The Measurement of Fertility

I. Introduction

Analysis of fertility often proceeds with little regard for the validity and reliability of the measurement of the dependent variable -- fertility. While fertility is a clearly observable behavior there are choices that are required regarding the reference period, unit of analysis, and level of analysis that are applicable. Decisions regarding these choices should be based on both theoretical aims of the study and data availability.

Our main concern here is to study the determinants of fertility at the **individual level**. We therefore concentrate on individual level measures of fertility, although at several stages of the descriptive analysis we also present aggregate measures of fertility. The data used -- national censuses -- restricts our choice of individual fertility measures. We cannot, for example, undertake analysis of birth-interval data, (see Rindfuss et al. 1987) as this is not collected, and cannot as yet be reliably constructed from the census data we employ.

In fact, fertility data collected from censuses are usually very limited. In most of the eight censuses we deal with here the only information collected is the number of children-ever-born; a cumulative or cohort measure of fertility. The time reference for fertility measures based on this information vary according to the time in which women have been involved with childbearing, most commonly a function of the age of the women. There are a number of aggregate measures of period fertility -- ie., fertility estimates that refer to a fixed reference period -- which can be estimated from children-ever-born data, or from information on the numbers of children and women at specified age groups (Hill, 1981; U.N., 1983; Rele, 1987). These measures are, however, aggregate and therefore cannot be employed in examining the determinants of individual levels of fertility.

The two measures chosen for this study are children-ever-born, and a period measure of recent fertility derived from a procedure which involves matching children with mothers so that an indication of the timing of fertility, based on the age of the child, can be obtained. In the following sections I will outline these two measures and detail the attempts that have been made to evaluate the quality of the data.

II. Children-Ever-Born

a) Measurement Issues

While children-ever-born is the most frequent type of fertility information collected in censuses, and can be utilized for both individual and aggregate analysis, it is not without measurement problems. Shyrock and Siegel (1976) note a number of possible sources of error that may occur in the collection of children-ever-born information: women, especially at older ages, may not be able to correctly recall the number of children they have borne, particularly those children who died at young ages or who have left home (Seltzer, 1973); women may selectively omit children, for example illegitimate children, when they recall children-ever-born; alternatively, women may include children to whom they are not the biological mother, for example, step-children; and, in instances where the person recalling the number of children-ever-born is not the mother of the children, errors may occur due to lack of knowledge. In general, however, such sources or error are likely to be relatively minor (Shyrock and Siegel, 1976).

One exception that has received some attention, and in many instances is related to the information about children-ever-born being collected from individuals other than the mother (U.N., 1983:230), is the situation in which large numbers of ever-married women are recorded as providing a `not-stated' answer to the question of children-ever-born. El-Badry (1961) has noted that in these instances many of the women are probably childless as enumerators often fail to record a response, and therefore a code of `not stated' is given, when a women says she has never borne children. If these women are excluded from the calculation of mean CEB the resulting estimate will be biased upwards. Inclusion of these women, by setting their parity to 0, will result in an under-estimate of mean parity as it is likely that a proportion of the women are, in fact, childless. El-Badry (1961) has proposed a correction which is based on estimating the proportion of women recorded as `not stated' who are likely to childless. The technique is based on the observation that across age groups there is a usually a linear relationship between the proportion of women who report 0 parity and those who are coded `not stated'. The parameters -- constant and slope -- of a line

fitted to the series of points detailing the proportion of women childless and not stated can then be used to adjust upwards the number of women who report they are childless. This technique is suitable only for adjusting aggregate measures of average parity.

b) Evaluation of Data

I) Internal Consistency

Of the eight censuses used in the current study there are significant proportions of ever-married women who report `not stated' for children-ever-born in five of the censuses. In Malaysia in 1970 and 1980, 4.5 percent and 4.6 percent respectively, of ever-married women are coded as `not stated'. An even higher percentage is reported for Thailand, where in 1970, 5.1 percent and in 1980, 6 percent of ever-married women are recorded as `not stated'. Finally, in Indonesia in 1971, 9 percent of ever-married women are coded `not stated' for children-ever-born. With the exception of 1971 Indonesia census we have excluded these women from our analyses rather than assigning their parity as 0, or applying an adjustment factor. Our rationale for this action is that exclusion of the women with parity not reported provides a closer `fit' to estimates of mean children-ever-born published by the respective national statistical offices and/or other sources (see Jabatan Perangkaan Malaysia, 1977 and 1983, for Malaysia: Arnold et al. 1978, U.S. Department of Commerce, 1978, and Chayavon et al. 1988, for Thailand). In keeping with this rationale we have recoded `not stated' values for Indonesia in 1971 to 0 (see Cho et al, 1980, and Adioetomo, 1984). If women who report `not stated' constitute a select sample of women then average measures of cumulative fertility may be biased upward to some degree.

In Table 1 are displayed, by age group, the percentage of ever-married women who had a `not stated' or `unknown' value on CEB for the 5 five Southeast Asian censuses where the percentage exceeded 1 percent. With the possible exception of Thailand in 1970, the pattern of responses across age groups -- with decreasing proportions coded `not stated' or `unknown' at each successive age group -- indicate a

situation in which, at the younger ages, a substantial proportion of women with no response are likely to have had no children. The bias is most extreme for the 1971 Indonesian census, the case where we did assign zero to the `not stated'. For the other censuses, the subsample of women with `unknown' fertility probably does exclude some women whose true value is zero, is especially severe at the youngest ages.

We also exclude the very small number of cases -- less than 0.1 percent for all censuses -- in which children-ever-born is reported to be 20 or over. As questions on children-ever-born are asked only to ever-married women in all the censuses we record the CEB for never-married women as 0.

Table 1

Percentage Distribution by Age Group of `Not Stated' and `Unknown' Values on Children-Ever-Born, for Ever-Married Women: Malaysia 1970 and 1980, Indonesia 1971, and Thailand 1970 and 1980

Age Group	CENSUS				
	Indonesia 1971	Peninsular Malaysia 1970	Peninsular Malaysia 1981	Thailand 1970	Thailand 1980
15-19	25.3	20.7	8.9	4.4	16.6
20-24	11.4	7.3	7.2	11.5	9.9
25-29	7.3	3.7	4.8	5.8	6.4
30-34	6.1	2.7	4.1	3.6	4.4
35-39	6.2	2.4	3.2	2.9	3.6
40-44	7.0	2.5	3.8	3.3	3.5
45-49	6.8	2.4	3.4	3.4	3.7
Total	9.0	4.5	4.6	5.1	6.0

II) Comparison With Published Results

In Table 2 we compare our estimates of children-ever-born from the microdata files with other published estimates from independent data sources for similar time periods. The 1970 figures are displayed in the top panel of Table 1 while in the bottom panel we display 1980 estimates. The estimates in all cases

Table 2
Comparison of Children-Ever-Born to Ever-Married Women, by Age, for 1970 and 1980 Round of Censuses and Published Data for Similar Periods: Malaysia, Indonesia, the Philippines, and Thailand

	1970							
	Indonesia		Malaysia		Philippines		Thailand	
Age	1[a]	2[b]	1[c]	2[d]	1[e]	2[f]	1[g]	2[h]
15-19	0.6	0.6	0.8	0.9	1.1	0.7	0.7	0.7
20-24	1.7	1.7	1.7	1.9	1.8	1.6	1.5	1.8
25-29	2.8	3.0	2.8	3.3	3.2	2.8	2.8	3.1
30-34	4.0	4.2	4.2	4.6	4.6	3.9	4.1	4.4
35-39	4.8	4.8	5.5	5.7	5.7	4.9	5.8	5.6
40-44	5.3	4.9	6.1	6.1	6.2	5.3	6.5	6.4
45-49	5.2	4.9	6.2	5.8	6.2	5.5	6.5	6.5
Total	3.5	3.5	4.2	4.3	4.6	3.6	4.5	4.3
	1980							
	Indonesia		Malaysia		Philippines		Thailand	
Age	1[i]	2[j]	1[k]	2[l]	1[m]	2[n]	1[o]	2[p]
15-19	0.6	0.6	0.7	0.8	0.9	0.7	0.7	0.7
20-24	1.7	1.5	1.7	1.5	1.9	1.6	1.4	1.4
25-29	2.8	2.8	2.7	2.4	3.0	2.6	2.1	2.3
30-34	4.0	3.9	4.3	3.6	4.3	3.6	3.1	3.3
35-39	4.8	5.0	5.6	4.7	5.7	4.7	4.2	4.2
40-44	5.3	5.3	6.3	5.6	6.7	5.4	5.3	5.1
45-49	5.2	5.4	7.1	5.9	7.0	5.6	6.1	5.5
Total	3.5	3.8	4.5	3.7	4.6	3.5	3.3	3.3

Sources: [bdfh] - Microdata samples of 1970 Rounds of Censuses. [a] 1976 Indonesian Fertility Survey, (Hodgson and Gibbs, 1980). [c] 1974 World Fertility Survey, (Hodgson and Gibbs, 1980). [e] 1968 National Demographic Survey, (ESCAP, 1978). [g] - 1969/70 Longitudinal Surveys, (Debavalya and Knodel 1978). [jlnp] - Microdata samples of 1980 Rounds of Censuses. [i] 1976 Indonesian Fertility Survey, (Hodgson and Gibbs, 1980). [k] 1976/77 Malaysian Family Life Survey, (Goldstein and Goldstein, 1983). [m] 1978 National Demographic Survey, (NCSO, 1979). [o] - 1981 Contraceptive Prevalence Survey, NIDA (1985).

refer to children-ever-born for the sample of ever-married women. The availability of comparable data for some countries, most notably Indonesia, makes exact comparisons difficult. For example, for Indonesia, 1976 data from the Indonesian Fertility Survey, which was restricted to the most populous islands of Java and Bali, are used to compare both 1971 and 1980 census results.

In Thailand, where the comparisons in terms of period of measurement are the closest, the age-specific measures of children-ever-born obtained from the census and surveys are very similar. In 1970 the census estimates for younger age groups are slightly higher than those of the survey while the reverse situation holds for the middle age groups. In 1980 the two series of estimates are very similar except for the oldest age group were the census estimate is approximately one-half a child below that of the survey estimate.

A tendency of apparent under-reporting of children-ever-born for older women can be seen in the data for Malaysia, especially for 1980. To some extent however, the differences in this case may result from distorted mean parity reports from the 1976/77 Malaysian Family Life Survey which was not fully representative of the population of Peninsula Malaysia, with 3 of the 52 primary sampling units being purposively selected, and which had a small sample size, especially when broken down by age categories (Butz and DaVanzo, 1978). The 1970 comparisons shown in the top panel of Table 2, while providing some cause for concern at older ages, are more acceptable.

The ability of surveys, with their more highly trained, paid, and motivated staff, to obtain more accurate responses on children-ever-born than are obtained in censuses (Seltzer, 1973), has been used in the Philippines to explain the large differences in

values of children-ever-born between survey and census results, especially for older women (NSCO, 1979:88). These differences, which can be seen in Table 2, are substantial, especially 1980 comparisons. For example, the 1980 Philippines census estimate of mean children-ever-born for women aged 45-49 was 5.6, however, the estimate for the same age group from a 1978 national survey was 1.4 children higher -- 7.0. For this age group cumulative fertility can be expected to be fairly stable over a two year period. It is likely therefore, given the factors listed above, that cumulative fertility is under-reported at older ages in the Philippines. It should be noted that a similar tendency for under-reporting is evident in 1970 and therefore comparisons of change of CEB between 1970 and 1980 may not be invalid.

A related problem is that the tendency to under-report cumulative fertility is may be correlated with characteristics of women. The possible bias is examined with a comparison of data from the 1980 Philippines census and the 1978 Republic of the Philippines Fertility Survey (RPFS) in Table 3, where mean parity is cross-tabulated by education and age.

The pattern of differences in under-reporting by educational level are not consistent. Only at the oldest ages -- women older than age 34 -- is there a clear decline in the differences in CEB reported from the two sources, and even at these ages women with a college degree exhibit a large difference than those with only some college. At the youngest age there is no clear pattern in the differences in CEB across educational categories, although the absolute differences in some instances are substantial.

Table 3
Comparison of Mean Parity by Education and Age Group: 1978 Republic of the Philippines Fertility Survey (RPFS) and 1980 Philippines Census

EDUCATION	Age Group											
	15-24			25-34			35-44			45-49		
	RPFS	Cen	%Diff	RPFS	Cen	% Diff	RPFS	Cen	% Diff	RPFS	Cen	%Diff

None	1.66	1.44	**-13**	3.71	3.45	**-7**	6.67	5.08	**-24**	7.86	5.47	**-30**
Primary	2.09	1.55	**-26**	4.32	3.71	**-14**	7.01	5.67	**-19**	7.56	6.17	**-18**
Intermediate	1.72	1.49	**-13**	3.94	3.41	**-13**	6.35	5.37	**-15**	7.17	5.91	**-18**
High School	1.60	1.31	**-18**	3.26	2.80	**-14**	5.54	4.73	**-15**	6.18	5.43	**-12**
Some College	1.09	1.09	**0**	2.54	2.38	**-6**	4.16	3.95	**-5**	5.35	4.76	**-11**
Completed College	1.21	0.99	**-18**	2.25	2.03	**-10**	3.79	3.34	**-12**	4.86	4.08	**-16**

Sources: 1980 Microdata sample of the Philippines Census and NSCO (1979)

The main conclusion to be drawn from an evaluation of the internal and internal consistency of children-ever-born data from censuses is that they should be treated with care. At older ages, especially for women aged 45-49, there is a tendency for children-ever-born to be understated. This tendency appears to vary across countries, being most apparent in the Philippines, and least of a problem in Thailand. It is also likely that the probability of understatement of CEB will be related to socio-economic status, although this appears to be confined to women at older ages. This was found to the case in the Philippines where we compared distributions on mean parity from two sources across categories of age and education. For reasons cited above we exclude the oldest group of women -- those aged 45-49 -- from most of our analyses.

III. Own-Children Measures of Recent Fertility

A common aim of research is to explain fertility behavior in terms of individual characteristics. The individual characteristics that are deemed to be important determinants of fertility are often changeable, for example individuals often change occupations, place of residence, etc. during the period in which they are making fertility decisions. A cumulative fertility measure, such as children-ever-born, summarizes the result of behavior, and factors that influence that behavior, over extended periods of time. Using a cumulative fertility measure can therefore create problem in trying to establish the correlates of fertility because of difficulties in establishing the temporal sequencing of fertility and events hypothesized to affect

fertility. An alternative is to concentrate on fertility that has only recently occurred. This enables the researcher to more accurately specify the timing between individual and aggregate characteristics, and fertility. In this study we derive a measure of recent fertility which refers to behavior occurring in the period 1 to 4 years before the census.

The study of the determinants of recent fertility is often restricted by data availability. In particular, models of recent fertility determination which attempt to provide national or country-level estimates of the dynamics underlying recent fertility, or the contextual effects on fertility, are often hampered by the size and geographical constraints of available data. The most appropriate source of data in such cases are census data. However, census data are usually limited in the amount of information available on recent fertility. To overcome this limitation a number of census-based measures of recent fertility have been derived. A widely used technique is the own-children method.

Recent fertility data obtained from this method have been most widely employed at an aggregate level which usually limits the analysis to crosstabulations. The same own-children method can be employed to generate measures at the individual level, however, a number of methodological problems occur which must be addressed. While these problems also occur in an aggregated framework, the application of adjustment techniques is more difficult at the individual level.

a) Matching Children with Mothers

The own-children method was developed in order to obtain aggregate period fertility estimates from census data (Cho, 1973). The underlying principle is that census data where individuals are grouped in households allow for matching mothers and their children, by age of both the mother and children, and therefore the estimation of age-specific fertility for recent years. The original applications of this method were based on indirect matching by inferring "the mother-child link from information on relationship to the head of the household and from the compatibility between the age of the presumed mother and those of her children" (UN, 1983:183).

Many recent censuses have improved the range of questions and the coding of family relationships. Some censuses include a direct question to match each child with their own mother in the household.

The own-children method has undergone a series of modifications since it was first proposed. Most of these modifications are, however, directed towards adjustment of the results of the own-children data so that more accurate measures of aggregate fertility can be obtained. For example, procedures meant to adjust for age misreporting and under-enumeration were developed by Retherford, et al. (1978). Some research has also been done to examine how alternative specification of relationships used for matching might affect the accuracy of the matching procedure (Levin and Retherford, 1982).

An extension of the own-children technique that is meant to allow birth interval analysis has been recently suggested (Luther and Cho, 1987). This technique, which involves `filling in' the own-children information through application of probablistic models which would permit estimation of deceased and missing (non-matched) children, is carried out for individual women although the authors note that the aim of the procedure is to "reflect accurately birth intervals and parity progression ratios in the aggregate, rather than for individual women" (Luther and Cho, 1987:4).

For the eight southeast asian censuses in this study logical methods were used to match children and mothers. The matching rules were based on those used in previous research. For a child to be matched with a mother several conditions had to be met: the child had to be aged 0 to 4, the potential `mother' had to be aged between 15 and 49, and the relationship to head to household (or in the case of Malaysia in 1970, head of family), had to indicate a logical link between a mother and child. For example, a women who was aged between 15 and 49 and who was listed as the spouse of the head of the household was eligible to be the mother of any child aged between 0 and 4 who was identified as a child of the head of the household. Similarly, a grandchild of the head of the household could be the child of a married daughter of the head, or a daughter-in-law of the head of the household. In situations such as this, where more

than one possible mother was available, the child was matched to the first eligible mother in the household listing. The age of each matched child was attached to the individual record of his/her `mother'.

It should again be stressed that the goal of this study is to examine the fertility of women in their reproductive years -- i.e., our unit of analysis is women aged 15-49 -- therefore children were not matched if they were living in households in which there was no woman aged 15-49. Children who were living in a household in which there was a woman aged 15 to 49 but who could not be matched to a `mother' has information on their unmatched status, and age, attached to the record of the first woman aged 15-49 found on the household listing. The data on `unmatched' children are used to adjust some of the aggregate measures of fertility.

The 1980 censuses of Indonesia, the Philippines, and Thailand, permitted a refinement of the matching technique in that on each child's record the record number of the child's mother was recorded. For these three censuses a two stage process was employed; first, those children who could be directly linked to mothers through a comparison of record numbers were matched; secondly, the matching procedure based on relationship to household head was applied in those situations where a record number match was not possible. The reason why the second procedure was adopted in addition to the direct matching was to ensure comparability in matching with the previous censuses and because missing values existed for the variables which allowed direct matching.

b) Measurement Problems

There are three major problems involved in the application of the own-children technique: matching difficulties, especially where mothers and children live in separate residences, problems of census enumeration and coverage; and child and maternal mortality. Each of these problems has been addressed in studies which use the own-children estimates to study aggregate patterns of fertility.

Studies which examine the **determinants of individual variations** in recent

fertility are much less frequent, perhaps because of the extra constraints imposed by the assumptions of the method when multivariate analysis is attempted. For example, Rindfuss and Sweet (1977) undertake numerous adjustments to their own-children data when their analysis is based on aggregate own-children fertility measures, however, for their individual level analysis of fertility -- measured as own-children aged less than 3 -- they can make no adjustments of the data. They note that the lack of information of the effects of potential sources of error are not available at the individual level and therefore precludes data adjustment. Swicegood et al. (1988) who also use own-children aged less than 3 as their measure of recent fertility, appear to have made no adjustments to their measure nor do they discuss potential problems. In the following section, we outline some of the ways in which aggregate level studies have attempted to deal with these problems.

i) Underenumeration of Children and Mothers

Two major problems of miss-enumeration exist. One is the underenumeration of young children, and the second is the misstatement of ages of both mothers and children. Given that underenumeration is most common for the youngest children, underestimation will be highest for the most recent period estimates of fertility. Similarly, misstatement of ages resulting in age-heaping, for example the well reported situation of children aged less than 1 being recorded as age 1 (Shyrock and Siegel, 1976:114), will result in artificial swings in estimates of recent fertility. To overcome these problems researchers typically aggregate over several ages, and/or avoid estimates based on the youngest children (Cho et al., 1980, Rindfuss and Sweet, 1977). Another way of overcoming under-enumeration is to adjust the numbers of children and, if necessary, mothers, by estimates of the extent of underenumeration, if known (Retherford et al., 1978).

Table 4 displays, for each of the eight censuses, the percentage distribution of own-children across ages 0 to 4. For the five year period we would expect the percentages to be approximately equal or, since fertility has generally been declining, to increase with

age. The omission of infant/child deaths would bias the results in the opposite direction. Only for one census, Indonesia 1971, does there seem to be a major violation of this expectation, with only 13 percent of the matched children aged less than 1, in comparison to the expected 20 percent. Cho et al. (1980) estimate that the 1971 Indonesian census included an undercount of between 40 and 45 percent of children aged less than 1. The results shown here would tend to support their argument.

Table 4

Percentage Age Distribution of Children Aged 0-4 Living in Household With a Woman Aged 15-49 matched with their `mother': by Census

	Distribution of Matched Children Age					
Census	0	1	2	3	4	Total
Indonesia 1971	13	21	22	21	23	100
Indonesia, 1980	19	19	21	21	20	100
Malaysia, 1970	20	19	21	20	20	100
Malaysia, 1980	18	21	20	21	20	100
Philippines, 1970	18	21	21	20	19	100
Philippines, 1980	23	21	20	19	18	100
Thailand, 1970	22	20	19	19	19	100
Thailand 1980	19	19	20	21	22	100
					Total	19 20 21

Sources: Microdata census files

The results for the other seven censuses conform more or less to the general expectation. The distribution for the Philippines in 1980 is somewhat surprising but there is some indication of an increase in fertility between 1975 and 1980 (see Miralao

in this volume). The possible problems of underenumeration for Indonesia in 1971 would suggest, however, that where possible the own-children measure should not include children aged less than 1 so our measure of recent fertility includes only children aged 1-4 -- which represents births from one to five years before the census.

ii) Children and Mothers Living Apart

The second of the matching problems in the own children method is the separate residence of mothers and children. This problem is most likely to cause problems where indirect matching of mothers and children is necessary. In this instance, a proportion of the matched `mothers' will not be the biological mothers. For example, in societies where it is a common practice for children to live with their grandmothers, the grandmothers may be classified as the `mothers' of their grandchildren. Even where mismatching does not occur in a situation of separate residence of mother and child, the problem of being unable to make a match remains.

Another situation in which a mismatch is likely to occur, or where no match can be made, is where a child is separated from their mother through the death of the mother. However, even in Indonesia where mortality rates are the highest in the region, crude death rates for women were, in 1972, below 5 per 1000 for every age group from 15-19 to 30-34 -- the ages in which most fertility is likely to occur (ESCAP, 1986). Therefore, maternal mortality is likely to result in a very small proportion of mismatches or non-matches.

Some idea of the scope of matching problems can be obtained by examining the proportion of children that could be matched to their presumed mother. The results of this comparison for the eight censuses used here can be seen in Table 5. In general the proportion of enumerated children matched declines with the age of children, this is to be expected (Hill, 1981), as older children are more likely to be adopted out, or be living with other kin. The percentage of cases matched is impressive. Only for Malaysia in 1980, Indonesia in 1971, and Thailand in 1980, do the percentages matched fall under 95 percent, and the smallest percentage matched -- for Malaysia in

1980 -- approaches 90 percent.

It is difficult to locate specific reasons why, for any one country, proportions matched should vary across census years. We would not normally expect large scale changes in the proportions of young children residing with parents over the decade of the 1970s, although this is what seems to have occurred in Thailand (Mason and Martin, 1985). In some cases the change might be due to the information available for matching. For example, the largest disparities occur for Malaysia where there was a 5 percent decline in percent matched between 1970 and 1980. In the 1970 Malaysian census information was available on relationships within primary and secondary families in households (Jabatan Perangkaan Malaysia, 1977). A primary family unit was the nuclear family which included the head of the household. A secondary family unit was another nuclear family that resided in the same household as the primary unit. Typically, secondary family units would be related to the primary unit, for example the family of a married child of the household head. In the 1980 census, however, relationship data refers to the head of the household without reference to family units.

Table 5

Percentage of Children Aged 0-4 Living in Household With a Woman Aged 15-49 matched with their `mother': by Census and Age of Child

Census	Age 0	1	2	3	4	Total
Indonesia 1971	93	92	92	91	91	92
Indonesia, 1980	96	96	96	95	95	96
Malaysia, 1970	96	96	95	95	94	95
Malaysia, 1980	90	89	89	90	89	90
Philippines, 1970	97	97	96	96	95	96
Philippines, 1980	97	97	97	97	97	97
Thailand, 1970	97	96	96	96	95	96
Thailand 1980	92	92	92	92	92	92

Per

Total	96	96	96	95	95	96

Sources: Microdata census files

To date there has been little research which examines the propensity of children to live apart from their mother in these four societies. One exception is a recent study by Mason and Martin (1985), who examine living arrangements in six Asian countries. They analyze patterns in three of the countries included in this study; the Philippines, based on a sample of the 1975 census; Thailand, with data from the microdata samples of the 1970 and 1980 Thai censuses; and Indonesia using data from the 1976 inter-censual survey (SUPAS).

Their analysis, which concentrates on females, shows that in Thailand, compared to the other societies they examine, there is a much larger percentage of females aged 0 to 4 classified as grandchildren of the head of the household -- 15 percent in 1970 and 22 percent in 1980, compared to 11 percent for the Philippines and 8 percent for Indonesia. In all three societies 96 percent, or over, of females aged 4 or less were classified as either children or grandchildren of the head of the household.

Children and grandchildren are the easiest to match with mothers as the relationships are comparatively unambiguous, however, some grandchildren live in households where there mother is not present. Mason and Martin (1985) argue that the high percentage of Thai children living with grandparents results from the significant and increasing proportion of Thai women who follow the cultural norm of matrilocality. The increase in the proportion of Thais living as grandchildren may reflect patterns of migration of young women who leave their children to the care of their grandparents. This latter explanation might help explain the decline in matching that occurred for Thailand between 1970 and 1980 (see Table 5). The proportion

unmatched in Thailand in 1980 is similar to the percentage unmatched in other own-children studies based on 1980 census data (Arnold et al. 1985).

iii) Mortality

The final problem of estimating recent fertility based on the own-children method has to do with biases introduced through the role of mortality. We have already noted that maternal mortality can create matching problems. However, the problems are much more general. Censuses enumerate the population alive at a particular point in time while our fertility estimates refer to periods before the census. Those women and children who died between the time at which the fertility estimate refer and the date of the census cannot be directly included into either the numerator or denominator of fertility measures. The longer the gap between the census date and the period of the fertility estimate the greater the potential affect of mortality.

If mortality affected women and children equally there would exist no bias in the measure of fertility. This is, however, not the case. The mortality of infants and very young children is much higher than the mortality of women who are in their childbearing years. Therefore failure to take into account mortality will result in under-estimates of fertility.

c) Methods of Adjustment

A number of adjustments to own-children data have been suggested to improve the aggregate fertility estimates derived from such data. The adjustment that is most commonly applied involves reverse surviving children and women to the period in which fertility is to be estimated. This procedure corrects for children and mothers who were not enumerated because they had died before the date of the census. This adjustment relies upon accurate estimates of mortality to reverse-survive the mothers and children from the census. The probabilities of dying, typically obtained from national life tables, are used to project backwards the number of births and women that would have been alive at a specified point, given the census enumeration of children

and mothers alive (U.N, 1983:182).

In situations in which matching of children was not possible, either though maternal mortality or through children living apart from their mothers, it is possible to apply a correction factor to the matched children estimates of fertility. This correction factor is based on the inverse of the proportion of children un-matched. It is necessary to assume some distribution of the ages of mothers for those `unmatched' children, with the usual procedure (UN, 1983) being to assume the same maternal age distribution as that found for `matched' children. This adjustment was used by Rindfuss and Sweet (1977) in their aggregate measures of fertility, and has also been used in the current study whenever aggregate measures of fertility, based on the own-children method, are employed.

Other corrections can be applied to take into account levels of underenumeration. For example, Arnold et al. (1985), in their calculation of Total Fertility Rates based on own-children tabulations of the 1980 Thailand census, adjusted upwards the number of children, relative to the number of women, by a factor of 1.085, as this was the ratio of the estimated underenumeration of children aged 0-14 to women aged 15-64. In their comparison of vital registration data with own-children measures of fertility for the U.S, Rindfuss and Sweet (1977) also adjust their estimates to take into account for net census undercount of children and women.

On the whole, the various types of correction appear to improve the fit between the estimated rates and the `true' rates, measured by vital statistics for example, although such tests are rare. Rindfuss and Sweet (1977) observed in their study of patterns of American fertility, that adjusted rates provide better matches with vital statistics than unadjusted rates. For example, for whites, the ratio of the vital registration total fertility rates and adjusted total fertility rates, for years 1955 to 1969, calculated from own-children data from the 1970 census, were mostly between 0.96 and 0.99. When using unadjusted total fertility rates the ratios were below 0.95 for 14 out of the 15 years. Rindfuss and Sweet (1977) conclude, however, that the inability to obtain data to adjust the rates for subgroups of the population reduces the applicability of adjustment

methods. Furthermore, Rindfuss (1977) argues that although unadjusted estimates do not provide reliable estimates of the levels of aggregate fertility, they are good estimators of the trends in aggregate levels of fertility. The reliability of estimated trends in aggregate fertility also holds for subgroups, provided that relative amount of error resulting from the application of the own-children method remains constant over time. However, comparisons between groups may be misleading if the sources of error in the own-children method are not constant among groups, or vary differentially across time.

For a study of the determinants of individual fertility, some of the problems noted above are reduced while others are magnified. As differences in fertility are more important than absolute levels of fertility, the focus shifts to the effects the assumptions on the covariates. Where some children are not living with their biological mothers, the `unmatched' children could be omitted from the study, provided that we are willing to assume that the probability of being `unmatched' is uncorrelated with the independent variables employed in models of fertility. This assumption would appear to be unrealistic as we might expect that separate residence might, for example, vary according to the propensity of women to migrate -- which is related to many of the same variables which are hypothesized to affect fertility -- although a lack of research on the subject does not allow anything but conjecture at this point.

A similar problem exists in relation to census miss-enumeration. If it was possible to assume that variation in enumeration, both in coverage and accuracy, were distributed randomly with respect to the independent variables in a model of fertility determination, then no problem would exist. Underenumeration, however, especially of very young children, can be expected to be related to many socioeconomic variables that affect fertility. Similarly, age misstatement can be expected to correlate with many socioeconomic variables, such as mother's level of education. Finally, infant mortality is likely to be related to many of the covariates of fertility.

There are two possible sources of adjustment factors to correct for errors in own-children estimates of fertility. The first source would be a survey, however, survey data

cannot be used to estimate the extent of miss-enumeration or age-misstatement. Estimation of levels of mortality for population sub-groups would also be difficult to obtain because of the small sample sizes and rapidly changing patterns of infant mortality. The most obvious use of survey data, if available, would be to estimate the probability of a child not living with his/her mother in terms of the independent variables to be used in the fertility model. This would require life-history data of the women in the sample.

The second approach would rely on census data, which because of their large size make possible the estimation of mortality for numerous sub-groups of the population. For example, Brass techniques of estimating infant or child mortality could be constructed for groups of women according to their age, education, and economic status. It would also be possible to calculate the extent of age misstatement, and appropriate adjustments. Adjustments for differential enumeration for subgroups of the population are possible if a census evaluation is available. For example, the extent of coverage can be estimated by comparing the number of children enrolled in primary grades, adjusted for mortality, with the numbers reported at pre-school ages in a census several years earlier (Anderson and Silver, 1985). Adjustment factors, calculated in terms of probabilities, could then be calculated and attached to individual women's records.

While the problems noted above have serious implications for the interpretation of effects -- some of which we will discuss below -- adjustments are only possible at the aggregate level. Group specific or individual-level adjustments are usually beyond the scope of available data. Even in Luther and Cho's (1987) attempt to reconstruct individual birth histories, the assignment of births, which are assumed to have occurred but are not enumerated, is done on the basis of model age-specific fertility schedules. This does not take into account individual characteristics of women. Even where estimates of underenumeration and age-misstatement are available at the national level, they are generally not available for combinations of categories of individual characteristics.

Even though it is not feasible to adjust own-children data at the individual level of the individual women, careful evaluation of the effects and degree of potential sources of error is essential. The greatest possibility of error will arise where there are large differences in mortality levels between groups and relatively small differences in fertility across the same groups. The risk is dependent on the absolute level of mortality. Similar percentage differences in the between group levels of mortality, in situations of high and low overall levels of mortality, will bias the estimates of fertility more in the former situation.

Under-enumeration, age-misreporting, and separation of mothers and children are all more likely to occur, we might hypothesize, for the less-educated segment of the society. If this is the situation, a population that exhibits a `true' positive relationship between education and fertility, would have this effect attenuated by measures of fertility based only on own-children. On the other hand, in populations in which a negative relationship existed between education and fertility, while all other factors discussed here exhibited positive relationships, differences between educational groups would be magnified, compared to the `true' differences. Again the effects would be dependent upon the absolute levels of the measure, and the differences between groups on that measure.

In most societies we might expect that levels of under-enumeration, age mis-statement, and separation of mothers and children would not be of sufficient magnitude to create problems, this is not always the case. For example, as noted above, Cho et al. (1980) report the large scale under-enumeration of children under the age of 1 in the 1971 Indonesian census. In their analysis of fertility trends in the United States, Rindfuss and Sweet (1979) argue that own-children fertility estimates for younger age groups tend to lower, and those for older age groups tend to be higher, than the real rates because of the transfer of children between these two age groups. This point is echoed by Hill (1981: 479) who states "there is some evidence that fertility distributions estimated from own-children data tend to be somewhat older than the true distributions, possible because of adoption effects."

d) Evaluation of Own-Children Data

I) Internal Consistency

In this section, we evaluate the validity of the measure of recent fertility obtained through the application of the own-children method for two of our Southeast Asian censuses. Our ability to evaluate the accuracy of the matching procedure is limited by the lack of direct information on the timing of births in the census -- precisely the reason why own-children measures were chosen as our measure of recent fertility. However, two censuses, the 1980 Philippine and Indonesian censuses, contain direct questions on recent fertility which can be used in comparisons with our own-children measure. In the 1980 Philippines census a question was asked on the number of births that had occurred in the previous 12 months. In the 1980 Indonesian census the month and year of the last live birth collected. We assume that the direct questions are more comprehensive than indirect own-children based estimates. This assumption is a necessary simplification of reality -- a simplification because there are undoubtedly errors in the direct measure of recent fertility. The quality of the data from the direct question on recent fertility does appear to be quite high. Hull and Dasvarma (1988) have used the data on last live birth to estimate Total Fertility Rates for each of the 27 provinces.

Measures of recent fertility used in this study, are based on births occurring the period 1 to 4 years before the time of each census. The information elicited in the Indonesian and Philippine censuses only allow comparisons based on the previous 12 months. This is the reference period for the direct question in the Philippines. In the case of Indonesia, information on the last birth can only be used to generate a fertility estimate for a period of limited duration before the census. Even with the limitations on the reference period there remain potential inconsistencies with the comparison. For the Philippines there is no information available on whether a child born in the previous 12 months was still alive at the time of the census. The own-children measure

is based only on children who had survived to the time of the census. Secondly, while the own-children measure, if the matching is undertaken accurately, will be able to account for multiple births, but the direct measure for Indonesia cannot. To overcome this latter problem we only consider, unless otherwise indicated, whether there was a child under age 1 in the household, rather than examining the number of children.

We begin our evaluation by first extracting a sample of ever-married women, aged 15 to 49, from the 1980 Philippine and Indonesian censuses. Next, we attempt to match those women who reported a live birth within the last twelve months with women matched with a child in the household who is under the age of one. In Table 6 are shown the numbers of women who reported a birth in the previous 12 months cross-classified by the number of women who where matched with a child aged less than 1. We also provide an estimate, in the fourth column of the table, of the number of children born in the last 12 months who would have been expected to survive to the end of the 12 months. When compared with the numbers of women matched with a child this provides a rough estimate of the effects of infant mortality on the matching process.

Table 6

Percentage Distribution of Women with Matched Children Aged Less than 1 by Women Reporting a Birth in the Previous 12 Months: Indonesia 1980 and Philippines 1980

	PHILIPPINES					
Direct Question on Whether Birth in Previous 12 Months	**Own Children Estimate** Match with Child Aged Less Than 1					
12 Months	No	Yes	Total	Expected Survivers[a]	Total Matched[b]	% Expected Survivors Matched
No	**[c]	1.1	862	---	---	---
Yes	8.4	90.6	82,367	78,733	77,071	98

INDONESIA						
Birth in Previous 12 Months	Match with Child Aged Less Than 1		Expected Total	% Expected Total Survivers[a]	Survivors Matched[b]	% Expected Survivors Matched
	No	Yes				
No	**[c]	8.0	19,144	---	---	---
Yes	23.8	68.2	220,798	204,190	182,730	89

Sources: Indonesian and Philippines 1980 Census Microdata

Notes: [a] - Obtained by Applying the Life Table Function L_0/l_0. Indonesian life table obtained from U.S. Department of Commerce (1979) and Philippines life table obtained from United Nations (1986).

[b] - Refers to the number of women who were matched with a child aged less than 1

[c] - Only women aged 15-49 at the time of the census and who either are matched with a child aged less than 1 or who report a birth in the 12 months prior to the census are considered for inclusion in the table.

Life table data for both countries refer to a period centered on 1975. The period in which births took place was 1979-1980 and, as mortality was declining during the period 1975 to 1979, the number of survivors is likely to be under-estimated to a small degree.

The results indicate that in the Philippines the matching process was able to account for most children born in the 12 months prior to the census and who would have been expected to be alive at the time of the census. In fact approximately 98 percent of the expected survivors were matched. In Indonesia, however, only 89 percent of the expected survivors were able to be matched. In addition to the relatively small proportion of unmatched children aged less than 1, this leaves a significant proportion of children unaccounted for. We investigate the possible reasons for this discrepancy in a later part of this section.

More difficult to explain are the occurances of an `own-children' match where no birth was reported in the previous 12 months. These inconsistencies may be due to age misstatement or matching a child to the wrong mother (because the `true' mothers and children are separated through the death of the mother or through the mother living apart from the child). It is reassuring to note that this source of error was almost absent in the case of the Philippine 1980 census, only accounting for 1.1 of all cases in which a birth was reported and or a children was matched, while in the 1980 Indonesian

census, this situation occurred in only 8 percent of the cases where a birth in the last 12 months had been reported or where a match had taken place.

For a more precise evaluation of mismatches we adopt as out standard those children reported born in the 12 months prior to the census. In Table 7 we report the percentage of these children matched for groups of women with different levels of completed schooling. The estimates in the top panel of the table refer to the Philippines. These data indicate a high level of accuracy in the matching process for the Philippines in 1980. Overall, of women who reported a birth in the previous 12 months approximately 92 percent were also matched to a child aged less than 1. As expected matching was least successful for women with no education, but differences across educational groups in the level of matching were modest with no discernible pattern.

Table 7

Percentage Distribution of Reported Live Births in the Previous 12 Months According to Matching Status: By Completed Education, Philippines, 1980 and Indonesia, 1980

PHILIPPINE

Education	**Live Birth in Previous 12 Months** No Match	Match	Total %
		None	10.4
	89.6	100	
Some Primary	8.3	91.7	100
Completed Primary	7.9	92.1	100
Some Secondary	8.1	91.9	100
Completed Secondary	8.7	91.3	100
Tertiary	9.7	90.3	100
Total	8.5	91.5	100

INDONESIA

Education	Live Birth in Previous 12 Months: No Match	Match	Total %
None	62.7	100	37.3
Some Primary	25.5	74.4	100
Completed Primary	20.1	79.9	100
Junior High (SMP)	13.3	86.7	100
Senior High (SMA)	11.9	88.1	100
Tertiary	10.2	89.8	100
Total	25.9	74.1	100

Source: Sources 1980 Microdata Samples Indonesian and Philippine Censuses
Note: Percentages may not sum to 100 because of rounding error

The results for Indonesia, shown in the second panel of Table 7, are less encouraging. Of the women who reported that their last birth had occured within the the 12 months prior to the date of the census approximately one-quarter (25.9%) were not matched with a child aged less than 1. We would in fact expect a proportion of women would not be able to be matched with a child -- due to infant mortality and children living away from their mothers -- the effects of infant mortality for example, would be expected to be quite strong in Indonesia where infant mortality rates in 1980 exceeded 100 (BPS, 1987). The numbers, however, exceed by a large amount any reasonable estimate of what could be considered `correct' non-matches.

Mismatches are most likely to occur for the least educated group. For women with no education, who either reported a birth in the previous 12 months, approximately 37 percent were not matched with a child. Conversely only about 12 percent of persons with a senior high school level of education who reported a birth could not be matched. Unlike the observed relationships in the Philippines, the variation among educational groups in the proportion not matched in Indonesia is substantial. The higher the level of education the higher the probability of a match.

The 1980 Indonesian census data permit a more detailed look at some of the possible sources of the mismatching. Information was collected on whether the last

child born had died by the time of the census. This allows a direct estimate to be made of the percentage of mismatches due to the death of a child. Information was also available on the number of children living away from home. By comparing the number of children a woman has borne with information on the number of surviving children living away from home, estimates can be made of the probable and possible percentage mismatched because the child was living away from home.

Finally, we can estimate the probable and possible percentages of mismatches due to age misstatement. This is possible by calculating the number of surviving children living in the household. The situation of a mismatch **probably** caused by age misstatement occured under the following conditions; there is only one child of the woman living in the household, the woman had a birth in the previous 12 months, and the woman has a matched child aged 1, but no matched child aged less than 1. A **possible** mismatch due to age misstatement occurred when all the above conditions held, but the woman had more than one child living in the household. As the categories adopted are not mutually exclusive a hierarchy of states was selected. For those instances in which a child born in the previous 12 months was not matched to a mother the following hierarchy was adopted in attempting to account for the mismatch; child died, probable age misstatement, probable living away from the mother, possible age misstatement, possible living away from mother, and unknown reason for mismatch. The results, arranged across categories of educational attainment and mother's age, are shown in first and second panels of Table 8 respectively.

As expected mortality plays a greater role in mismatches occurring for the least educated group. For example, for women with no education 6 percent who reported a birth in the previous 12 months also reported the death of their child. Among women with a tertiary education 2 percent reporting a birth also reported the death of the child. The variation in infant mortality across groups, while substantial, makes up only a small component of the mismatches. Of the women who reported having their last child in the previous 12 months only 5 percent were involved in mismatches resulting from the death of the child, while a further 21 percent were involved in mismatches

due to other causes. The remaining 74 percent were correctly matched.

The largest proportion of mismatches occur through probable and possible age-misstatement. For example, of the 38 percent of women with no education who reported a birth but who were not matched with a child, over two-thirds could be accounted for by age misstatement. For the most highly educated group less than one-third of the situations in which a match did not take place could be attributed to age misstatement. The proportion of mismatches that can be attributed to probable, or possible, separation from the mother is small for all groups, although it constitutes a higher proportion of mismatches amongst the more highly educated groups and among the oldest women.

Table 8

Percentage Distribution of Own-Children Status of Women Reporting a Live Birth in the Previous 12 Months, by Completed Education and Age Group: Indonesia, 1980

Characteristic	Own Children Status							
	Matched	Died	Age Misstatement		Living Away		Unknown	Total
			Probable	Possible	Probable	Possible		
Education								
None	62	6	7	19	1	2	4	100
Incomplete Primary	74	5	5	10	1	1	4	100
Complete Primary	79	4	4	7	1	1	4	100
Junior High	86	3	2	4	1	1	4	100
Senior High	87	2	2	3	1	1	4	100
Tertiary	89	2	1	2	1	1	4	100
Total	74	5	5	11	1	1	4	100
Age								
15-19	74	6	10	2	2	1	6	100
20-24	75	4	7	8	1	1	5	100
25-29	75	5	3	13	0	1	4	100
30-34	74	5	2	15	0	1	4	100
35-39	72	5	1	17	0	2	3	100
40-44	68	6	1	19	0	4	3	100
45-49	60	8	1	21	0	6	4	100

Total	74	5	5	11	1	1	4	100

Source: 1980 Microdata Sample of Indonesian Census.
Note: Percentages may not sum to 100 because of rounding error

In second panel of Table 8 the match status of own-children is displayed by age of the mother. After taking into account the levels of fertility there is little variation across age groups in the proportion of mismatches. Of the women who reported a birth in the previous 12 months between 25 and 32 percent of women in each age group, except for women aged 45-59, could not be matched to children aged less than 1. For the oldest women, 40 percent who reported a birth could not be matched. The pattern of mismatches varied somewhat, with younger women displaying a higher proportion of mismatches as a result of the mother and child being separated or infant mortality. The major source of non-matching for all age groups -- age misstatement -- increased with age.

The analysis of the causes of mismatching provides us with some indication of the possible validity of our interpretations of analysis based on own-children measures of fertility. The effects of mortality are likely to be of minor significance. The effects will be compounded due to the age groups we employ for our measure of recent fertility -- own-children aged 1 to 4 -- but even in a situation such as Indonesia where infant mortality is extremely high, the effects are likely to be minimal. However, we have also seen that the effects of mortality vary substantially across educational groups and this should make us wary of over-interpreting small differences between groups. A similar conclusion about the effects of mortality on own-children estimates of fertility from the 1970 census of Thailand has been made by Retherford et al. (1980:8), who conclude "although absolute errors in estimated fertility differentials are usually small, relative errors are frequently large."

For Indonesia in 1980 mismatching that occurred as a result of children not residing with parents was insignificant and varied little across age or educational

groups. This potential source of mismatching is, however, likely to be strongly affected by cultural preferences and therefore could constitute a significant source of error in other societies, such as Thailand. Age misstatement, in the Indonesian context, is likely to contribute most to the mismatching. By using age groups 1-4 we are not only minimizing problems of census under-count but also we are reducing the effect of age misstatement by averaging out the errors occurring at the extremes (i.e. age misstatement at ages 1, 2, and 3 will not effect the measure). It should also be noted that due to low levels of literacy age misstatement can be expected to be a larger problem in Indonesia than in other societies.

The net effect of these patterns of error are graphically shown in Figure 1 where we show, for Indonesia in 1980, three series of recent fertility estimates plotted across educational categories. The most inclusive of these series uses the percentage of women who reported a birth in the previous 12 months or women who were matched with a child aged under 1 as the measure of recent fertility. The other two series are based on the percentage of women reporting a birth in the previous 12 months, or the percentage of women matched with a child aged under 1, respectively.

As can be seen from Figure 1, the trend in recent fertility is essentially the same across educational categories for all three series. Therefore even in the case of Indonesia where, because of low levels of literacy and high levels of infant mortality, we would expect matching errors to be large, interpretations are similar for all three series. However, it should also be noted that the amount of variation across educational categories is smaller for the `match only' series compared to the 'birth only' series. This is a result of the matching errors being concentrated at the lower end of the educational scale.

II) Comparison with Period Measures of Fertility

One further set of comparison can be made in order to examine the usefulness of own-children estimates of fertility. In this set of comparisons -- shown in Tables 8 and 9 below -- the fertility measures presented are what we refer to as Partial Fertility Rates

(P-TFR's). The method of calculation for the P-TFR's is the same as that for TFR's, however, we have not adjusted our estimates for infant and maternal mortality, and the age specific fertility rates upon which we base the P-TFR's do not include children living in households in which there was no woman aged 15-49. Age groups of women for which the P-TFR's are calculated refer to the age at the time of the census minus 3. This was done in order to approximate the average time at which fertility took place -- fertility is centered on a period 1 to 4 year before the census. For some age groups this adjustment will result in bias, for example the youngest age group, aged 18 to 22 at the time of the census, are likely to have experienced a higher proportion of their fertility in more recent years, and therefore we would expect that the fertility reported for them would over-estimate the fertility of women aged 15 to 19.

Table 9

Comparison of Age-Specific Fertility Rates and Partial Total Fertility Rates (P-TFR) , by Age, for 1970 and 1980 Round of Censuses and Published Data for Similar Periods: Malaysia, Indonesia, the Philippines, and Thailand

	1970							
	Malaysia		Indonesia		Philippines		Thailand	
Age	1[a]	2[b]	1[c]	2[d]	1[e]	2[f]	1[g]	2[h]
15-19	68	76	155	120	56	79	73	76
20-24	248	224	286	234	227	224	248	225
25-29	292	260	273	226	302	258	293	255
30-34	241	220	211	176	272	225	246	229
35-39	153	137	124	112	199	158	188	181
40-44	59	61	55	49	100	76	105	90
P-TFR	5.3	4.9	5.5	4.6	5.7	5.1	5.8	5.3
	1980							
	Malaysia		Indonesia		Philippines		Thailand	
Age	1[i]	2[j]	1[k]	2[l]	1[m]	2[n]	1[o]	2[p]
15-19	39	47	116	99	51	68	61	52
20-24	180	173	248	209	213	203	183	157
25-29	231	212	232	200	254	236	189	155
30-34	169	163	177	152	220	201	146	119
35-39	106	102	104	92	164	141	105	84
40-44	44	46	46	39	76	70	57	50
P-TFR	3.9	3.7	4.6	4.0	4.9	4.6	3.7	3.1

Note: Published sources of TFR have been adjusted to reflect the omission of age group 45-49 in our comparisons. Estimates from the microdata files have been made based on currently married women at the time of the census. Age refers to an approximation of age at the time of fertility (current age - 3).

Sources: [bdfh] - Microdata samples of 1970 Rounds of Censuses. [a] 1967 Vital Statistics, (Chang et al, 1987) [c] 1967-1970, Based on Adjusted Own-Children Estimates from 1971 Census (U.S Department of Commerce, 1979). [e] 1968-1972, Based on 1973 National Demographic Survey, (ESCAP, 1978). [g] - Based on 1968/69 and 1971/72 Longitudinal Surveys, (U.S. Department of Commerce, 1978) [jlnp] - Microdata samples of 1980 Rounds of Censuses. [i] 1978 Vital Statistics, (Chang et al, 1987) [k] 1976-1979 estimate based on adjusted own-children data from 1980 Census, (Biro Pusat Statistik, 1988) [m] 1980 estimate (Cabigon, 1988) [o] - 1977 estimate based on adjusted own-children from 1980 census (Arnold et al. 1985)

We have adjusted the rates by the inflating them by the inverse proportion of children unmatched. We compare our estimates of P-TFR, and the age-specific rates upon which they are based, to estimates of TFR for roughly the same period obtained from other sources.

For all censuses our estimates are below those from other sources. The differences between the two estimates for each census are generally small, ranging in absolute terms from between 0.2 and 0.9 of a child, and in relative terms from 5 to 15 percent. The smallest differences can be seen for Peninsular Malaysia while the largest differences occur for Indonesia. This was as expected as, of the four countries, Malaysia has the lowest levels of infant and child mortality while Indonesia has by far the highest.

The differences between our estimates and those based on other sources are generally greater for the 1970 round of censuses compared to the 1980 round. This can be attributed to the reductions in mortality that took place in all countries over the decade of the 1970s. In the one exception where both the relative and absolute differences between our estimate and the published estimate are greater for 1970 than 1980 -- Thailand -- the cause is probably the lower proportion of children matched for the 1980 Thai census relative to the 1970 census (see Table 5).

Comparison of the our estimates of age-specific pattern of fertility with those obtained from other sources indicate no marked discrepancies except for the higher estimates of recent fertility for the youngest age group which were obtained by our methods. As explained above, this is a result of the way in which we have defined our age groups. The group of women who were on average aged 15-19 at the time of the giving birth in the period 1 to 4 years before the census were defined as being aged 18 to 22 at the time of the census. We are therefore including a higher proportion of married women in this age group, and thus increasing the probability of a recent birth occurring than would otherwise be the case.

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