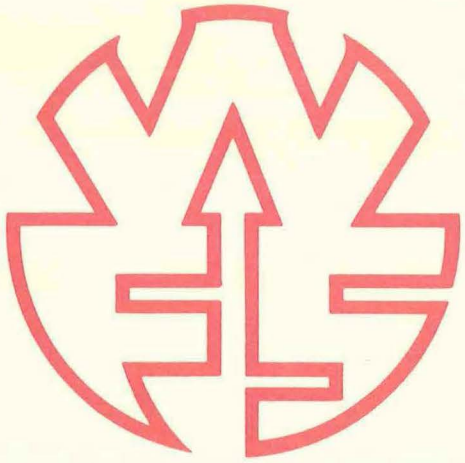

COMPARATIVE STUDIES

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Cohort Nuptiality in Asia and the Pacific: An Analysis of WFS Surveys

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The World Fertility Survey (WFS) 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 co-operation 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. Substantial support is also provided by the UK Overseas Development Administration.

For information on Country Reports, WFS publications, and WFS depository libraries, write to the Publications Office, International Statistical Institute, 428 Prinses Beatrixlaan, PO Box 950, 2270 AZ Voorburg, Netherlands. For information on the WFS generally, write to the Information Office, World Fertility Survey, International Statistical Institute, 35-37 Grosvenor Gardens, London SW1W 0BS, UK.

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L'EMF est entreprise, en collaboration avec les Nations Unies, par l'Institut International de Statistique, qui coopère avec l'Union internationale pour l'étude scientifique de la population. Le financement de ce programme est essentiellement assuré par le Fonds des Nations Unies pour les activités en matière de population et par l'Agence des Etats-Unis pour le développement international. Une contribution importante est aussi faite par le Département pour le développement des pays d'outre-mer du Royaume-Uni.

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El proyecto está a cargo del Instituto Internacional de Estadística, contando con la colaboración de las Naciones Unidas y en cooperación con la Unión Internacional para el Estudio Científico de la Población. Es financiado principalmente por el Fondo de las Naciones Unidas para Actividades de Población y por la Agencia para el Desarrollo Internacional de los Estados Unidos. La Oficina Británica para el Desarrollo de Países Extranjeros proporciona también un gran apoyo financiero.

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COMPARATIVE STUDIES

Cohort Nuptiality in Asia and the Pacific: An Analysis of WFS Surveys

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Preface

One of the main objectives of the WFS programme is the collection and dissemination of internationally comparable data on fertility. An increasing number of institutions and research workers at international and national levels are engaged in cross-national comparative analysis of the wealth of data obtained from WFS surveys. The secretariat itself undertakes a certain amount of comparative analysis, as represented, for instance, by the cross-national summaries subseries of the *WFS Comparative Studies* series. The present report is an example of work done by others.

In addition to the intrinsic interest and importance of the subject of nuptiality itself, the present study has a number of welcome features for WFS. It is regional in character and is appropriately sponsored by the East-West Center, Honolulu, which has a long tradition of collaboration with countries in Asia and the Pacific. In addition to WFS data, it uses relevant census information for the past 30 years and provides a useful example of how data from different sources can be brought to bear in research of this kind. Further, it follows a methodology elaborated within WFS (*WFS Technical Bulletins no 7*), uses software developed at WFS (NUPTIAL) and follows the approach outlined in one of our Illustrative Analyses (*WFS Scientific Reports no 13*).

For these reasons, the WFS is grateful to the authors and to the East-West Center for the opportunity to publish the results of their research.

HALVOR GILLE
Project Director

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1 Introduction

The countries of Asia and the Pacific are very diverse with respect to the ages when marriage typically occurs (Blayo 1978; P.C. Smith 1980, 1982), yet they have uniformly high percentages of men and women who marry eventually. In recent years the female age at marriage has varied from an average of 17 years or below in such countries as Bangladesh, India and Nepal, to above 23 years in Sri Lanka, Republic of Korea, Philippines and much of the Pacific. The male age at marriage has also varied considerably across countries. Yet, among these countries, only the Philippines has had less than 95 per cent of all men and women entering marriage at least once.

The wide range observed on the timing of marriage is all the more notable considering that the age at marriage has risen recently in all the countries and that there has been some convergence on marriage timing (D.P. Smith 1980; see also figure 1). The south-east Asian societies have moved toward a common pattern, and as a group they have shifted toward the East Asian late-marriage level. The South Asian subcontinent has lagged, but even there change has begun to occur. The existence of an upward trend throughout the region may indicate a growing similarity among these populations with regard to family organization, in the manner suggested nearly two decades ago by William Goode (1963), but this sweeping conclusion will not be warranted until we have much additional understanding of the causes of the observed changes.

It is widely recognized that the facts just cited must, in some way, reflect both the important and persistent cultural variations with the region and the pervasive social and economic changes that have occurred in recent years. The region's underlying socio-economic diversities are indicated by data from the ten World Fertility Survey (WFS) rounds conducted in Asia and the Pacific over the past few years (table 1). All the world's major religious traditions are represented by these countries, as are divergent systems of kinship, property devolution, and the like. Levels of economic development also vary widely. *Per capita* GNP in Fiji, Korea and Malaysia is many times the levels in Bangladesh, Sri Lanka and Pakistan. As table 1 indicates, there are also substantial differentials in economic structure as indexed by the percentage of the working population employed outside of agriculture and the percentage living in urban areas. Social characteristics are equally variable: female literacy ranges from a negligible level in Nepal and Pakistan to nearly universal literacy in the Philippines; infant mortality in Bangladesh is four times that in Korea; life expectancy ranges over nearly 30 years, from 40 to 70.

Thus, the Asian and Pacific region presents a picture of widely divergent patterns of marriage timing, along with a homogeneous pattern of universal marriage; some convergence is evident in marriage patterns over time, yet substantial differentials do persist. The major goal of the present analysis is to offer a description of levels and trends in marriage timing in ten Asian and Pacific countries on the basis of their recent WFS surveys. We present cohort nuptiality parameters based on an age model of the marriage process. These survey-based cohort estimates are compared with other kinds of survey estimate, as well as with estimates based on the censuses. We also look into the consistency and plausibility of the estimates for each country, focusing on possible distortions due to reporting errors either in current age or age at marriage. Finally, we discuss briefly the future course of nuptiality in the region on the basis of projections of the completed experience of the cohorts that were part of the way through the marriage process at the time of the surveys. Disaggregation of national populations into socio-economic subgroups and a multivariate analysis of socio-economic differentials is also being undertaken at present.

1.1 DATA

Cross-national comparisons of important demographic processes have been facilitated greatly by the WFS surveys carried out in the 1970s throughout the developing world. Within practical limits, the conceptual and the procedural consistency that has been realized across the national surveys minimizes extraneous sources of variation and allows researchers to focus on genuine substantive differences and their causes. Moreover, with their common format and coding the World Fertility Survey data sets have stimulated the development of analytic methodologies and accompanying computer software. In this report, for example, we employ the ten WFS surveys for Asia and the Pacific and software developed by the WFS organization specifically for the WFS data files to examine recent nuptiality levels and trends in the Asian and Pacific region.

The WFS household schedule provides the marital status distribution of the household population by age and sex. These data are largely comparable across countries since most used the recommended two question format: 'Has (he/she) ever been married?' and, if yes, 'Is (he/she) now married, widowed, divorced or separated?'. Of the ten countries covered in this report, only the Philippines deviated by omitting the first of the two questions. In Korea and Nepal the minimum age for these questions was 15; it was 12 years in Sri Lanka and Thailand, ten years in Pakistan, Philippines and Indonesia, and eight years in Bangladesh. In Fiji and Malaysia no minimum age was employed. Coding of marital status was uniform except that the Sri Lanka and Bangladesh surveys distinguished 'married, not consummated'.

The WFS individual survey provides a full marriage history, including the number of marriages and the starting and ending dates of each. Of the ten Asian and Pacific countries, only Nepal failed to obtain complete marriage

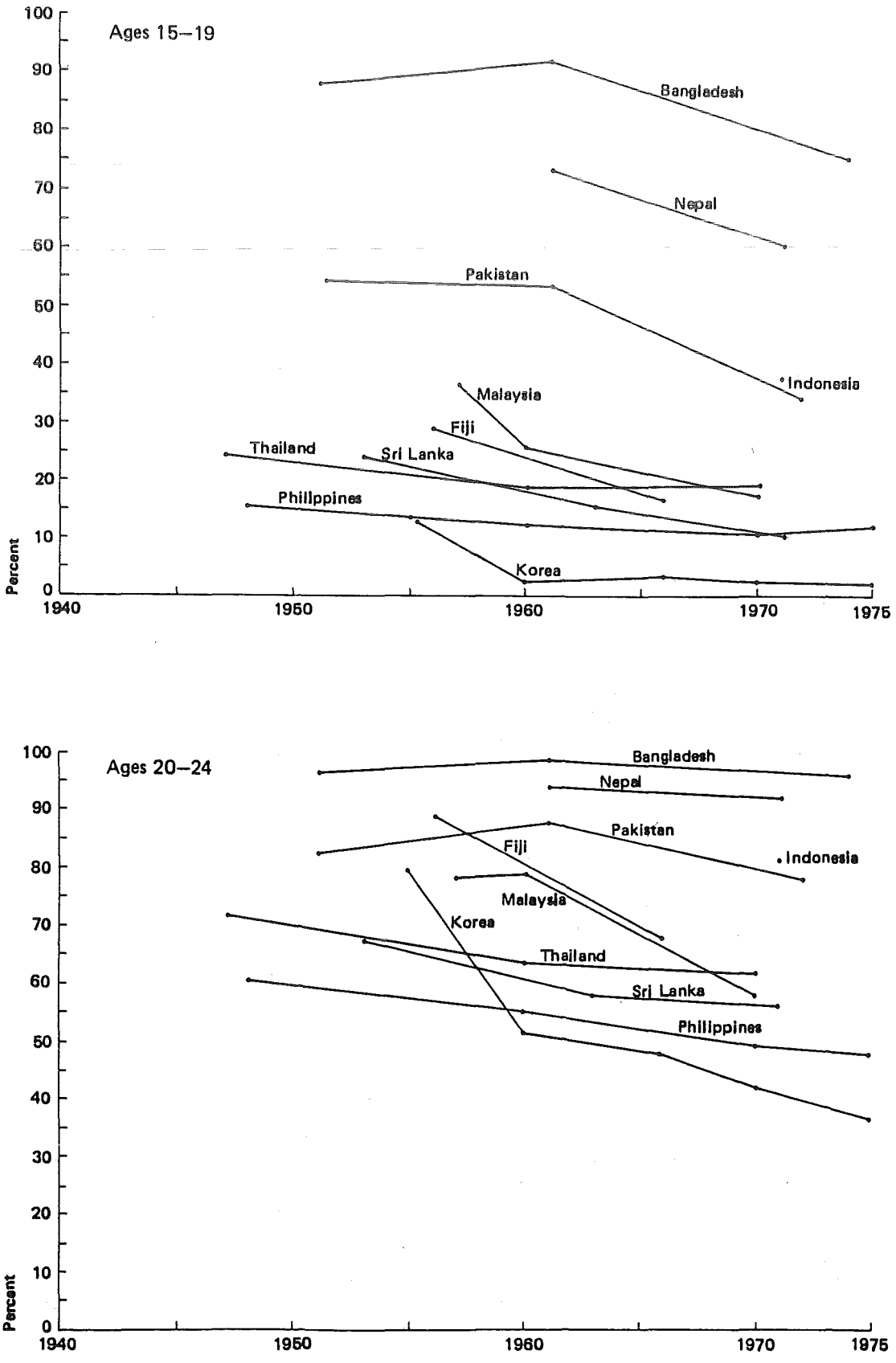


Figure 1 National trends in the percentages ever married in age groups 15–19 and 20–24

Sources: Official census publication (see table 1)

Table 1 Socio-economic indicators for the ten WFS countries in Asia and the Pacific

Country	Economic indicators		Social indicators					
	Per capita GNP (US$) (1)	% employed outside of agriculture (2)	% Urban (3)	Major religion (4)	%	Female literacy (%) (5)	Infant mortality rate (6)	Life expectancy at birth (7)
Bangladesh	100	23.0	11	Muslim	85.0	19.6	139	47
Fiji	1690	46.4	37	Hindu	44.0	77.5	41	71
Indonesia	380	40.3	20	Muslim	93.7	46.2	91	50
Korea, Rep. of	1500	50.0	48	None[a]	61.0	81.6	37	66
Malaysia	1320	53.9	29	Muslim	53.0	59.8	44	61
Nepal	130	5.6	5	Hindu	90.0	6.2	133	43
Pakistan	270	42.8	28	Muslim	97.0	12.0	142	52
Philippines	600	49.2	36	Roman Catholic	85.0	88.5	65	61
Sri Lanka	230	60.2	27	Buddhist	67.0	72.8	42	64
Thailand	590	28.0	14	Buddhist	95.3	82.7	68	61

[a]Predominantly Confucian.

Source: Columns 1, 2, 3, 6 and 7 from *1981 World Population Data Sheet*; col. 5 from *WFS Comparative Studies*, no 4: 10; col. 4 from WFS First Country Reports; col. 2 (except Bangladesh) from *1976 Year Book of Labour Statistics – ILO*, table 2; col. 2 (Bangladesh only) from *1979 Year Book of Labour Statistics – ILO*, table 2B

histories, instead obtaining only the date of marriage in the individual interview and combining this with current marital status from the household schedule. Dating of the marital event is generally in terms of the date of 'marriage', implying the start of regular exposure to the risk of pregnancy. Exceptions among the ten countries include Sri Lanka, where the date when the wife 'started living with' her husband was recorded; Nepal, where a probe was used to identify periods of non-exposure after marriage; and the Philippines and Bangladesh where the duration of exposure before marriage or non-exposure afterwards was obtained (only from the currently married in Bangladesh).

Although there are surely problems of comparability across the ten data sets, there is an underlying conceptual uniformity. Marriage is treated in *de facto* terms and not with reference to either civil or religious sanctions. The probes for cohabitation before or non-exposure after the time of first marriage were not utilized in all countries, but this actually serves to reinforce a common *de facto* or 'exposure' concept of marriage, since the probes were used in settings where exposure to regular sexual activity and marriage were thought to be less than identical.

The WFS surveys provide sample sizes sufficient to support disaggregation into five-year birth cohorts (table 2). The smallest sample of the ten, for Thailand, has 4228 households and 3775 ever-married women. Only the youngest Korean cohort is represented by fewer than 100 cases, and of the 70 country/cohort groups only nine have fewer than 500 cases; six of these are at ages 15–19 where cohort experience is very incomplete and of limited use in the present analysis in any case.

Table 2 Numbers of sample households and ever-married women by age, ten WFS surveys

Country	No of households	No of ever-married women							
		15–49	15–19	20–24	25–29	30–34	35–39	40–44	45–49
Bangladesh	5 788	6 244	1 205	1 347	1 108	791	672	626	495
Fiji	5 071	4 928	228	904	1 052	954	738	610	442
Indonesia	10 586	9 136	995	1 630	1 496	1 414	1 401	1 244	957
Korea, Rep. of	21 173	5 420	55	554	1 171	1 078	1 022	867	673
Malaysia	7 755	6 310	262	915	1 166	1 083	1 092	861	931
Nepal	5 687	5 940	741	1 226	1 146	855	736	720	516
Pakistan	4 859	4 918	597	843	911	821	623	623	500
Philippines	12 703	9 268	276	1 222	1 775	1 711	1 673	1 410	1 201
Sri Lanka	8 137	6 562	193	909	1 290	1 192	1 132	924	922
Thailand	4 228	3 775	212	602	738	602	593	573	455

Source: Various WFS First Country Reports, tables 1.1.1, except for numbers of households which were taken from Mohammad Kabir (1980). The Demographic Characteristics of Household Populations, *WFS Comparative Studies* no 6, table 5.1

1.2 METHODS OF ANALYSIS

The main method of analysis employed is maximum likelihood estimation of the parameters of the Coale model nuptiality schedule, based on the distributions of ages at marriage reported in the surveys. The Coale age model of the nuptiality process is described in detail elsewhere (Coale 1971), as is maximum likelihood estimation of the model's three parameters (Rodríguez and Trussell 1980). The latter report also describes the computer software we have employed, software which was developed by Rodríguez and Trussell for application to WFS standard recode tapes. Only a brief discussion of the Coale model and the details of estimation are given here.

The model expresses a very pronounced regularity in the age pattern of entry into first marriage, a pattern which Coale observed across a wide range of societies and apparently different marriage patterns. Trial and error curve fitting led Coale to a complex double exponential curve involving three parameters: a_o, k and C (Coale 1971). The a_o term is the age at which the curve first departs 'consequentially' from universal non-marriage; k indicates the tempo of the transition of a cohort from the never-married state to its ultimate proportion ever marrying, which is indexed by C. Alternatively, Coale's a_o and k parameters can be re-expressed as the mean (μ) and the standard deviation (σ) of the age at marriage distribution (Rodríguez and Trussell 1980: 11–12).

One of the most important and useful implications of the observed age regularity is that when, in a survey, a cohort is observed only part of the way through its completed marriage experience, that completed experience can be extrapolated rather well on the basis of the partial experience that is available. This is a critical advantage with cross-section data such as those from the WFS, where only the oldest (and in some respects the least interesting) cohorts can report complete or near-complete experience.

The model has been shown to provide useful estimates of the nuptiality parameters for cohorts with as few as half their marriages having already occurred. When less than half the completed experience is available, the model works less well; most often in these instances the model fails to produce reasonable estimates of the proportion ultimately marrying. In these cases it is convenient to re-estimate the μ and σ values with c constrained at some reasonable level.

Rodríguez and Trussell (1980) outline alternative approaches to fitting the age model to WFS data. Briefly, the individual data for ever-married women can be used to estimate μ and σ, which would then describe the distribution of first marriages among the ever married (and those ever to marry) in a population. Or, as in the application here, the individual and household data can be combined to obtain estimates μ, σ and c describing the entire cohort of women.

2 Preliminary Analysis

2.1 CENSUS PERCENTAGES EVER MARRIED

The general decline in nuptiality regionwide is evident in table 3 and figure 1. In all countries there is a downward trend in percentages ever married, especially in the 15–29 age range. The percentage ever married at age 15–19 is now very low (under 20 per cent) in most countries (the exceptions are in South Asia and Indonesia), and has even declined in Bangladesh, Nepal and Pakistan. The percentage ever married at age 20–24 generally has declined to between 50 and 75 per cent, except for South Asia where there has been little change (Sri Lanka excluded), and Korea where only one-third of the age group has married.

In contrast to this, the percentages ever married at the older ages show no indication of change, remaining at well over 90 per cent in all ten countries. The remarkably high prevalence of marriage in Asia is notable (P.C. Smith 1980). Among the countries described here, only in Sri Lanka and the Philippines is the percentage ever married at age 50 or so anything less than universal.

These shifts in schedules of cross-sectional marital structure can be summarized by the cross-section of singulate mean ages at marriage (SMAMs) shown in table 3 (Hajnal 1953; Smith 1982). All the countries show increases; the average increase across all countries and time periods is 0.8 years per decade. It needs to be recognized, however, that computation of cross-section SMAMs in this way when marriage patterns are obviously changing violates the synthetic cohort assumption underlying the methodology (Agarwala 1962). The analogous two-census calculation shown in the last column of table 3 gives a truer picture of recent experience though we are limited to one intercensal period and one estimate per country. These estimates are generally higher since they describe recent periods in a time of overall upward change.

2.2 MEAN AGES AT MARRIAGE FROM THE SURVEYS

Retrospective information on the timing of marriage is also available for cohorts interviewed in the WFS surveys, and a semblance of comparability across cohorts and countries can be achieved by tabulating mean ages at marriages for cohorts aged 25 and over (before which age most marriages occur) and limiting analysis to marriages occurring before age 25. Estimates of this kind (table 4) generally show upward trends across cohorts, corroborating the census results in table 3. However, this type of survey-based estimate is deficient in two important ways. First, the two younger cohorts (15–19 and 20–24) cannot be represented because their marriage experience is so incomplete. Unfortunately, this precludes investigation of the recent marriage experience in just those cohorts wherein changes are most likely to be interesting. Secondly, the truncation of ages at marriage at 25, necessary for comparability across cohorts, has different effects for different countries. The cohort estimates we present below as well as those reported by D. Smith (1980; see also Table A1) suggest that the truncated experience is negligible (less than 5 per cent of all events) for three countries, small (5–14 per cent) for five others, but substantial (15 per cent or more) for Sri Lanka and the Philippines. In the latter country more than one marriage in five occurs after age 25.

Thus, census data on marital status permit only indirect estimation of mean marriage ages; these synthetic measures are not appropriate under the very conditions of change we hope to assess. Similarly, the directly obtained survey means are incomplete descriptions for the older cohorts while the younger cohorts cannot be described at all. The model of the nuptiality process employed below permits us to describe true cohorts, including some of the most recent ones. Moreover, it provides us with plausible estimates for the remaining experience of all the cohorts.

Table 3 Percentages ever married among females by age, and the singulate mean age at marriage, various census years for ten WFS countries in Asia and the Pacific

Country and year	Age group							Singulate mean age at marriage	
	15–19	20–24	25–29	30–34	35–39	40–44	45–49	One census method	Two census method
Bangladesh									
1951	88.7	96.9	98.8	99.5	99.7	99.7	99.8	15.5	
1961	92.0	99.0	99.0	99.6	99.8	99.8	99.9	13.9	15.4
1974	75.5	96.8	99.1	99.4	99.6	99.6	99.7	15.9	
Fiji									
1956	29.0	89.0	94.0	95.0	95.0	95.0	97.0	20.4	
1966	17.0	68.0	89.0	94.0	96.0	96.0	96.0	21.0	20.7
Indonesia									
1971	37.4	81.6	95.0	97.8	98.5	98.8	99.0	19.2	
Korea, Rep. of									
1955	13.8	79.2	97.0	99.3	99.7	99.7	99.8	20.5	
1960	2.6	51.2	95.2	99.4	99.8	99.9	99.9	22.6	23.4
1966	3.9	48.4	92.3	99.0	99.7	99.9	99.9	22.8	22.7
1970	2.9	42.8	90.3	98.6	99.6	99.8	99.1	23.3	22.4
1975	2.6	37.5	88.2	97.9	99.3	99.7	99.8	23.7	23.7
Malaysia									
1957	37.0	78.6	94.4	97.9	98.5	98.5	98.6	19.2	
1960	25.1	79.3	95.2	97.2	98.3	98.3	98.4	19.4	
1970	17.5	58.6	86.6	94.3	96.5	97.8	98.4	21.8	21.1
Nepal									
1961	73.8	94.6	98.1	99.0	99.2	99.4	99.5	16.7	
1971	60.7	92.1	97.4	98.6	98.9	99.1	99.2	16.8	18.2
Pakistan									
1951	54.4	82.3	93.6	96.1	96.6	97.6	97.7	17.9	
1961	53.4	88.0	94.9	97.0	97.4	97.8	98.0	17.6	17.7
1972	34.5	78.7	92.7	96.4	97.9	98.4	99.2	20.0	19.1
Philippines									
1948	15.7	60.1	81.5	87.7	90.8	91.5	93.2	22.1	
1960	12.7	55.7	80.5	88.4	91.9	92.4	92.9	22.2	
1970	10.9	49.8	78.5	88.4	92.0	92.7	93.3	23.8	22.3
1975	12.4	48.8	75.7	87.9	91.8	93.2	93.9	23.2	23.2
Sri Lanka									
1953	24.3	67.5	87.2	92.5	94.6	95.0	95.6	21.1	
1963	15.3	58.6	82.7	92.2	95.1	95.8	96.1	22.0	21.5
1971	10.6	46.8	75.4	89.1	94.2	95.3	95.9	23.5	
Thailand									
1947	24.5	71.9	89.5	94.5	96.1	96.8	97.2	20.5	
1960	18.6	63.8	86.7	93.6	96.0	96.9	97.4	21.6	
1970	19.2	62.1	84.4	91.9	94.8	96.1	97.0	21.9	20.9

Sources: Official census publications

Table 4 Mean age at first marriage among women who married before age 25, by cohort, for ten WFS countries

Country	Cohort					All ages
	25–29	30–34	35–39	40–44	45 +	25 +
Bangladesh 1975[a]	12.1	11.4	11.5	11.4	10.9	11.7
Fiji 1974	18.3	17.5	17.2	17.1[b]		17.6
Indonesia 1976	16.2	15.9	15.6	15.6	15.7	15.8
Korea (Rep. of) 1976	21.1	20.5	19.5	18.1	16.9	19.4
Malaysia 1974	18.8	18.1	17.3	17.1	16.7	17.6
Nepal 1976	14.9	14.8	15.3	15.1	15.3	15.0
Pakistan 1975	17.0	16.6	16.2	15.7	16.2	16.4
Philippines 1978	19.6	19.5	19.3	19.2	19.3	19.4
Sri Lanka 1976	18.9	18.1	17.9	17.7	17.9	18.2
Thailand 1975	18.7	18.7	18.7	18.4	18.8	18.7

[a]For women who married before age 20.
[b]For ages 40 and over.
Sources: First WFS Country Reports

3 Basic Cohort Results

The results reported in table 5 (panels A–J) were obtained by fitting the Coale marriage curve to the available cohort experience in each survey. The implied completed marriage pattern for each cohort is summarized by a mean ($\hat{\mu}$) and a standard deviation ($\hat{\sigma}$) for the distribution of ages at first marriage and by an estimate of the proportion of each cohort ultimately marrying ($\hat{c}$). For some countries and cohorts an alternate model has been estimated in which c is fixed at a plausible level. These 'fixed-c' results are shown whenever the 'estimated' c exceeds 1.0 or is substantially lower than seems reasonable. Before considering substantive results we need to discuss these assumptions regarding cohort proportions ever marrying (c), and the sensitivity of our results to the assumptions about c that are made.

The underlying problem, as we indicated earlier, is that the experience of most of the cohorts we are studying is incomplete and thus the ultimate proportion marrying cannot be estimated. The Coale age at marriage curve is quite effective at predicting the subsequent age pattern of marriages for those in a cohort who will marry but have not yet done so, provided the proportion of presently unmarried women who will eventually marry can be approximated. Experience has shown that results of the Coale model are rather sensitive to the proportion ultimately marrying that is utilized (Rodríguez and Trussell 1980; Trussell 1980).

For four countries (Bangladesh, Indonesia, Korea and Nepal), our results indicate that marriage is virtually universal with no cohort trend in c even though μ is rising, and this pattern is corroborated by the census data shown earlier (table 3) as well. The 'fixed-c' model was estimated for some cohorts in these countries, but only because $\hat{c}$ in the 'estimated-c' model exceeds 1.0, an impossibility. Two other countries (Fiji, Malaysia) show a very slight downward trend in $\hat{c}$ across cohorts, but $\hat{c}$ remains at a very high level and we have again estimated the 'fixed-c' model only where the estimated c exceeds 1.0.

Finally, four countries (Pakistan, Philippines, Sri Lanka and Thailand) present more serious problems of interpretation and judgement. For each of these four countries there is a substantial downward trend in $\hat{c}$ across survey cohorts, and from the pattern it is not evident for which cohort $\hat{c}$ may begin to be much lower than the true value only because too little of the cohort's ultimate experience is available by the time of the survey to identify the parameter precisely.

Other evidence of the relationship between μ and c provides little guidance. First of all, there is an underlying negative association between $\hat{\mu}$ and $\hat{c}$ in the WFS data as a whole; this is indicated by the estimates for the broad age range given in figure 2A. The underlying relationship and the deviations from it are quite clear. Korea falls away from the pattern because $\hat{c}$ for that country is exceptionally high for such a late marrying population, even for one in Asia. This exceptional pattern for Korea has been recognized before (Coale, Goldman and Cho 1981). Pakistan's World Fertility Survey c estimate is artificially low because of the low $\hat{c}$ values at ages under 30. Since $\hat{c}$ is near unity for all the five-year groups from age 30 onwards (table 5, panel G), we infer that the correct level of $\hat{c}$ for the younger age groups (and for the broad age groups as well) is near unity.

Figure 2B shows that the survey and census $\hat{c}$s are closely associated, as they should be, with the exception of the low WFS $\hat{c}$ value for Pakistan. We should note here that the differences between census and WFS $\hat{c}$ values are inconsistent in direction, whereas the differences between census and survey $\hat{\mu}$ values are systematic, with the census value always higher. On reflection, this pattern is plausible, considering the general upward shift of $\hat{\mu}$ over time and the fact that the census values, as synthetic measures, describe a more recent period than do the survey values.

The negative cross-section relationship between $\hat{\mu}$ and $\hat{c}$ suggests that wherever marriage is delayed among recent cohorts the proportion ever marrying may end up being lower in those cohorts as well. However, the national-level census time series show changes in $\hat{\mu}$ without changes in $\hat{c}$ (table 3), and our own WFS results corroborate this (table 5).

On balance, we have concluded that the determinants of changes in $\hat{\mu}$ and c are distinct (see also Dixon 1978) and that the proper assumption for each country is to fix c at its level over the recent past. The timing of marriage seems to be immediately responsive to changes in the pattern of life and the range of choices available in the adolescent and early adult years. But the prevalence of marriage, or the probability of never marrying for an individual, apparently reflects deeper features of social organization such as principles of kinship. These features change but slowly, so that related behavioural changes such as a rise in non-marriage may not be observed until more time has passed.

Therefore, 'fixed-c' models have been estimated wherever $\hat{c}$ falls substantially below the prevailing level among preceding cohorts. We have judged the estimated c values to be too low at ages under 25 in Pakistan, Sri Lanka and Thailand and at ages under 30 in the Philippines.

3.1 TRENDS IN THE TIMING OF MARRIAGE

Figure 3 depicts cohort trends in $\hat{\mu}$. To make evident the effects on $\hat{\mu}$ of fixing versus estimating the c parameter, we have plotted both estimated and fixed-c estimates of μ. The solid lines indicate the series we consider to be most plausible with regard to levels of c. It will be noted that in instances where the estimated c value was greater than one, the fixed-c model produces a lower estimate of μ, and where c was judged unacceptably low, the fixed-c model

Table 5 Estimates of the mean and standard deviation of the age distribution of first marriages, and the proportion eventually marrying, both household and individual data

Age group (cohort)	Type of estimate of c	$\hat{\mu}$	$\hat{\sigma}$	$\hat{c}$	$\widehat{SE}\hat{\mu}$	$\widehat{SE}\hat{\sigma}$	$\widehat{SE}\hat{c}$	p-value (HH and I)
A Bangladesh 1975								
Conventional age groups								
15–19	estimated	17.7	5.8	1.282	0.359	0.274	0.053	0.452
	fixed (c = 0.996)	16.0	4.5	0.996	0.101	0.094	*	0.452
20–24	estimated	14.3	3.6	0.994	0.118	0.101	0.006	0.516
25–29	estimated	13.6	3.2	0.994	0.100	0.081	0.003	0.134
30–34	estimated	12.9	2.9	0.999	0.109	0.091	0.001	0.253
35–39	estimated	13.1	3.3	0.996	0.126	0.111	0.002	0.001
40–44	estimated	12.9	2.9	0.998	0.127	0.104	0.002	0.337
45–49	fixed (c = 1.000)	13.1	3.5	1.000	0.100	0.061	*	0.140
Broad age groups								
15–49	estimated	14.1	3.7	0.998	0.044	0.029	0.001	0.000
20–49	estimated	13.5	3.2	0.997	0.051	0.044	0.001	0.000
B Fiji 1974								
Conventional age groups								
16–19[a]	estimated	28.2	7.9	3.746	3.374	1.769	2.665	0.024
	fixed (c = 0.968)	22.5	4.9	0.968	0.266	0.227	*	0.003
20–24	estimated	21.3	4.7	1.006	0.327	0.254	0.043	0.001
	fixed (c = 0.968)	21.1	4.6	0.968	0.132	0.112	*	0.001
25–29	estimated	20.4	4.9	1.006	0.190	0.165	0.012	0.182
	fixed (c = 0.968)	20.1	4.6	0.968	0.146	0.121	*	0.161
30–34	estimated	19.2	4.4	0.979	0.151	0.132	0.006	0.010
35–39	estimated	18.9	4.3	0.971	0.165	0.142	0.006	0.093
40–44	estimated	18.7	4.5	0.981	0.186	0.160	0.006	0.135
45–49	estimated	18.7	4.6	0.989	0.226	0.197	0.005	0.983
Broad age groups								
16–49[a]	estimated	20.3	4.9	0.980	0.070	0.060	0.003	0.000
20–49	estimated	19.8	4.7	0.980	0.071	0.061	0.003	0.000
C Indonesia 1976								
Conventional age groups								
15–19	estimated	29.4	11.1	4.125	2.980	1.587	1.592	0.500
	fixed (c = 0.990)	20.1	5.8	0.990	0.176	0.165	*	0.500
20–24	estimated	18.8	5.6	1.031	0.215	0.171	0.018	0.003
	fixed (c = 0.990)	18.4	5.4	0.990	0.150	0.129	*	0.003
25–29	estimated	17.1	4.9	0.993	0.147	0.124	0.006	0.018
30–34	estimated	16.5	4.5	0.973	0.126	0.103	0.005	0.059
35–39	estimated	16.2	4.6	0.988	0.126	0.104	0.003	0.000
40–44	estimated	16.0	4.4	0.993	0.128	0.106	0.002	0.000
45–49	estimated	16.2	4.4	0.994	0.141	0.114	0.002	0.011
Broad age groups								
15–49	estimated	17.5	5.1	0.998	0.055	0.046	0.002	0.000
20–49	estimated	16.9	4.8	0.987	0.055	0.045	0.002	0.000
D Republic of Korea 1976								
Conventional age groups								
16–19[a]	estimated	26.0	6.2	0.956	6.670	3.603	1.619	0.423
	fixed (c = 0.998)	25.8	6.0	0.998	0.534	0.422	*	0.792
20–24	estimated	27.1	6.5	1.804	0.812	0.534	0.226	0.011
	fixed (c = 0.998)	23.7	4.3	0.998	0.090	0.102	*	0.335
25–29	estimated	23.7	4.4	1.082	0.141	0.122	0.011	0.000
	fixed (c = 0.998)	22.8	3.7	0.998	0.079	0.062	*	0.004
30–34	estimated	22.4	4.0	1.009	0.101	0.091	0.002	0.327
	fixed (c = 0.998)	22.1	3.8	0.998	0.101	0.076	*	0.327
35–39	estimated	20.7	3.3	0.995	0.090	0.046	0.001	0.000
40–44	estimated	18.9	3.3	0.997	0.110	0.090	0.001	0.004
45–49	estimated	17.6	2.6	0.997	0.097	0.079	0.001	0.044
Broad age groups								
16–49[a]	estimated	22.4	4.7	1.000	0.043	0.037	0.000	0.327
20–49	estimated	21.9	4.7	1.000	0.048	0.041	0.000	0.327

[*Table continues*]

Table 5 (*cont*)

Age group (cohort)	Type of estimate of c	$\hat{\mu}$	$\hat{\sigma}$	$\hat{c}$	$\hat{SE}\hat{\mu}$	$\hat{SE}\hat{\sigma}$	$\hat{SE}\hat{c}$	p-value (HH and I)
E Malaysia 1974								
Conventional age groups								
15–19	estimated	24.3	6.8	0.989	1.768	1.045	0.338	0.524
	fixed (c = 0.986)	24.3	6.7	0.986	0.380	0.319	*	0.579
20–24	estimated	23.4	6.7	1.040	0.531	0.386	0.065	0.246
	fixed (c = 0.986)	23.1	6.4	0.986	0.169	0.153	*	0.254
25–29	estimated	22.1	6.6	1.007	0.298	0.247	0.020	0.055
	fixed (c = 0.986)	21.9	6.4	0.986	0.165	0.154	*	0.054
30–34	estimated	20.2	5.7	0.968	0.203	0.172	0.009	0.002
35–39	estimated	18.9	5.2	0.973	0.156	0.131	0.005	0.152
40–44	estimated	18.6	4.9	0.986	0.170	0.141	0.004	0.000
45–49	estimated	17.8	4.6	0.994	0.172	0.145	0.004	0.368
Broad age group								
15–49	estimated	21.2	6.2	0.980	0.073	0.066	0.004	0.040
20–49	estimated	20.6	6.0	0.977	0.084	0.070	0.004	0.000
F Nepal 1976								
Conventional age groups								
15–19	estimated	20.3	6.9	1.589	0.669	0.470	0.130	0.000
	fixed (c = 0.992)	17.1	4.8	0.992	0.142	0.126	*	0.000
20–24	estimated	17.0	5.2	1.079	0.190	0.160	0.010	0.000
	fixed (c = 0.992)	16.2	4.5	0.992	0.111	0.082	*	0.034
25–29	estimated	16.2	4.7	1.014	0.156	0.134	0.004	0.000
	fixed (c = 0.992)	15.9	4.5	0.992	0.134	0.110	*	0.000
30–34	estimated	15.8	4.5	0.995	0.144	0.126	0.004	0.000
35–39	estimated	16.6	4.9	0.998	0.184	0.151	0.003	0.556
40–44	estimated	16.4	5.7	0.998	0.184	0.151	0.002	0.002
45–49	estimated	16.6	5.1	0.994	0.219	0.181	0.004	0.028
Broad age groups								
15–49	estimated	16.4	4.8	0.998	0.055	0.049	0.001	0.000
20–49	estimated	16.2	4.7	0.998	0.061	0.052	0.001	0.000
G Pakistan 1975								
Conventional age groups								
15–19	estimated	17.5	3.9	0.746	0.301	0.231	0.043	0.000
	fixed (c = 0.968)	18.9	4.8	0.968	0.163	0.153	*	0.000
20–24	estimated	17.6	4.4	0.612	0.265	0.220	0.020	0.019
	fixed (c = 0.968)	21.7	7.6	0.968	0.216	0.207	*	0.019
25–29	estimated	17.2	4.2	0.955	0.154	0.130	0.009	0.000
30–34	estimated	16.7	3.9	0.973	0.139	0.116	0.006	0.002
35–39	estimated	16.2	4.0	0.976	0.158	0.131	0.006	0.004
40–44	estimated	15.5	3.3	0.988	0.132	0.111	0.004	0.028
45–49	estimated	15.9	3.6	0.991	0.151	0.123	0.004	0.389
Broad age groups								
15–49	estimated	17.7	4.7	0.937	0.082	0.070	0.006	0.000
20–49	estimated	17.5	4.6	0.939	0.075	0.063	0.006	0.000
H The Philippines 1978								
Conventional age groups								
15–19	estimated	28.4	8.9	1.247	2.927	1.559	0.673	0.000
	fixed (c = 0.939)	26.9	8.2	0.939	0.161	0.117	*	0.001
20–24	estimated	21.9	5.4	0.666	0.319	0.237	0.028	0.001
	fixed (c = 0.939)	24.6	7.3	0.939	0.177	0.158	*	0.001
25–29	estimated	21.7	5.2	0.819	0.182	0.150	0.014	0.000
	fixed (c = 0.939)	23.1	6.3	0.939	0.171	0.152	*	0.043
30–34	estimated	21.7	5.6	0.911	0.163	0.138	0.009	0.004
35–39	estimated	21.3	5.4	0.927	0.144	0.120	0.007	0.000
40–44	estimated	21.0	5.2	0.955	0.145	0.121	0.006	0.000
45–49	estimated	21.3	5.4	0.949	0.155	0.125	0.006	0.001
Broad age groups								
15–49	estimated	22.6	5.9	0.916	0.069	0.057	0.004	0.000
20–49	estimated	22.2	5.9	0.917	0.070	0.058	0.004	0.000

Table 5 (*cont*)

Age group (cohort)	Type of estimate of c	$\hat{\mu}$	$\hat{\sigma}$	$\hat{c}$	$\hat{SE}\hat{\mu}$	$\hat{SE}\hat{\sigma}$	$\hat{SE}\hat{c}$	p-value (HH and I)
I Sri Lanka 1976								
Conventional age groups								
15–19	estimated	23.0	5.9	0.435	1.645	1.030	0.140	0.031
	fixed (c = 0.980)	26.6	7.8	0.980	0.598	0.485	*	0.001
20–24	estimated	23.0	6.8	0.724	0.589	0.421	0.049	0.000
	fixed (c = 0.936)	25.3	8.4	0.936	0.240	0.228	*	0.015
	fixed (c = 0.850)	24.4	7.8	0.850	0.039	0.088	*	0.000
25–29	estimated	23.6	7.9	0.919	0.367	0.305	0.025	0.000
30–34	estimated	21.7	6.9	0.941	0.245	0.209	0.012	0.000
35–39	estimated	20.8	6.5	0.967	0.210	0.180	0.007	0.001
40–44	estimated	20.1	6.2	0.961	0.199	0.169	0.006	0.000
45–49	estimated	19.9	5.7	0.981	0.189	0.151	0.004	0.000
Broad age groups								
15–49	estimated	22.9	7.5	0.952	0.104	0.088	0.006	0.000
20–49	estimated	22.4	7.3	0.953	0.106	0.089	0.005	0.000
J Thailand 1975								
Conventional age groups								
15–19	fixed (c = 0.93)	22.3	5.4	0.930	28.300	8.600	3.100	†
20–24	estimated	21.4	5.1	0.900	0.397	0.303	0.046	0.253
	fixed (c = 0.93)	21.6	5.3	0.930	†	†	†	†
25–29	estimated	21.2	5.1	0.921	0.260	0.212	0.020	0.000
30–34	estimated	20.8	5.0	0.929	0.235	0.201	0.012	0.003
35–39	estimated	20.7	4.9	0.945	0.209	0.170	0.010	0.000
40–44	estimated	20.2	4.4	0.963	0.188	0.151	0.008	0.059
45–49	estimated	20.3	4.3	0.967	0.199	0.162	0.008	0.493

*Not estimated.
†Not available.
[a]Minimum age at interview is 16.
Sources: NUPTIAL results for WFS data sets.
Trussell, James (1980). Illustrative Analysis: Age at First Marriage in Sri Lanka and Thailand. *WFS Scientific Reports* no 13, table 7

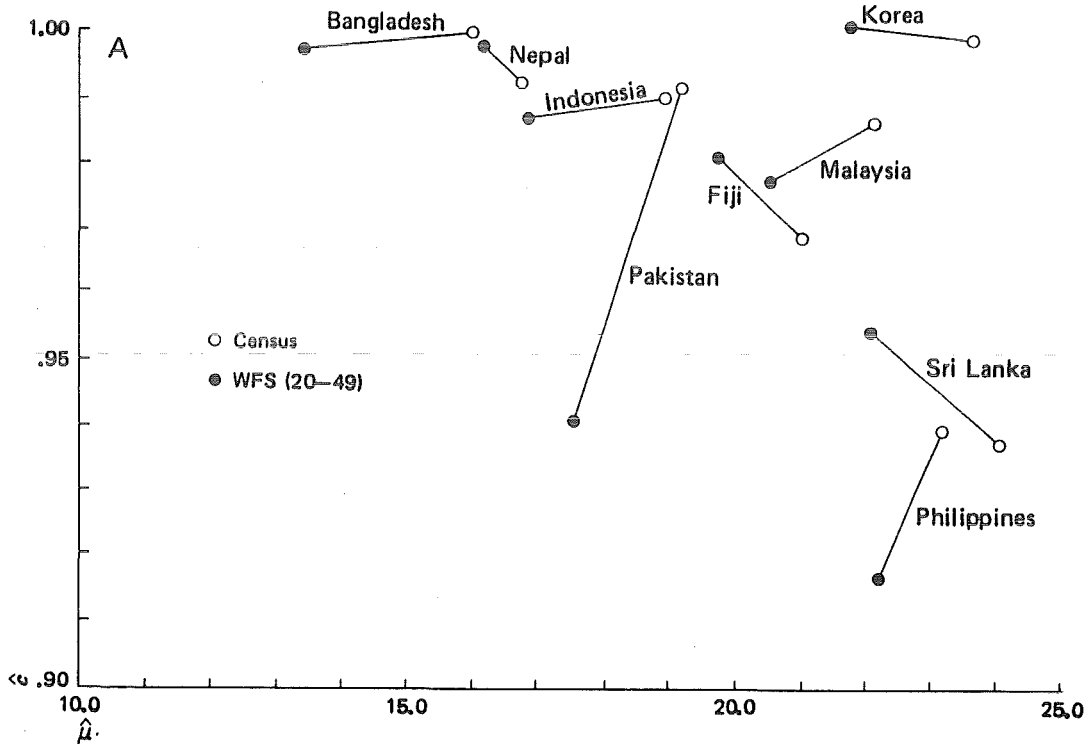
produces a higher estimate of μ. The result of this process of comparison and judgement is a series of $\hat{\mu}$s which is smooth and plausible with regard to the magnitudes of successive increases. The only exception is Pakistan where the cohort pattern of $\hat{\mu}$s is irregular.

To gain a general perspective on the changes in marriage timing reflected in our results we have averaged the $\hat{\mu}$ values for the two oldest cohorts (40–44 and 45–49) and for the two youngest (15–19 and 20–24). This gives us $\hat{\mu}$ values for two ten-year cohorts separated by 25 years. The 40–49 age group was born during a period centring on about 1930, its marriages occurring in the immediate post-war period and the early 1950s. This broad cohort had a mean age at marriage averaging 17.8 across the ten countries. The 15–24 cohort was born during a period centring on about 1945 and its marriages occurred in the 1960s. The ten-country mean for this group is 21.5. These two figures suggest for the ten countries an increase in the age of marriage of 3.7 years over a period of about two and a half decades, or of about 0.15 years of age per calendar year.

The estimated increases in $\hat{\mu}$ over the 25 years range from 6.5 years in Korea to only 0.2 years in Nepal. Sri Lanka, Korea and Malaysia experienced increases of 5.0 years or greater; Pakistan and the Philippines each had an increase of 4.6 years; Fiji and Indonesia had increases of 3.1–3.2 years; Bangladesh and Thailand increased by 1.7–2.2 years; Nepal with its negligible increase is an outlying case.

Sri Lanka, Korea and Malaysia have had remarkable transitions, beginning with relatively early marriage and shifting quite rapidly to a pattern of late marriage. The Philippines already had a late-marriage pattern earlier in the century but has shown substantial further change nevertheless. The recent cohort in Nepal is still at a very early age at marriage. All the remaining countries are moderate with respect to both the age at marriage in earlier times and the tempo of subsequent change across cohorts.

The $\hat{\sigma}$ parameter varies across these populations from Bangladesh and the earlier cohorts in Korea, where $\hat{\sigma}$ is no greater than 3.5 years, to Sri Lanka where $\hat{\sigma}$ is in the range from 6.0–8.5 years over the entire set of cohorts. The Bangladesh concentration around a very few ages at marriage indicates a very rapid tempo of the marriage process once begun. This in turn reflects both that society's cultural homogeneity and its low level of socio-economic differentiation. At the other extreme, Sri Lanka's dispersed pattern of marriage ages probably reflects not only its level of economic development but also its considerable cultural diversity. The populations among the ten under study having relatively dispersed ages at marriage are – in addition to Sri Lanka – Philippines, Malaysia, Nepal and Thailand.



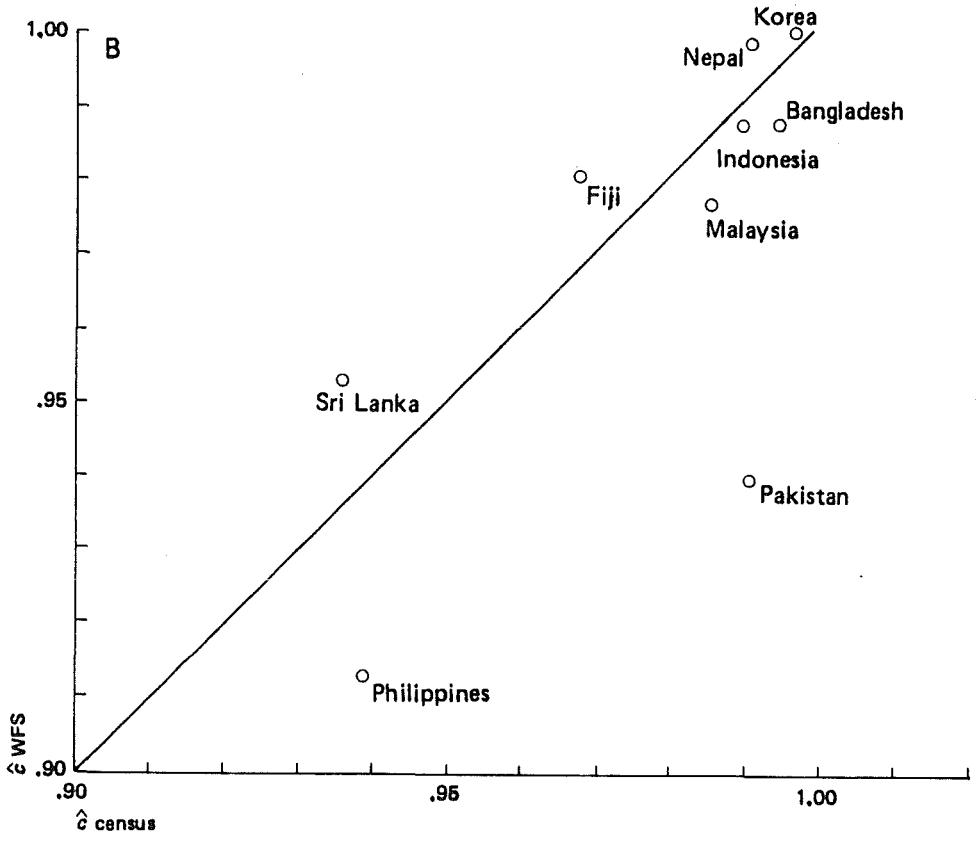


Figure 2 Relationships between $\hat{c}$ and $\hat{\mu}$ in the surveys and $\hat{c}$ in the censuses

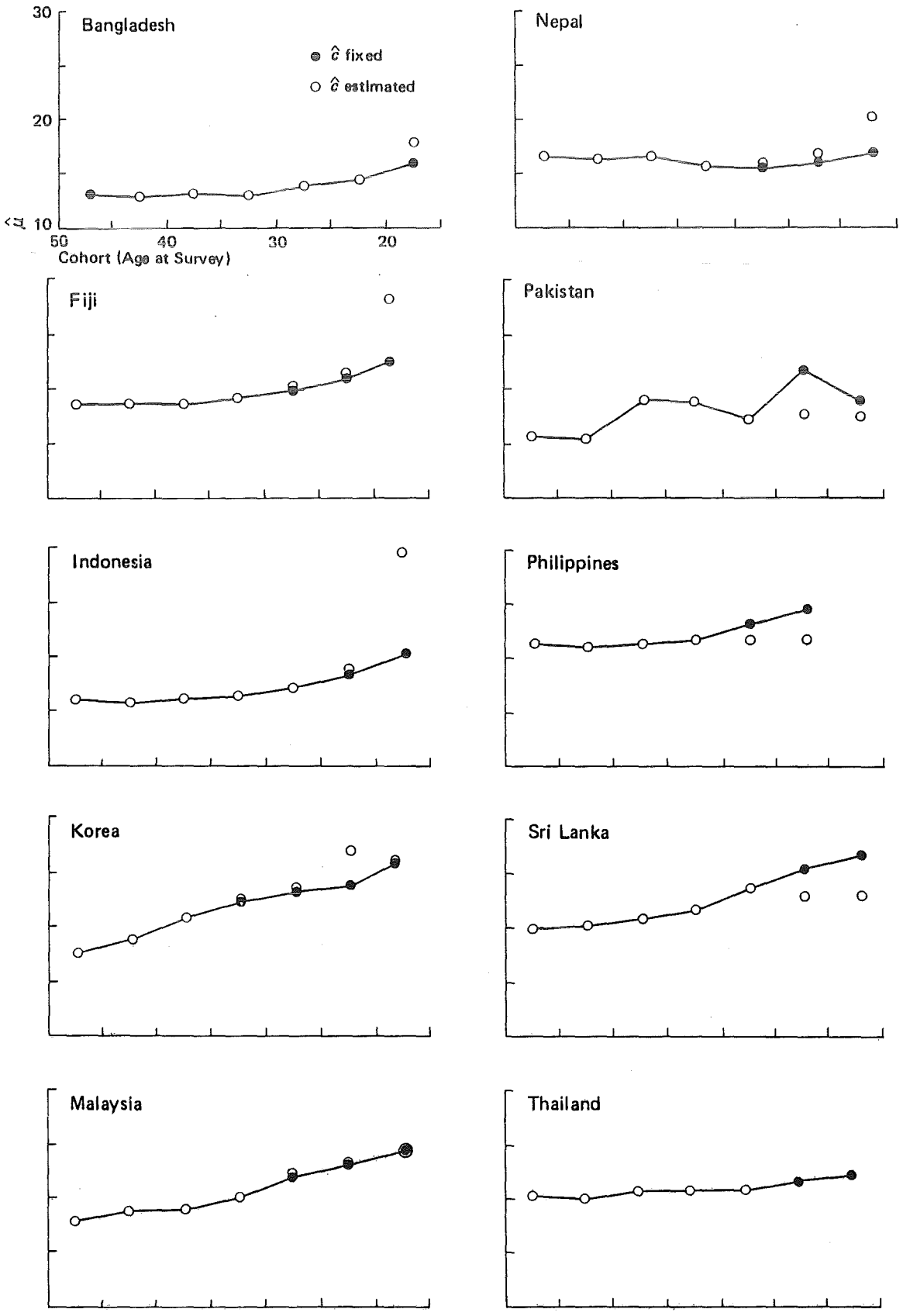


Figure 3 Cohort trends in the mean age at marriage

Source: table 5A–J

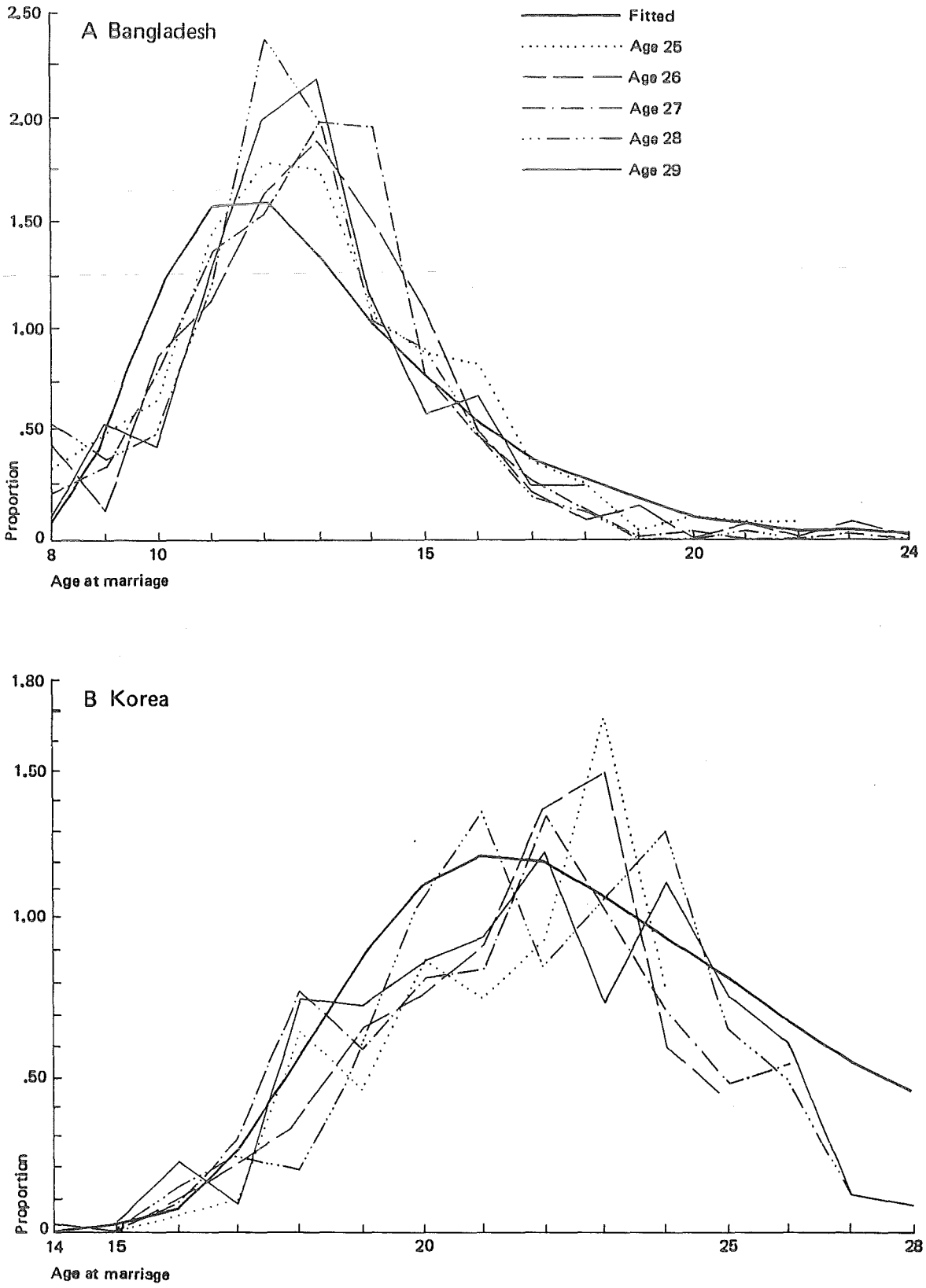


Figure 4 Adjusted observed and fitted proportions marrying at each age for the cohort aged 25–29 at the time of the survey, individual data: Bangladesh and Republic of Korea

In every country but Nepal the upward movement of $\hat{\mu}$ is accompanied by an increase in $\hat{\sigma}$, reflecting a dispersion on marriage ages associated with economic and social differentiation. The transitions in both $\hat{\mu}$ and $\hat{\sigma}$ in Korea are especially notable.

The nature of these cohort changes and cross-national differences is illuminated by looking at the behaviour of Coale's a_0 and k parameters of the nuptiality curve, easily obtained from $\hat{\mu}$ and $\hat{\sigma}$. Since

$$\hat{\mu} = a_0 + 11.36\,k \text{ and}$$

$$\hat{\sigma}^2 = 43.34\,k^2$$

where the constants are the rescaling factors needed to obtain a standard age curve with $\hat{\mu} = 0$ and $k = 1$:

$$a_0 = \hat{\mu} - 11.36\,k$$

$$k = \hat{\sigma}/6.58.$$

These parameters index the age at which the marriage curve for a cohort departs from zero (a_0) and the tempo of the marriage process once begun (k). The 'onset' parameter is scaled in years and the 'tempo' parameter is scaled as a proportion of the tempo in the standard curve. A high value of k indicates a slow marriage process, while a high level of a_0 indicates a late start.

We can readily determine the share of the change in $\hat{\mu}$ resulting from a change in a_0 versus a change in k. We find that in five countries (Bangladesh, Indonesia, Sri Lanka, Korea, Malaysia) changes in both a_0 and k contribute to the increase in $\hat{\mu}$, with between half and two-thirds of the total change due to increases in a_0. In three cases the increase in a_0 is very slight (the Philippines) or a small decline is observed (Pakistan, Thailand). In these cases the entire shift in $\hat{\mu}$ is due to increases in k. In Fiji, however, nearly all of the shift in $\hat{\mu}$ reflects an upward movement in a_0.

3.2 THE FIT OF MODEL AND DATA

A few comments are in order concerning the goodness of fit of the Coale age curve and the WFS cohort data. The final column of table 5 contains p-values associated with

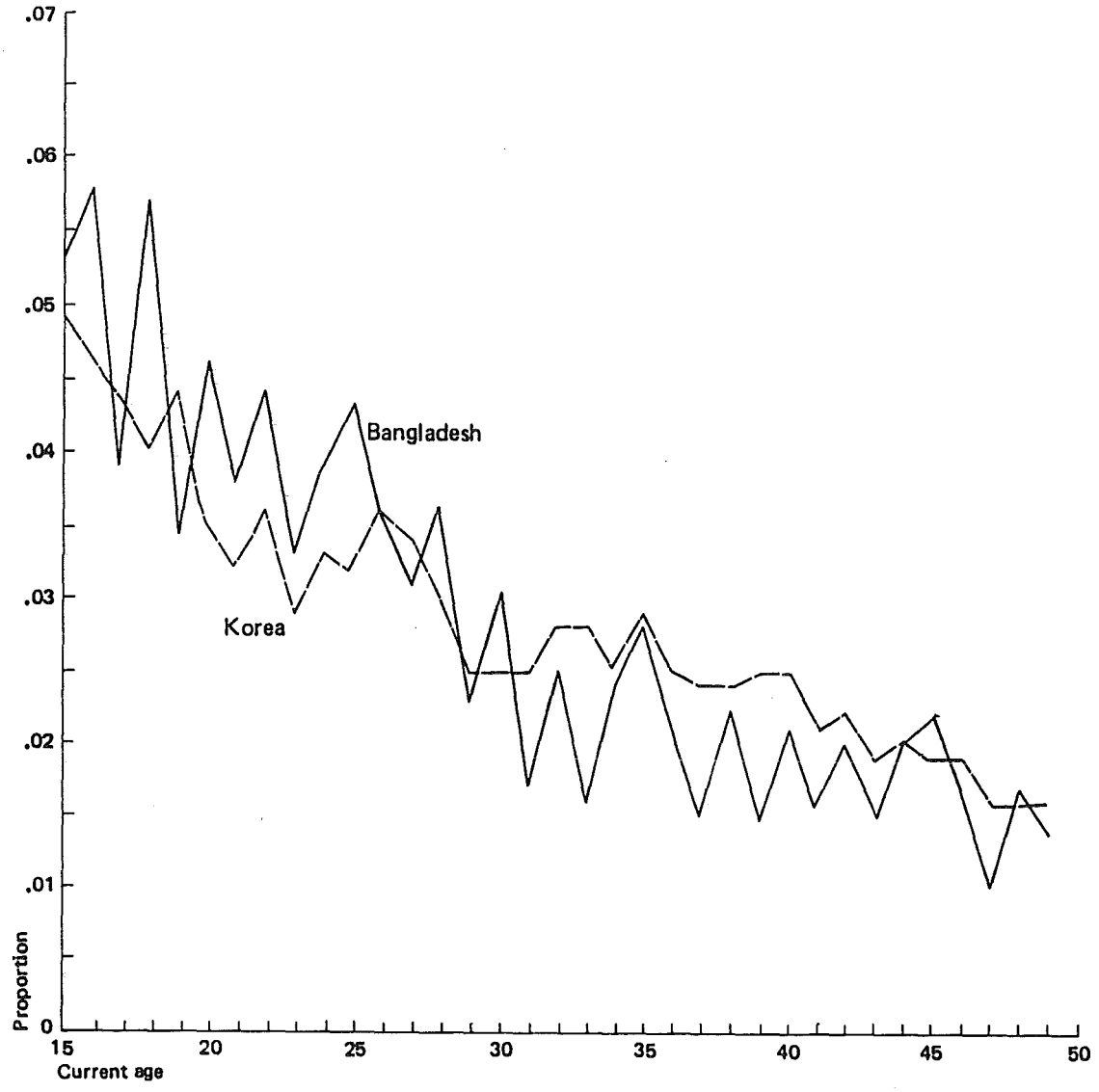


Figure 5 Proportional distribution of women, by age 15–49, household data: Bangladesh and Republic of Korea

maximum likelihood chi-squared tests of the null hypothesis that the observed nuptiality schedule can be fitted with only three parameters (Rodíguez and Trussell 1980; Trussell 1980: 15). The p is a computed value above which the null hypothesis can be rejected.

The fit of model and data is in general not very good by this criterion. Of the 42 p-values shown in table 5 (ignoring those where c is fixed rather than estimated), 28 (two-thirds) are below 0.05 and can be rejected. The model's fit across broad age ranges can be rejected for all countries except Korea.

It is important to realize in light of these results that the significance test employed is a very rigorous and therefore conservative one. Deviations of data from the model's predictions can occur for several reasons. In particular, we should distinguish three sources of error:

1 Errors in the data, especially with respect to age or age at marriage responses, which could lead to age heaping not predicted by the model;
2 Heterogenous nuptiality patterns within age groups, reflecting cohort trends; and
3 Failure of the model to portray faithfully the true age pattern of marriages.

Only the third type of error would raise serious doubts

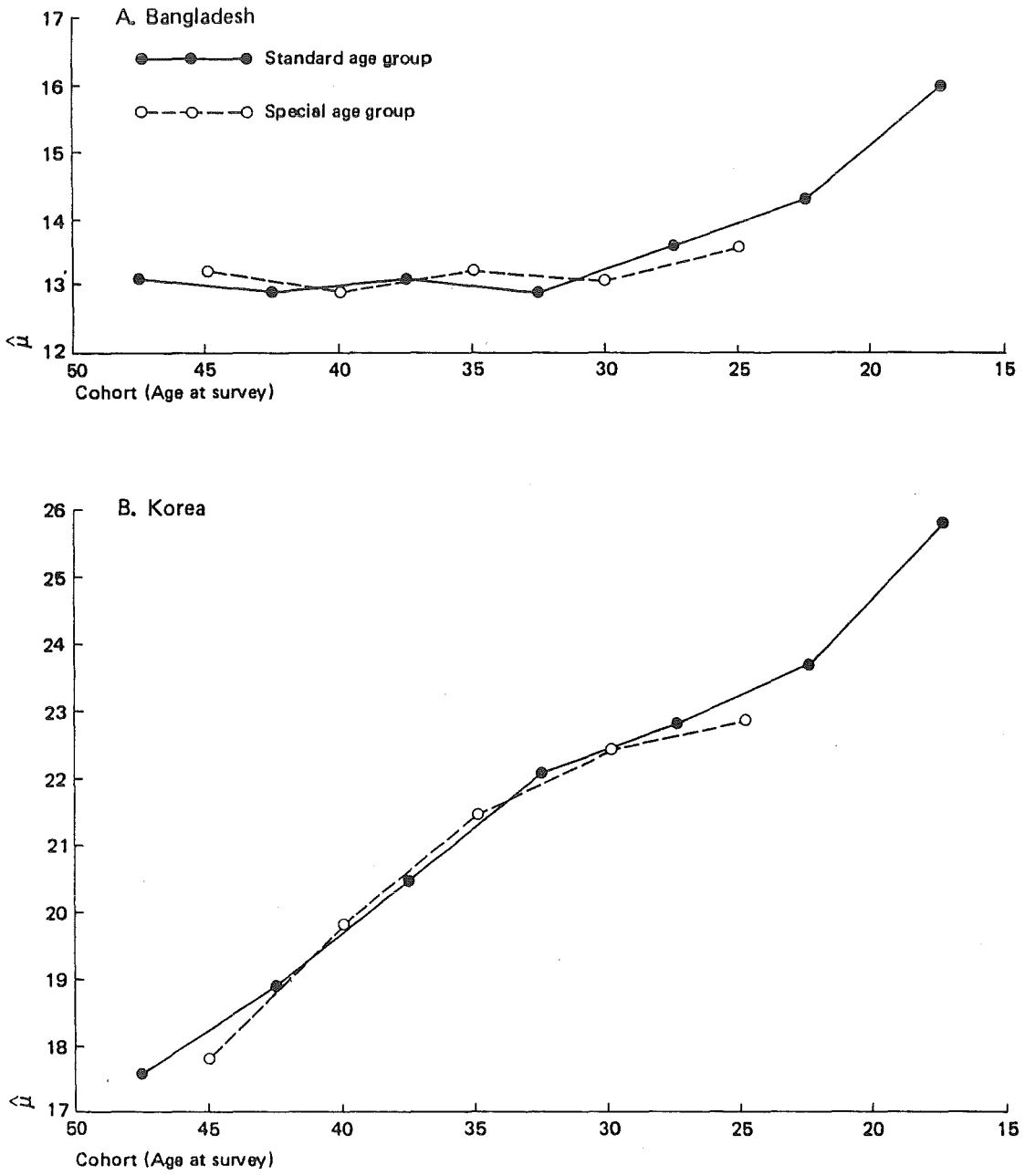


Figure 6 Cohort trends in the mean age at marriage, cohorts defined on standard and special five-year age groups: Bangladesh and Republic of Korea

about the usefulness of our results. Age heaping errors would produce mainly random deviations from the model, unless of course age heaping and marriage behaviour are associated. Cohort trends clearly do exist across broad age groups, but the model nevertheless can be fitted to the average experience of a cohort and provide a summary of it.

The poor fit of the model to data for broad age groups is certainly due in part to the presence of trends across ages. But even when we disaggregate the samples into five-year age groups we find that the fit of theoretical curve to data varies substantially. The poor fit for some five-year cohorts may reflect trends across the five single-year groups, but this is not likely to be an important influence across only five years of time. Distortions of the data with respect to responses on age at marriage or current age are a more likely problem. We have examined detailed tabulations of age at marriage for single-year cohorts and the patterns observed, illustrated in figure 4 for Bangladesh and Korea, lead to the conclusion that marriage pattern trends across single-year cohorts within any five-year age group are not a significant factor in our results (we draw this conclusion from the fact that the single-year experiences overlap substantially in figure 4).

We have also examined carefully the pattern of age misreporting and find, not surprisingly, that the quality of age reporting varies across countries and in general is far from perfect. This is illustrated in figure 5, again with results for Bangladesh and Korea. Focussing on age-heaping error, which figure 5 indicates is quite common, we must be concerned about the fact that age heaping tends to place people in the next older conventional age group more often than in the next younger conventional age group (eg misstating age 26 as age 25 does not transfer an individual to the next younger five-year age group, whereas misstating age 24 as age 25 does cause a transfer to the next older five-year age group). As a consequence, age heaping might influence our results even if there is no association between misstatement of current age and either the true or reported age at marriage since, given the trend in $\hat{\mu}$ across cohorts, the true μ for any cohort would be exaggerated. The trend would appear to occur earlier than was actually the case. Moreover, it is possible that heaping on current age is associated with actual age at marriage in some way. We think the most plausible explanation is that respondents of low socio-economic status are both more likely to heap their ages and more likely to marry early. In this event, $\hat{\mu}$ would be understated most among women in the older cohorts.

Both the situations just outlined could result in some exaggeration of any true upward trend in μ across cohorts. Nevertheless, an exercise to adjust for the possible impact of age misreporting on our results strongly indicates that age misreporting has had no systematic effect on our parameter estimates. When we redefine our age groups to identify cohorts centring on the ages likely to be heaped, we obtain results that are essentially the same as for conventional age groups. These results are given in table A1 and are depicted for Bangladesh and Korea in figure 6. In Korea, where age responses are generally of high quality, the re-grouping of current age has virtually no effect on the results. In Bangladesh, where age data are relatively poor, there is slightly more effect but the trend appears no matter how current ages are grouped.

4 Comparisons with Other Estimates

4.1 WFS ESTIMATES FOR THE INCOMPLETE EXPERIENCE OF COHORTS

As we noted above, a device widely used in first round analyses of WFS data on nuptiality has been to limit attention to women aged 25 and older and confine analysis to marriages occurring before age 25. Our results show that comparability is achieved in this way only at some cost. As figure 7 shows, the close association between these WFS-type estimates and our own is disturbed significantly in the late-marrying societies. The WFS-type result excludes significant remaining marriage experience in populations with late marriage, whereas our procedure takes advantage of the known age pattern underlying the first marriage process to complete the marriage patterns of the cohorts.

4.2 RETROSPECTIVE COMPARISONS WITH CENSUS MARITAL STRUCTURE

Since the World Fertility Survey individual questionnaires record ages at first marriage for ever-married women, while the household questionnaires provide proportions of women by their current ages who were ever married by the survey dates, it is possible to combine this information and thereby reconstruct for each cohort (age group) in a survey the proportions ever married by any date before the survey (Trussell 1980: 25–30; Flórez and Goldman 1980: 13–16). Because the information is available for single years of age at the time of each survey, it is straightforward to select age groups (cohorts) on current age which place those cohorts in standard age groups on the dates of censuses in the past.

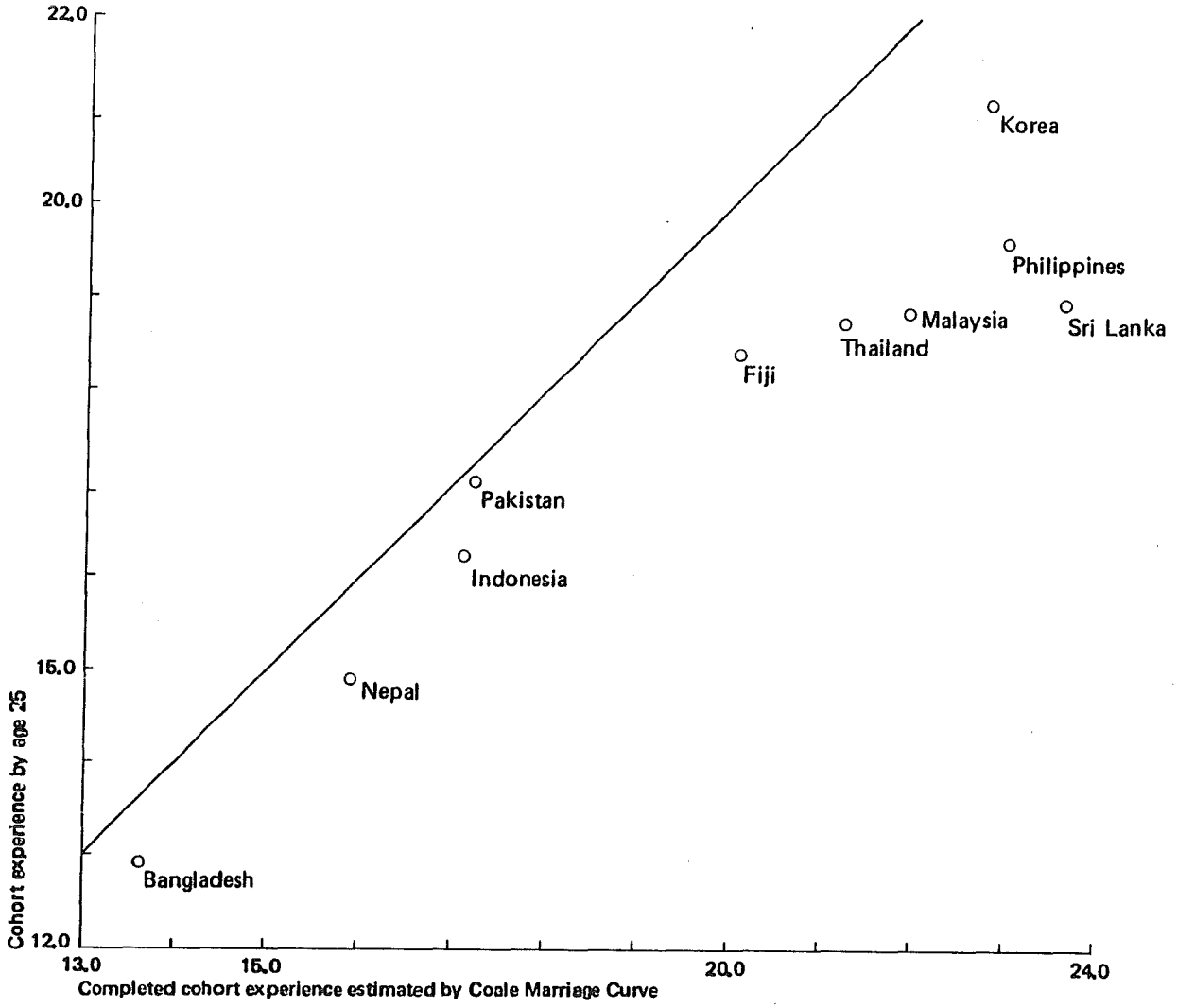


Figure 7 Alternate estimates of the mean age at marriage for cohort aged 25–29 at the time of survey, ten WFS countries

Table 6 Comparisons of census and WFS retrospective estimates of percentages ever married

Census year and basis for estimate	Age group						
	15–19	20–24	25–29	30–34	35–39	40–44	45–49
A Bangladesh							
1974							
WFS (1)	0.735	0.959	0.995	0.997	0.998	0.998	*
Census (2)	0.755	0.968	0.991	0.994	0.996	0.996	0.997
Ratio: (1)/(2)	0.974	0.991	1.004	1.003	1.002	1.002	*
1961							
WFS (1)	0.936	0.990	0.995	0.992	*	*	*
Census (2)	0.920	0.990	0.990	0.996	0.998	0.998	0.999
Ratio: (1)/(2)	1.017	1.000	1.005	0.996	*	*	*
1951							
WFS (1)	0.942	0.983	*	*	*	*	*
Census (2)	0.887	0.969	0.988	0.995	0.997	0.997	0.998
Ratio (1)/(2)	1.062	1.014	*	*	*	*	*
B Fiji							
1966							
WFS (1)	0.238	0.776	0.916	0.958	0.980	*	*
Census (2)	0.170	0.680	0.890	0.940	0.960	0.960	0.960
Ratio: (1)/(2)	1.400	1.141	1.029	1.019	1.021	*	*
1956							
WFS (1)	0.384	0.805	0.950	*	*	*	*
Census (2)	0.290	0.890	0.940	0.950	0.950	0.950	0.970
Ratio: (1)/(2)	1.324	0.904	1.011	*	*	*	*
C Indonesia							
1971							
WFS (1)	0.476	0.867	0.950	0.980	0.991	0.994	*
Census (2)[a]	0.430	0.852	0.963	0.983	0.988	0.989	0.999
Ratio: (1)/(2)	1.107	1.018	0.986	0.997	1.003	1.005	*
D Republic of Korea							
1975							
WFS (1)	0.036	0.472	0.907	0.986	0.994	0.996	*
Census (2)	0.026	0.375	0.882	0.979	0.993	0.997	0.998
Ratio: (1)/(2)	1.385	1.259	1.028	1.007	1.001	0.999	*
1970							
WFS (1)	0.045	0.470	0.929	0.994	0.993	*	*
Census (2)	0.029	0.428	0.903	0.986	0.996	0.998	0.991
Ratio: (1)/(2)	1.552	1.098	1.029	1.008	0.997	*	*
1966							
WFS (1)	0.050	0.566	0.969	0.994	0.995	*	*
Census (2)	0.039	0.484	0.923	0.990	0.997	0.999	0.999
Ratio: (1)/(2)	1.282	1.169	1.050	1.004	0.998	*	*
1960							
WFS (1)	0.125	0.758	0.982	*	*	*	*
Census (2)	0.0260	0.512	0.952	0.994	0.998	0.999	0.999
Ratio: (1)/(2)	4.808	1.480	1.032	*	*	*	*
1955							
WFS (1)	0.199	0.874	*	*	*	*	*
Census (2)	0.138	0.792	0.970	0.993	0.997	0.997	0.998
Ratio: (1)/(2)	1.442	1.104	*	*	*	*	*

[*Table continues*]

Table 6 (*cont*)

Census year and basis for estimate	Age group						
	15–19	20–24	25–29	30–34	35–39	40–44	45–49
E Malaysia							
1970							
WFS (1)	0.167	0.592	0.866	0.947	0.974	0.994	*
Census (2)	0.175	0.586	0.866	0.943	0.965	0.978	0.984
Ratio: (1)/(2)	0.954	1.010	1.000	1.004	1.009	1.016	*
1960							
WFS (1)	0.348	0.733	0.915	0.980	*	*	*
Census (2)	0.251	0.793	0.952	0.972	0.983	0.983	0.984
Ratio: (1)/(2)	1.386	0.924	0.961	1.008	*	*	*
1957							
WFS (1)	0.383	0.777	0.948	*	*	*	*
Census (2)	0.370	0.786	0.944	0.979	0.985	0.985	0.986
Ratio: (1)/(2)	1.035	0.989	1.004	*	*	*	*
F Nepal							
1971							
WFS (1)	0.648	0.922	0.977	0.986	0.994	0.988	*
Census (2)	0.607	0.921	0.974	0.986	0.989	0.991	0.992
Ratio: (1)/(2)	1.068	1.001	1.003	1.000	1.005	0.997	*
1961							
WFS (1)	0.664	0.894	0.959	0.976	*	*	*
Census (2)	0.738	0.946	0.981	0.990	0.992	0.994	0.995
Ratio: (1)/(2)	0.900	0.945	0.978	0.986	*	*	*
G Pakistan							
1972							
WFS (1)	0.329	0.836	0.949	0.972	0.984	0.993	*
Census (2)	0.345	0.787	0.927	0.964	0.979	0.984	0.992
Ratio: (1)/(2)	1.154	1.113	1.015	1.003	1.000	1.009	*
1961							
WFS (1)	0.618	0.906	0.974	0.986	*	*	*
Census (2)	0.534	0.880	0.949	0.970	0.974	0.978	0.980
Ratio: (1)/(2)	1.157	1.030	1.026	1.016	*	*	*
1951							
WFS (1)	0.767	0.950	*	*	*	*	*
Census (2)	0.544	0.823	0.936	0.961	0.966	0.976	0.977
Ratio: (1)/(2)	1.410	1.154	*	*	*	*	*
H The Philippines							
1975							
RPFS (1)	0.122	0.495	0.778	0.892	0.930	0.947	
Census (2)	0.124	0.488	0.756	0.878	0.917	0.931	
Ratio: (1)/(2)	0.984	1.014	1.029	1.016	1.014	1.017	
1970							
RPFS (1)	0.164	0.562	0.816	0.909	0.939	*	
Census (2)	0.108	0.497	0.785	0.882	0.920	0.927	
Ratio: (1)/(2)	1.519	1.196	1.039	1.031	1.021	*	
1960							
RPFS (1)	0.218	0.660	0.847	*	*	*	
Census (2)	0.127	0.557	0.805	0.884	0.919	*	
Ratio: (1)/(2)	1.717	1.185	1.052	*	*	*	

Table 6 (*cont*)

Census year and basis for estimate	Age group						
	15–19	20–24	25–29	30–34	35–39	40–44	45–49
I Sri Lanka							
1971							
WFS (1)	0.117	0.436	0.763	0.917	0.960	0.966	*
Census (2)	0.105	0.466	0.752	0.890	0.941	0.953	*
Ratio: (1)/(2)	1.114	0.936	1.015	1.030	1.020	1.014	*
1963							
WFS (1)	0.246	0.631	0.850	0.953	*	*	*
Census (2)	0.150	0.587	0.829	0.917	*	*	*
Ratio: (1)/(2)	1.640	1.075	1.025	1.039	*	*	*
1953							
WFS (1)	0.371	0.711	*	*	*	*	*
Census (2)	0.243	0.675	*	*	*	*	*
Ratio: (1)/(2)	1.527	1.053	*	*	*	*	*
J Thailand							
1970							
WFS (1)	0.207	0.631	0.847	0.923	0.952	0.967	
Census (2)	0.190	0.621	0.844	0.919	0.948	0.961	
Ratio: (1)/(2)	1.089	1.016	1.004	1.004	1.004	1.006	
1960							
WFS (1)	0.249	0.691	0.908	0.951	*	*	
Census (2)	0.138	0.613	0.859	0.933	*	*	
Ratio: (1)/(2)	1.804	1.127	1.057	1.019	*	*	
1960 (Adjusted)							
WFS (1)	0.249	0.691	0.908	0.951	*	*	
Census (2)	0.185	0.638	0.866	0.935	0.959	*	
Ratio: (1)/(2)	1.346	1.083	1.048	1.017	*	*	

*Not estimated.
[a]Provinces of Java-Bali only.

In table 6 (panels A–J) we present WFS estimates of the percentages ever married for conventional age groups on selected census dates, along with corresponding data from the censuses (taken from table 3 above).

Earlier exercises of this kind by Goldman, Coale and Weinstein (1979) with the Nepal Fertility Survey, Flórez and Goldman (1980) with the Colombia Fertility Survey, and Trussell (1980) with the Sri Lanka and Thailand surveys, produced similar patterns but different interpretations. In all these countries the reconstructed WFS percentages ever married were higher than the corresponding census percentages – sometimes considerably higher, notably in the younger age groups. (Trussell used the Thailand census data for 1960 without any adjustment for the Thai pattern of 'going to' age reporting (Chamratrithirong 1976), but our results show that the same general conclusions are supported by the adjusted 1960 census data for Thailand.) However, Goldman concludes that the census percentages ever married for Colombia are too low, while the detailed marriage history questions in the survey produced more accurate estimates. Trussell concludes that the WFS percentages ever married are too high, noting that in the case of Sri Lanka a reconstruction into the past based on 1971 census age at marriage responses agrees rather closely with earlier censuses while the Sri Lanka WFS reconstruction does not.

Our own results cover ten countries and 27 censuses – a total of 122 age group comparisons. The pattern in these data corresponds generally to the finding just cited; 99 of 122 WFS estimates exceed the corresponding census estimates. Clearly there is some tendency for censuses to record women as never married who would be recorded as ever married in a WFS-type interview. Still, the two sources show widespread agreement. Seventy-nine of the estimates agree within a five percentage point margin.

Of the 45 comparisons which differ by five percentage points or more, 23 involve age group 15–19 and all but two involve ages under 25. Also, in 40 of these 45 comparisons the WFS estimate of the percentage ever married is highest. These two patterns certainly suggest the presence of some kind of error in the data, but it is not clear whether the surveys or the censuses are deficient. As we have noted, Goldman *et al* and Trussell examine two WFS countries and make opposite assessments in this regard. More recently,

Table 7 Ratio of the proportion ever married in the WFS survey to the proportion ever married in the census, by age of cohort at the time of the WFS survey and at the time of the census

	Age in WFS survey					
Age in census	24–28	29–33	34–38	39–43	44–48	
A Bangladesh						
15–19		1.017		1.062		
20–24			1.000		1.014	
25–29				1.005		1951 census
30–34					0.996	
35–39						1961 census
40–44						
45–49						
B Fiji	23–27	28–32	33–37	38–42	43–47	
15–19	1.021		1.324			
20–24		1.019		0.904		
25–29			1.029		1.032	
30–34				1.141		1956 census
35–39					1.402	
40–44						1966 census
45–49						
C Rep. of Korea	16–20	21–25	26–30	31–35	36–40	41–45
15–19	1.400	1.548		1.272	1.442	
20–24		1.259	1.098		1.480	1.104
25–29			1.028	1.029		1.032 1955 census
30–34				1.007	1.008	1960 census
35–39					1.002	0.997
40–44						0.999 1970 census
45–49						1975 census
D Malaysia	19–23	24–28	29–33	34–38	39–43	44–48
15–19	0.952		1.385			
20–24		1.010		0.925		
25–29			1.010		0.961	
30–34				1.004		1.008
35–39					1.009	1960 census
40–44						1.016
45–49						1970 census
E Nepal	20–24	25–29	30–34	35–39	40–44	45–49
15–19	1.068		0.900			
20–24		1.001		0.945		
25–29			1.003		0.978	
30–34				1.000		0.986
35–39					1.004	1961 census
40–44						0.997
45–49						1971 census
F Pakistan	24–28	29–33	34–38	39–43	44–48	
15–19		1.157		1.410		
20–24			1.030		1.154	
25–29				1.026		1951 census
30–34					1.016	
35–39						1961 census
40–44						
45–49						

Goldberg (1981) has re-examined the Sri Lanka WFS data and concluded that the discrepancy in that survey arises from understatement of current ages rather than of ages at marriage. Even if we choose to accept the census results as accurate, we cannot readily conclude from presumed errors in the survey-based cross-section proportions ever married that the cohort $\hat{\mu}$s from the surveys are also biased. As Trussell notes (1980: 27), the impact of over-estimated proportions ever married on cohort mean ages at marriage is ambiguous since if the proportions by age for a cohort are too high by a constant factor there will be no effect on the cohort mean. Rearranging census and survey estimates on a cohort basis and recalculating WFS/census ratios (table 7) allows us to examine this possibility. This exercise is limited to the six countries (excluding Sri Lanka and Thailand already examined by Trussell) for which the timing of the censuses and the WFS survey permits alignment of age groups into cohorts.

For three of the six countries (Bangladesh, Korea and Pakistan) the pattern is very clear. Relative to the censuses the WFS responses overstate proportions ever married to a greater degree the further into the past estimates are made (compare entries within each column). Thus, taking the censuses as reference points, the degree of overestimation of proportions ever married (ie the degree of understatement of ages at marriage) is not constant but instead is greater for those who married youngest and furthest into the past. For the remaining countries differences are negligible or inconsistent in direction.

If this analysis is broadly correct we must conclude that our WFS cohort results include an unknown degree of exaggeration of any true upward trends in $\hat{\mu}$. Since uncertainty about the degree of underestimation of $\hat{\mu}$s at the early dates is combined with uncertainty about μ estimates for the youngest cohorts in the surveys, it is not possible to quantify the error or suggest suitable adjustments. Much depends on whether we choose to accept $\hat{\mu}$ results for the youngest cohorts based on 'fixed' or 'estimated' c levels. However, there seems to be no real doubt that the trend in μ is upwards.

5 Conclusion

5.1 SUMMARY

We conclude with a brief survey of our results, a few caveats, and a comment on the future of nuptiality patterns in the region.

An upward trend in the female age at marriage is indicated by all the available data, so that conclusion seems firmly buttressed and is merely corroborated by the analysis presented here. This mutual reinforcement by corroborating estimates of several kinds is important since each of the estimates is deficient in some important way. Census marital structures are synthetic in character and describe indeterminant periods before the censuses. Survey estimates suffer from the usual problems of age truncation and event censorship. And the approach taken in the WFS First Reports – comparison of the truncated marriage experiences of cohorts aged 25 and over – is useful but somewhat misleading for late-marriage countries where many events occur after age 25. Moreover, nothing can be said about the cohorts under age 25.

The Coale age model of nuptiality provides valuable additional information in the form of projections of the experience of the younger cohorts – just the cohorts in which we are most interested. However, three caveats are necessary. First, considerable judgement is required in interpreting the parameter estimates for the youngest cohorts, much hinging on the choice of c values. This is not an overwhelming problem for most Asian societies where c uniformly is very close to unity and there is no reason to suspect any decline in c among recent cohorts. In societies or regions where c is more variable – Europe and Latin America, for example – the difficulty will be correspondingly more serious. Secondly, we also note that the upward trend in μ is likely to overstate the true upward trend, at least slightly, wherever heaping on current age is prevalent. This effect is apparently unimportant in the Asian data examined here. Thirdly, we find a source of systematic bias in the age at marriage responses in the WFS surveys examined here – a bias which results in too low estimates of μ among older cohorts.

The last two points suggest some overestimation of any true upward trend in μ, but the effect is probably small. However, the uncertainty over c values presents a more serious complication in assessing future trends.

5.2 THE FUTURE

We began by noting that the population of Asia and the Pacific has long been characterized by considerable variation with regard to marriage timing but virtual uniformity with regard to the prevalence of marriage. The timing of marriage varies a great deal, yet nearly everyone marries eventually. These traditional features of Asian and Pacific marriage patterns present an interesting contrast with the marriage systems traditional across northern and western Europe before the 19th century. There the timing of marriage was remarkably uniform, with mean ages for females of about 25–26 years, but the prevalence of marriage varied from near universal levels in some countries to certain rather extreme situations (the Irish case is well known) where no more than 75 per cent of a cohort married. Research suggests that the principal differences between Europe and Asia that underlie these contrasting nuptiality patterns relate to the close connection in Europe – generally absent in Asia – between material resources, marriage, and household formation. The rules of property devolution which establish these connections in Europe are very different from those which prevail over much of Asia.

It is worth noting that the central problem we have confronted here in projecting the marriage experience of cohorts – that of anticipating proportions ultimately marrying – is a pivotal substantive issue as well as a methodological one. In this study we have assumed continuing very high levels of c throughout Asia, because this seems the most plausible assumption to make. But it should be recognized that the determinants of celibacy in Asian and other non-European settings are not well understood. If the forces operating so uniformly throughout Asia today produce not only later marriage but less marriage as well, the future course of nuptiality would be affected quite dramatically.

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Appendix A - Parameter Estimates Based on Non-Standard Age Groups

Table A1 Estimates of the mean and standard deviation of the age at marriage and the proportion eventually marrying, by special age groups, both household and individual data, nine WFS countries

Age group	Type of estimate of c	$\hat{\mu}$	$\hat{\sigma}$	$\hat{c}$	$\hat{SE}\hat{M}$	$\hat{SE}\hat{\sigma}$	$\hat{SE}\hat{c}$	p-value (HH and I)
A Bangladesh								
23–27	estimated	13.6	3.3	0.992	0.104	0.089	0.004	0.255
28–32	estimated	13.1	3.0	0.998	0.105	0.088	0.002	0.220
33–37	estimated	13.2	3.4	0.996	0.146	0.125	*	0.005
38–42	estimated	12.9	3.0	0.999	0.128	0.109	0.002	0.290
43–47	fixed (c = 0.996)	13.2	3.3	0.996	0.146	0.146	*	0.004
B Fiji								
23–27	estimated	20.9	4.9	1.006	0.232	0.194	0.019	0.027
	fixed (c = 0.968)	20.6	4.7	0.968	0.143	0.120	*	0.023
28–32	estimated	19.5	4.4	0.982	0.152	0.131	0.007	0.010
33–37	estimated	19.1	4.4	0.970	0.163	0.139	0.007	0.399
38–42	estimated	18.8	4.4	0.980	0.174	0.150	0.005	0.014
43–47	estimated	18.6	4.6	0.991	0.207	0.184	0.004	0.246
C Indonesia								
23–27	estimated	17.8	5.4	1.020	0.213	0.184	0.011	0.000
	fixed (c = 0.990)	17.4	5.0	0.990	0.117	0.096	*	0.000
28–32	estimated	16.6	4.7	0.963	0.138	0.115	0.006	0.032
33–37	estimated	16.3	4.6	0.987	0.125	0.104	0.003	0.053
38–42	estimated	16.1	4.5	0.990	0.125	0.103	0.003	0.000
43–47	estimated	162	4.4	0.995	0.136	0.111	0.002	0.001
D Malaysia								
23–27	estimated	22.8	6.8	1.034	0.250	0.278	0.030	0.188
	fixed (c = 0.986)	22.3	6.4	0.986	0.180	0.145	*	0.066
28–32	estimated	20.8	6.0	0.977	0.232	0.198	0.011	0.070
33–37	estimated	19.6	5.5	0.973	0.176	0.151	0.006	0.009
38–42	estimated	18.8	4.8	0.978	0.159	0.136	0.005	0.000
43–47	estimated	17.9	4.7	0.990	0.164	0.138	0.003	0.046
E Republic of Korea								
23–27	estimated	24.3	4.8	1.172	0.224	0.191	0.028	0.000
	fixed	22.9	3.8	0.998	0.073	0.067	*	0.486
28–32	fixed	22.5	3.7	0.998	0.092	0.068	*	0.027
33–37	estimated	21.5	3.7	0.998	0.104	0.080	0.002	0.006
38–42	estimated	19.8	3.4	0.997	0.107	0.086	0.001	0.000
43–47	estimated	17.8	2.7	0.995	0.097	0.082	0.001	0.511
F Nepal								
23–27	estimated	16.3	4.7	1.020	0.151	0.131	0.006	0.000
	fixed (c = 0.992)	16.0	4.5	0.992	0.130	0.106	*	0.000
28–32	estimated	16.0	4.7	1.000	0.147	0.123	0.003	0.000
33–37	estimated	16.3	4.7	0.994	0.180	0.148	0.004	0.359
38–42	estimated	16.4	4.9	0.998	0.175	0.143	0.002	0.001
43–47	estimated	16.9	5.2	0.994	0.230	0.190	0.004	0.000
G Pakistan								
23–27	estimated	17.1	4.1	0.937	0.168	0.140	0.011	0.000
	fixed (c = 0.968)	17.4	4.4	0.968	0.156	0.133	*	0.000
28–32	estimated	16.8	4.0	0.967	0.141	0.115	0.006	0.004
33–37	estimated	16.4	3.9	0.974	0.156	0.127	0.006	0.001
38–42	estimated	15.7	3.6	0.986	0.146	0.121	0.005	0.062
43–47	estimated	15.8	3.3	0.993	0.136	0.110	0.003	0.066

Table A1 (*cont*)

Age group	Type of estimate of c	$\hat{\mu}$	$\hat{\sigma}$	$\hat{c}$	$\hat{SEM}$	$\hat{SE\sigma}$	$\hat{SEc}$	p-value (HH and I)
H Philippines								
23–27	estimated	21.2	4.8	0.724	0.189	0.156	0.015	0.002
	fixed (c = 0.939)	23.6	6.7	0.939	0.159	0.141	*	0.001
28–32	estimated	21.9	5.5	0.892	0.159	0.137	0.010	0.001
33–37	estimated	21.6	5.5	0.929	0.149	0.126	0.007	0.000
38–42	estimated	21.0	5.3	0.943	0.141	0.117	0.007	0.004
43–47	estimated	21.2	5.2	0.950	0.146	0.120	0.006	0.004
I Sri Lanka								
23–27	estimated	24.0	7.9	0.898	0.483	0.364	0.036	0.000
28–32	estimated	22.5	7.5	0.930	0.292	0.242	0.015	0.000
33–37	estimated	21.1	6.7	0.970	0.236	0.181	0.008	0.001
38–42	estimated	20.2	6.2	0.956	0.204	0.174	0.007	0.008
43–47	estimated	20.2	5.9	0.980	0.188	0.154	0.005	0.000

*Not available.
Source: NUPTIAL results for WFS data sets