table A5 (*cont.*)

SRI LANKA BIRTH COHORT WITHIN MARRIAGE RATES. RURAL DOMAIN

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	209.2	6.91	4535.	1.124	.027	1.018
2	198.5	4.67	8938.	1.155	.034	.958
3	202.9	3.89	13196.	1.134	.029	.980
4	205.7	3.61	17312.	1.146	.031	1.025
5	206.9	3.39	21254.	1.139	.030	1.071
AGE 15-19						
1	425.5	48.47	129.	1.114	****	1.000
2	385.8	30.85	212.	1.109	****	.832
3	366.6	25.71	258.	1.145	****	.749
4	355.3	23.85	282.	1.121	****	.746
5	348.3	23.45	291.	1.116	****	.753
AGE 20-24						
1	371.3	19.58	686.	1.055	****	1.006
2	364.5	11.42	1277.	1.028	****	.825
3	362.8	9.66	1775.	1.053	****	.804
4	354.1	8.59	2201.	1.074	****	.785
5	358.5	7.88	2532.	1.061	****	.779
AGE 25-29						
1	329.1	18.97	914.	1.183	****	1.032
2	301.2	12.24	1785.	1.261	****	.894
3	310.7	9.41	2600.	1.222	****	.848
4	316.7	7.74	3358.	1.137	****	.848
5	320.1	7.01	4058.	1.149	****	.833
AGE 30-34						
1	243.7	19.33	802.	1.247	****	1.022
2	229.2	11.93	1598.	1.236	****	.918
3	242.7	9.35	2395.	1.161	****	.919
4	252.3	8.35	3178.	1.163	****	.932
5	252.3	7.80	3936.	1.167	****	.965
AGE 35-39						
1	147.8	14.04	783.	1.078	****	1.027
2	164.7	9.85	1576.	1.089	****	.968
3	174.8	8.16	2372.	1.101	****	.950
4	179.9	7.50	3168.	1.114	****	.986
5	185.0	6.74	3956.	1.053	****	1.037
AGE 40-44						
1	76.1	11.00	616.	1.029	****	1.001
2	68.8	7.95	1248.	1.102	****	1.007
3	75.7	7.20	1888.	1.167	****	1.013
4	92.4	7.13	2540.	1.165	****	1.065
5	96.7	6.67	3189.	1.140	****	1.118
AGE 45-49						
1	16.9	5.64	592.	1.062	****	1.001
2	19.9	4.51	1195.	1.062	****	1.052
3	25.1	4.26	1811.	1.072	****	1.081
4	28.0	4.02	2431.	1.058	****	1.135
5	36.3	4.27	3062.	1.097	****	1.151

Table A5 (*cont.*)

SRI LANKA BIRTH COHORT WITHIN MARRIAGE RATES. URBAN DOMAIN

PERIOD	RATE	SE	EXPOSURE	DEFT	ROH	BCF
ALL AGES						
1	160.8	9.88	1561.	1.053	.013	1.009
2	163.8	7.79	3074.	1.182	.045	.987
3	174.9	6.95	4533.	1.205	.051	1.022
4	188.3	6.83	5923.	1.244	.061	1.081
5	194.0	5.82	7256.	1.119	.028	1.120
AGE 15-19						
1	334.0	72.98	34.	.914	****	.985
2	381.5	50.15	54.	.965	****	.787
3	371.4	37.44	67.	.883	****	.720
4	376.4	31.49	75.	.923	****	.610
5	360.0	31.98	81.	.975	****	.613
AGE 20-24						
1	371.3	41.46	204.	1.221	****	1.003
2	374.9	24.89	372.	1.182	****	.839
3	376.5	21.43	513.	1.192	****	.841
4	390.4	15.64	623.	.972	****	.824
5	397.1	16.24	709.	1.063	****	.831
AGE 25-29						
1	277.1	28.79	355.	1.213	****	.999
2	286.5	18.28	689.	1.163	****	.912
3	307.9	12.94	991.	1.016	****	.869
4	319.4	11.32	1274.	.949	****	.913
5	327.7	9.21	1536.	.848	****	.907
AGE 30-34						
1	168.9	22.82	313.	1.046	****	1.030
2	154.1	14.40	626.	1.051	****	.950
3	177.9	13.54	934.	1.118	****	.968
4	208.8	14.00	1228.	1.245	****	.970
5	219.0	11.51	1518.	1.083	****	1.001
AGE 35-39						
1	64.3	19.52	248.	1.247	****	1.005
2	108.3	14.08	499.	1.015	****	.998
3	122.8	12.83	754.	1.093	****	.982
4	147.3	10.77	1011.	.937	****	1.031
5	158.2	9.30	1262.	.888	****	1.019
AGE 40-44						
1	19.2	8.75	199.	.898	****	1.003
2	17.3	4.97	402.	.770	****	.993
3	28.9	6.95	607.	1.050	****	.973
4	42.6	7.87	815.	1.078	****	1.033
5	61.2	10.21	1023.	1.307	****	1.043
AGE 45-49						
1	.0	.00	204.	.000	****	.000
2	1.4	1.42	418.	.769	****	1.002
3	10.8	5.54	639.	1.369	****	.991
4	12.8	4.66	853.	1.229	****	.984
5	14.9	4.72	1068.	1.230	****	1.034