ON ESTIMATING ANNUAL BIRTH RATES FROM CENSUS DATA ON CHILDREN

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I. INTRODUCTION

For the majority of the world's population, the registration of vital events is incomplete, hence measurement of fertility based on birth statistics is virtually impossible. Most nations, however, conduct population censuses and surveys. Data from such sources may be used to fill in a large part of the gap in our knowledge on fertility. This paper presents procedures for estimating recent current fertility from the census data on young children. Their applications do not require special questions to be added to normal census schedules, merely simple tabulations of young children by age of mother. The techniques described here are further elaborations of an earlier work on estimating current fertility from census or survey data on young children.[1] This paper demonstrates the method of estimating annual birth rates with the data from the 1966 census for Korea, which like the majority of the countries in the world does not have a complete and reliable vital registration system.

Fortunately, the age data from Korean censuses have been tested in various studies and found to be accurate. Koreans remember their ages in the lunar calendar system quite accurately, because the year, month, day and even the hour of birth are needed to meet important requirements in their cultural tradition.

1966 Census Data on Own Children

The 1966 Korean Census was conducted on 1 October 1966; by using the census data on own children under 10 years of age, estimates of fertility for each year of the ten-year period preceding the census date can be made.

All 1966 census respondents were asked basic items such as age, marital status, and level of education, whereas sample enumeration was carried out for such socioeconomic characteristics as fertility, occupation, and labor force participation. Of the total 37,530 enumeration districts (EDs)--excluding special enumeration districts, such as military and other institutions--10 per cent were enumerated for detailed characteristics.

The 10 percent sample census allows us to estimate age-specific birth rates for the ten years preceding the census date for administrative areas, down to Gun level. (A Gun is an intermediate administrative area with an average population of about 130,000.) For Myun (the smallest administrative area with an average population of about 12,000) we are able to derive the average age-specific birth rates for the two five-year periods preceding the census date. The computation of the age-specific fertility rates for Myun from the ratios of own children under 5 and 5-9 years of age requires the use of interpolation procedures as well as the development of regression equations from the data for larger areas. The methodological work on this aspect is presently being carried out by the author at the East-West Population Institute.

Accuracy of Age Data

The majority of Koreans, like the Chinese, believe in the 12-year cycle of 12 different animals. Therefore, an early assumption of Westerners that rural Koreans would not know their exact age is false. Even in the rural areas, age is accurately reckoned. Korean parents keep records of their children's dates of birth (and in the majority of cases the hour of birth as well) according to the lunar calendar for specific cultural and traditional requirements.[2]

As in the case of Japan, therefore, age heaping is probably less common in Korea than in the United States. (Age heaping is a kind of age misreporting in which certain ages, often those ending in a specific digit, such as 5, 10, 15, 20, 25, etc., are overreported, and other ages, such as 19, 29, 39, etc., are underreported.)

In order to obtain accurate age data in Korea, one must not ask only for the age of an individual but rather also for the date of birth, according to either the lunar or the Western calendar. In the case of the lunar calendar, the name of the animal of the birth year should be obtained. The following question was asked to obtain information on age in the 1966 Korean Census: "How old are you?" "Specify Lunar or Western calendar birth date."

A serious mistake was committed in the 1960 census in Korea by simply asking the question "How old are you?" without allowing for the different calendars. Consequently, the age data from the 1960 census require a great deal of adjustment and modification for use in demographic analysis.

According to the Koreans and the Chinese, a child is one year old at the time of birth (implying that the nine-month gestation period is counted as one year of life). Furthermore, age in Korea is not reckoned from the last birthday, but the New Year (1 January). Thus, if a child is born on 1 January 1970, he will be considered two years old on 1 January 1971, exactly one year after birth. Thus, if one simply asks how old a person is, the information obtained will be substantially different from the information obtained by asking the age in completed years at last birthday. For example, in one extreme case, a child born on 31 December 1969, will be two years old on 1 January 1970 (while actually, the child is one day old according to age in completed years).

II. CURRENT FERTILITY MEASURES FROM THE AGE DATA

Census or survey data on own children who live with their mothers provide valuable material for estimating fertility when birth statistics are inadequate. By counting the number of children who live in the same household by age of mother, one

can easily relate own children under a certain age to mothers or women in childbearing ages.

The principal techniques employed here require the knowledge of age-specific ratios of own children to women. For example, using data on own children aged 0-4 and 5-9 years, the procedure yields average annual fertility rates for the two five-year periods prior to the survey or census date. The estimates of fertility will be as accurate as the census or survey data on which they are based. The most important requirement is the accuracy of age reporting for young children.

Adjustments of Data

Necessary adjustments of the raw data are allowances for mortality of children and women in associated ages, and for those children not living with mothers. For the age data on children that are subject to age-misstatement, correction factors must be developed to adjust for age-misstatements of own children. In the case of the census data, an additional adjustment for undercount of children and women must also be made.

1. Mortality of Children and Women

a. Life Table

Mortality has declined in most countries. In recent years it has been so low in Korea that plausible variations of the adjustment factors would have little effect on the estimated fertility rates.

The Korean Bureau of Statistics has published two sets of life tables.[3] The 1955-1960 life table was calculated on the basis of the census data for 1955 and 1960. By comparing the age distribution of the two censuses, it was possible to estimate the proportion surviving in each age group, and (with certain adjustments) mortality rates. The 1955-1960 life table would reflect mortality during the five-year intercensal period.

The second life table is based on the enumerated number of deaths in the 1966 Special Demographic Survey (SDS). Because of the usual underenumeration of deaths of young children by the survey, some adjustments were made in the mortality figures for young children on the basis of the mortality curve for older ages. The life table based on the SDS data on deaths indicates the mortality situation in 1966. By employing Keyfitz's new iteration method,[4] a new life table based on the same survey data was prepared by the present author. The new life table differed little from the 1966 table published by the Bureau of Statistics.

The life table for 1955-1960 and the two life tables based on the 1966 survey indicate a substantial decline in mortality, and this trend appears quite reasonable. If the two sets of life tables, 1955-1960 and 1966, are to be employed for adjusting mortality of children for each of the ten years covered (1957-1966), interpolation of mortality rates between the two life tables must be made.

b. Brass technique

A census or survey usually provides data on the survival of children ever born by age of mother, which can be used to generate the adjustment factors for mortality by employing the procedure developed by William Brass.[5]

In the Brass procedure for estimating childhood mortality from reports of the number of children ever born who had died previous to the census, it is assumed that age-specific fertility and mortality rates have remained constant for the required age range and time period. The Brass estimates of child mortality are affected by the age pattern of fertility but are not affected by the level of fertility. In the case of Korea, the level and age pattern of fertility have substantially been changing in the recent years, and what is needed here is the adjustment factors that allow for changing age pattern of fertility brought about by rise in age at marriage in Korea.

Even without the adjustment for changes in the age pattern of fertility, the Brass estimates of childhood mortality from the 1966 census data on survival of children ever born appear reasonable, and deviate little from those child mortality rates based on the life tables cited above. (See part A of Table 2.)

c. Own Children and Children ever born to Women under 25 years of Age.[6]

Estimates of childhood mortality can be made from the data on number of own children living by age, for each age of mother, and on number of children ever born for each age of mother.

The general strategy is to use model life tables, and to determine the level of mortality which would: (1) yield the number of own children living for women at a particular age if employed to determine (by reverse-surviving) the number of births, and (2) provide a number of births equal to the total number of children ever born reported by age of these women. The procedure would allow for declining mortality.

By using the model life table, it is possible to find the fractional level of model life-table that would give an estimate of lifetime births equal to reported number of children ever born to women at a particular age, and that would indicate a level of mortality accounting for the reported difference between living own children and children ever born, for each age of women. In general, the estimated mortality will be lower for younger women, because their children will not have been exposed to the higher mortality in the past.

Since the data on children ever born to women by age in single years are not available from the 1966 census, the procedure is presently being experimented on the data from the 1970 census.

When mortality is relatively low in a country as in the case of Korea, further refinement of mortality adjustments will have little effect in the final estimate of fertility. For example, if the estimates of fertility for 1965 are made by using life tables reflecting two substantially different levels of mortality--notably, (1) $e_o^o = 64$ for females and 60 for males (1966 and (2) $_oe_o^o = 54$ for females and 51 for males (1955-60) showing a difference in life expectancy of about 10 years--we find that the estimated total fertility rates (TFR) differ by less than 5 percent and that the differences in the age-specific fertility rates are also very small:

Estimated Fertility Rates for Korea 1965

Age-specific Fertility Rates per 1000 Women

	Life Table with	TFR	15-19	20-24	25-29	30-34	35-39	40-44	45-49
1955-60	(1) Female $e_o^o = 54$	4.687	17	200	293	215	140	63	11
1966	(2) Female $e_o^o = 64$ Male $e_o^o = 60$	4.478	16	190	279	206	134	60	10
	Difference:	.208							

2. Children not living with mother

Most young children live in the same household as their parents and are, therefore, enumerated with their parents. In Asian countries, the proportion of young children who do not live with their mothers appears to be very small. For example, according to the 1966 Korean census of population, 98.2 percent of all persons under five years old were living with their mothers. Similarly, 95.3 percent of children five to nine years old were enumerated with their mothers.[7] The non-own children by each age were proportionately distributed to each age of women.

3. Census undercount

The Post-Enumeration Survey (PES) estimates in 1966 for the population are about the same as the 1966 census count. The census count of the population 0-4 years old equalled the PES estimate, but the PES estimate of the population 5-9 years old slightly exceeded the census count. If the PES estimate for the age groups 5-9 is used to correct for underenumeration in the 1966 census, fertility estimates for the period 5-9 years prior to the census would be slightly inflated, resulting in fertility estimates indicating a sharper decline. For this reason, no corrections are made for underenumeration in the present report.

The single-year age distribution from the 1970 census, however, will enable us to determine the extent of undercount of children in each age class in 1966. Preliminary estimates of fertility from the 1970 PES shown in Figure 1 indicate that children under 1 and 1 year of age appear to be somewhat underenumerated.

4. Age-misstatement

One must not entirely ignore the possibility of age-misstatement. The extent of age-misstatement of Korea, fortunately, has not been a major one in the previous censuses. A preliminary examination of the 1966 census age data for children indicates that there may be a small extent of age-misstatements in certain ages, but these would, at most, be a magnitude of 2 or 3 percent for which correction factors can be calculated using the ages distributions from the 1966 and 1970 census. The fertility estimates from the 1966 census presented in this paper have not been corrected for negligibly small extent of age misstatement.

Estimating Procedure

The essence of the estimating procedure is the reconstruction of the fertility experience of women enumerated in a survey or census in the ten-year period preceding the enumeration. Retrospective fertility estimates are made for the single-year cohorts of women from 15 to 54 years old at the time of the enumeration, and then, by simple interpolation of these estimates and by translation of the age of women at the time of the census to age at the reference period, the conventional period measures of age-specific fertility are derived. The following discussion describes in detail the procedure by which the fertility rates for each of the ten years preceding the 1966 Korean census date were estimated.

(1) Own children tabulation.

Usually, a census or survey operation requires coding the age of children living in the household. Own children can easily be tabulated by age of child and that of mother. For Korea, the data on own children by age were cross-tabulated by age of mother using single year classes between ages 0 and 10 for children, and 14 and 54 for women.

(2) Estimate of births: the numerator.

The women enumerated in the census represent a set of single-year female birth cohorts. Fortunately, as the census was taken on October 1, the age at the time of the census is approximately indentifiable by single calendar years. For example, women 15 years old at the census date, in this case 1966, may be taken as the birth cohort of 1952, women 16 years old as the cohort of 1951, and so forth. For each cohort, we have the number of own children under ten years of age by single years of age, as shown in Table 1 for Korea. These children can easily be "reverse-survived" to estimate the number of births for each of the ten years preceding the census. Thus, the number of children born to each birth cohort of women in the first year prior to the census is estimated by reverse-surviving children under one year of age and by making an allowance for the proportion of children not living with their mothers. In the same manner, children one year old can be "reverse-survived" to estimate the annual number of births in the second year prior to the census date. In general,

$$B^a_{-i} = C^a_i \; S^c_i \; M_i \; U_i$$

$$i = 0,1,2,--9$$

where B^a_{-i} is the number of births i years prior to the survey date to women age a at the census date;

C_i is the number of own children i years old living in the household at the time of the census;

S^c_i is the reverse-survival factor for children from age i to birth, calculated as l_0/L_i from an appropriate life table;

M_i is the inverse of the proportion of children aged i living with their mothers;

U_i is the adjustment factor for underenumeration for persons aged i years. (This allowance for underenumeration of children is usually required if the data originate from a census.)

(3) Estimate of single year female cohort: the denominator.

For each set of birth estimates for each of the ten calendar years preceding the census, cohort sizes for each of the cohorts are estimated at the midpoints of the same ten years. This is done by taking the number of women by single years of the census age and "reverse-surviving" them with appropriate adjustment for mortality. The resulting estimates are the denominators for birth estimates, yielding fertility rates for each of the ten calendar years. The estimated female population by the census age can easily be "reverse-survived" to estimate the necessary cohort sizes for each of the same ten years, by the following step:

$$W^a_{-i} = W_a \; S^w_i \; U_a$$

$$i = 0,1,2,--9$$

where W^a_{-i} is the number of women of the census age a, i years before the survey;

W_a is the number of women age a, at the time of the census;

S^w_i is the reverse-survival factor for i years calculated as $L_a/L_{a-i+\frac{1}{2}}$ from an appropriate life table.

(Again, use of the adjustment factor U_a is usually required if data are from a census.)

Thus, for instance, the ratio of children nine years old to mothers 30 years old at the census date represents the fertility of these women $9\frac{1}{2}$ years before the census, when allowances are made for mortality of both children and women, and for children not living with mothers. It represents the fertility rate for women 20 years old ten years prior to the survey date. The denominator in this case is estimated by "reverse-surviving" women 30 years old at the census date for $9\frac{1}{2}$ years. (Similarly, when computing the fertility rate for women for the first year preceding the census, the census estimate of the female population must be "reverse-survived" for half a year; for the second year, women must be "reverse-survived" for $1\frac{1}{2}$ years; and so forth.) Table 4 presents estimates of cohort sizes of the single-year female birth cohorts at the midpoint of each of the ten calendar years preceding the census date for Korea.

The assumption that the fertility of women living at the time of the census is representative of the fertility of all women, including those who died during the period under study, would obviate the need for making allowance for mortality of women in associated ages, and also for those children not living with their mothers, insofar as the mothers of children not living with their mothers are dead. This would mean that allowance is made only for mortality of own children.

This assumption technically facilities the estimation procedures. The problem, however, is what proportion of non-own children are of dead mothers. If the assumption that mothers of all non-own children are dead is made, this would slightly underestimate the level of fertility, particularly estimates derived from the data for older children, because the proportion of non-own children increase with age, and it is very likely that not all the mothers of non-own children are dead.

(4) Fertility rates by birth cohort of women.

The elements of the birth matrix in Table 3 are divided by the corresponding elements of each of the vectors in Table 4, to obtain the single year age-specific fertility rate for each of the years under study, namely,

$$f^a_{-i} = \frac{B^a_{-i}}{W^a_{-i}}$$

$$i = 0,1,2,--9$$

where f^a_{-i} is the fertility rate for women of the census age a, i years before the census date, namely the fertility rate i years preceding the census date.

The estimated fertility rates (expressed for 1,000 women) are presented in Table 5. These rates indicate the fertility experienced by each of the female cohorts in each of the ten calendar years preceding the census.

(5) Fertility rates by age of women.

The fertility rates for 1966 in Table 5 represent the fertility of women from $14\frac{1}{2}$ to $53\frac{1}{2}$ years old (by single years) at the time of actual childbearing, and the fertility rates for 1966

represent the fertility of women from 15½ to 52½ years old at the time of actual childbearing, and so forth. By simple linear interpolation, fertility rates were estimated for the conventional single year age of women. This was done by taking the moving average of the fertility rates by age in Table 5 for each calendar year, and then moving up the fertility rate column of 1966 by one cell (year of women's age), that of 1965 by two cells, and so forth. The results as shown in Table 6 are estimates of age-specific fertility rates (period measures) by conventional single year age for the ten years preceding the census.

It is, however, preferable to produce the five-year age-specific fertility rates simply out of convenience in handling and analysis. This is done either by taking the weighted average fertility rate[8] from the single year age-specific rates for each of the five-year age groups from 15-19 to 45-49 years of age, or by performing the necessary calculations separately for the numerator and the denominator of the conventional five-year age-specific fertility rates, i.e., from the sizes of female cohorts (Table 4) and the number of births (Table 3). Dividing the consolidated number of births by corresponding women in the five-year age groups and making an allowance for non-own children yields the five-year age-specific fertility rates which are shown in Table 7.

Comparison with the Fertility Rates from Other Sources

Estimates of fertility rates for a recent period should always be followed by an effort to check their accuracy. The fertility estimates from the 1966 census data will be validated when fertility estimates from the 1970 census data are made for the overlapping period from 1960-1966 using the same methodology. The 1970 census data on own children are presently being tabulated.

One kind of check can be made by using the Korean 1968 Fertility and Family Planning Survey, which covered a total of 8,500 households from 1 September to 31 October. The fertility estimates for the ten years preceding the survey date would enable us to provide a check on the census estimates for the period 1959-1966. Thus, utilizing the household roster and the pregnancy histories obtained by this survey, the number of children was tabulated by age of child and age of mother. The same mortality adjustments that were employed for the 1966 census data on own children were applied to the survey data. Since the field work for the survey was done in the month of September, the annual fertility estimates from the survey refer to the years preceding 15 September, which corresponds to roughly the time when the 1966 census was taken (1 October). Therefore, the estimated annual fertility rates from both the survey and the census refer to about the same time periods. For the five-year period from 1961-1966, the two sets of estimates agree quite well. (See Table 8.)

Following the population census conducted in October, 1970, the PES was conducted using a random sample of about 8,000 households; it was taken during the ten-day period 20-30 November to check the completeness and accuracy of the census count.

From the PES schedules, the own children under 10 years old were tabulated according to the age of their mothers. Preliminary estimates of the fertility rate for the period preceding the census date were derived from these data. The PES estimates of fertility rates also compare very well with the census estimates as shown in Figure 2; the enumeration was done 4 years apart.

III. CONCLUDING OBSERVATIONS

The own children method of estimating recent fertility can be a powerful technique in countries where the following principal requirements are met:

(a) The census or survey data on children's ages are reasonably accurate.

(b) Most of the young children live with their mothers, and their relationship to the head of the family or household is clear.

(c) Mortality in the years prior to the census is relatively low.

Considering age accuracy, for example, Malaysian data on age[9] indicate that the age records of children of such ethnic groups as Malays and Indians, for which the age-reporting had not previously been accurate, have in recent years improved to such an extent that reasonably accurate birth rates for these ethnic groups can be estimated. And in the case of the age data with minor extents of age-misstatement, plausible correction factors can be developed. With the general social development in Asia, and particularly with the introduction of a compulsory educational system in an increasing number of countries, there is greater need for reckoning children's ages. Consequently, the 1970-71 censuses of population will undoubtedly produce more accurate age data, particularly for younger children, than the previous ones.

In most Asian societies the relationship of young children to the head of family tends to be clearly defined. Therefore there appears to be little difficulty in relating own children to their mothers in the census or survey schedule if some effort is made to provide precoded relationships.

Mortality in most countries had declined to such an extent that plausible variations in the adjustment factors for mortality would cause only small errors in the estimated fertility rates.

The foregoing observations suggest that countries with poor vital statistics would do well to produce tabulations on own children from their forthcoming population censuses. Such tabulations do not require adding special questions to the census questionnaire and can be obtained at moderate expense if done on a sample basis. The own children method, if carefully applied, will not only generate good estimates of recent fertility

trends but may also facilitate studies of differential fertility.

FOOTNOTES

[1]Wilson H. Grabill and Lee-Jay Cho, "Methodology for the Measurement of Current Fertility from Population Data on Young Children," Demography, II (1965).

[2]For example, "Sajoo" (literally translated as the four pillars of a person): meaning that the time, day, month, and year of birth determine the child's future, and provide a basis for favorable marriage match. In the past, some mothers would try to postpone a birth until a certain hour of the day that would be propitious to a good combination of "Sajoo", although this practice is rare today.

[3]Korean Bureau of Research and Statistics, A Comprehensive Study on 1966 Population Census, Seoul, Korea, 1970.

[4]Nathan Keyfitz, "Finding Probabilities from Observed Rates or How to Make a Life Table," The American Statistician, 24(1):28-31 (February, 1970).

[5]William Brass et al., The Demography of Tropical Africa, Princeton: Princeton University Press, 1968, pp. 104-132; and United Nations, Manual IV, Methods of Estimating Basic Demographic Measures from Incomplete Data, ST/SOA/A/42, New York: United Nations, 1967.

[6]Suggested by Professor Ansley J. Coale of the Princeton University.

[7]Lee-Jay Cho and Man Jun Hahm, "Recent Change in Fertility Rates of the Korean Population," Demography, V. 2, (1968).

[8]The weights being the number of women in each age.

[9]Lee-Jay Cho, Estimates of Population for West Malaysia, Department of Statistics, Government of Malaysia, Kuala Lumpur, 1969.

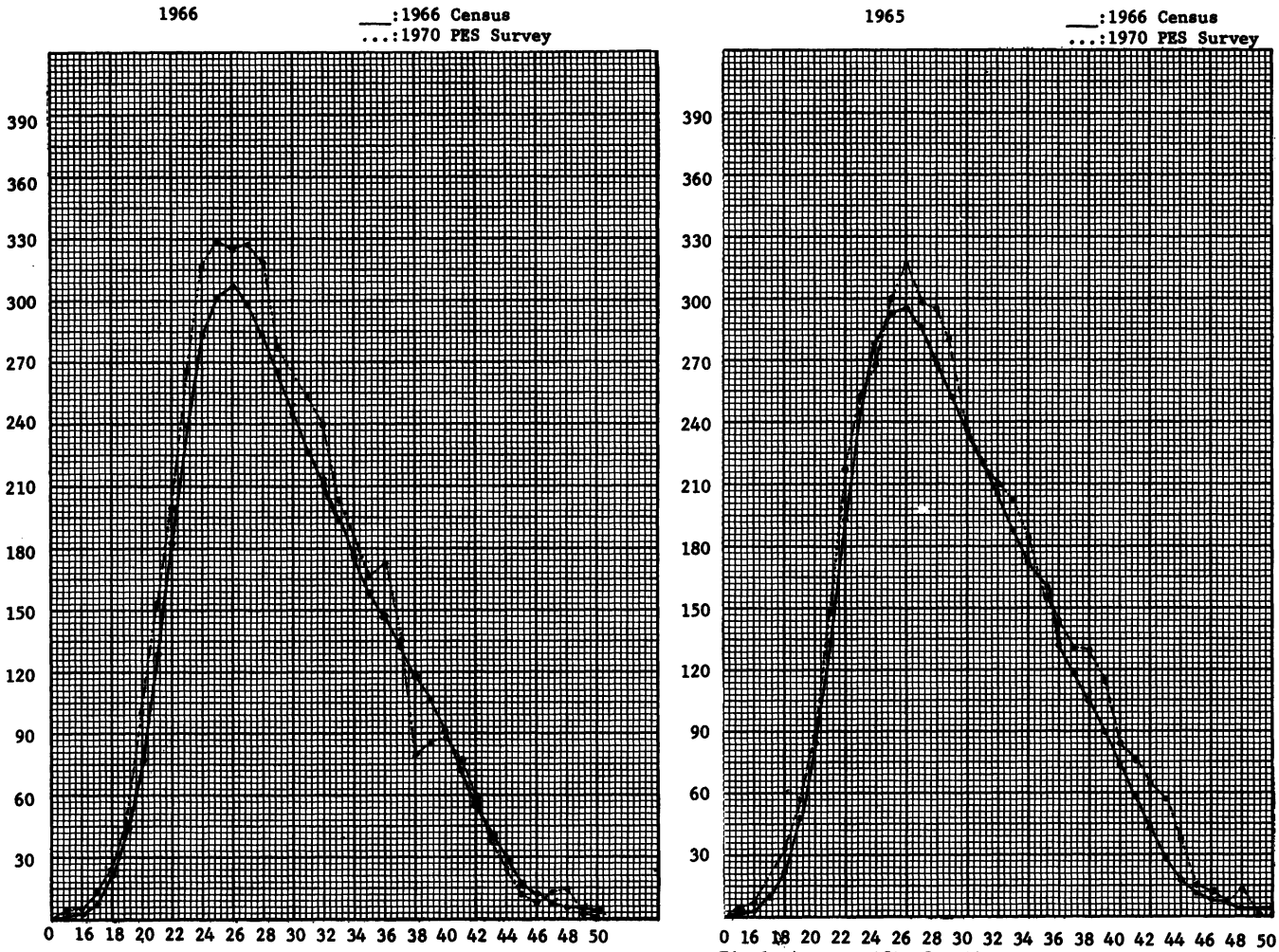
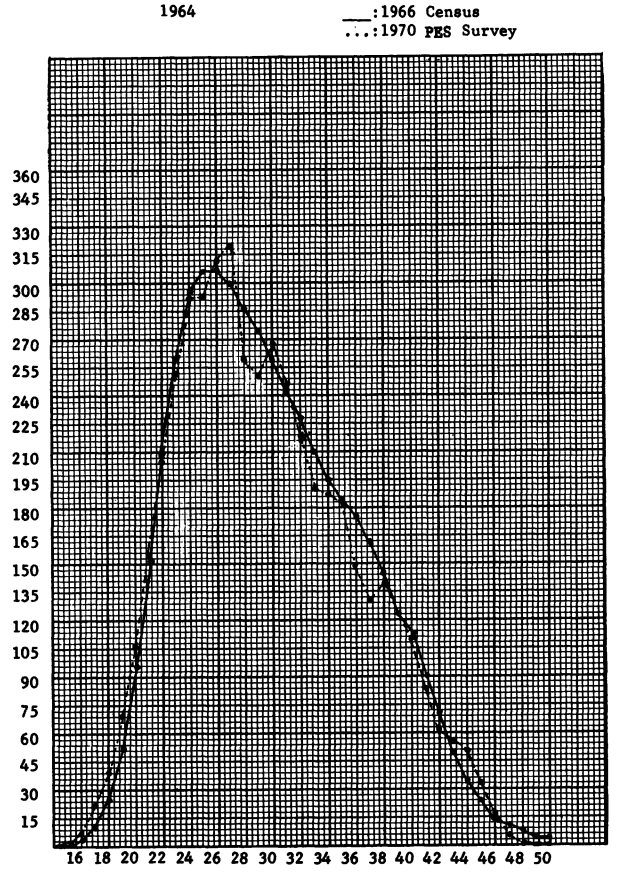
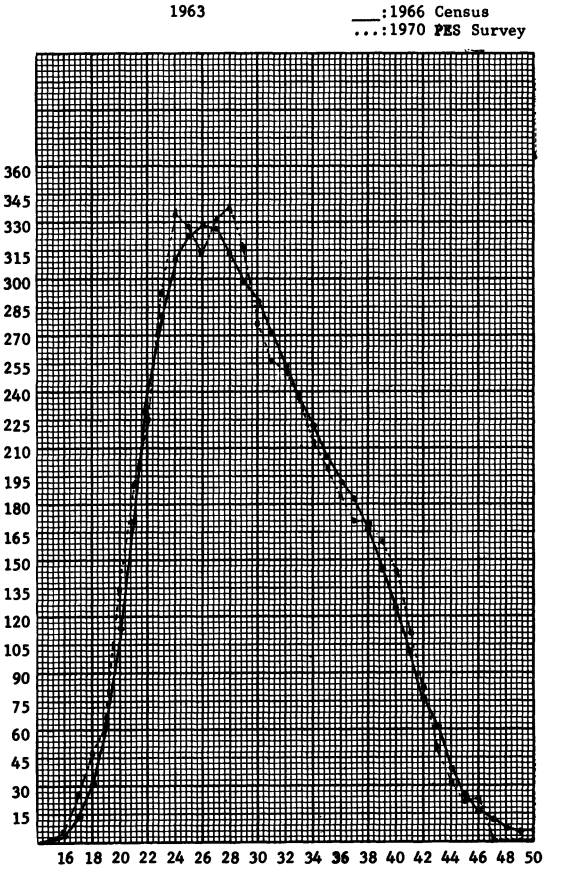


Fig.1 Age-specific fertility rates estimated from the 1966 Census and 1970 post-enimeration survey for Korea: 1961-1966





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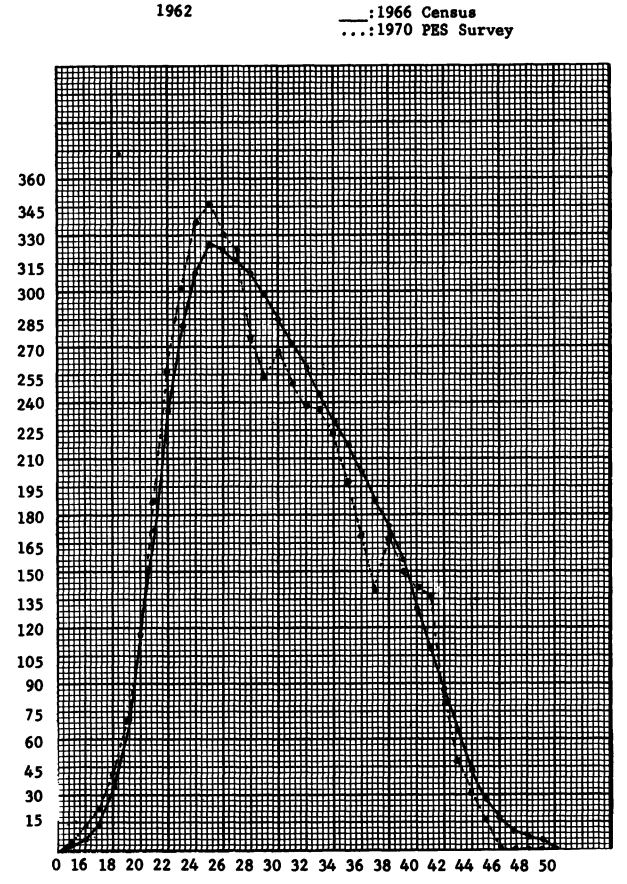

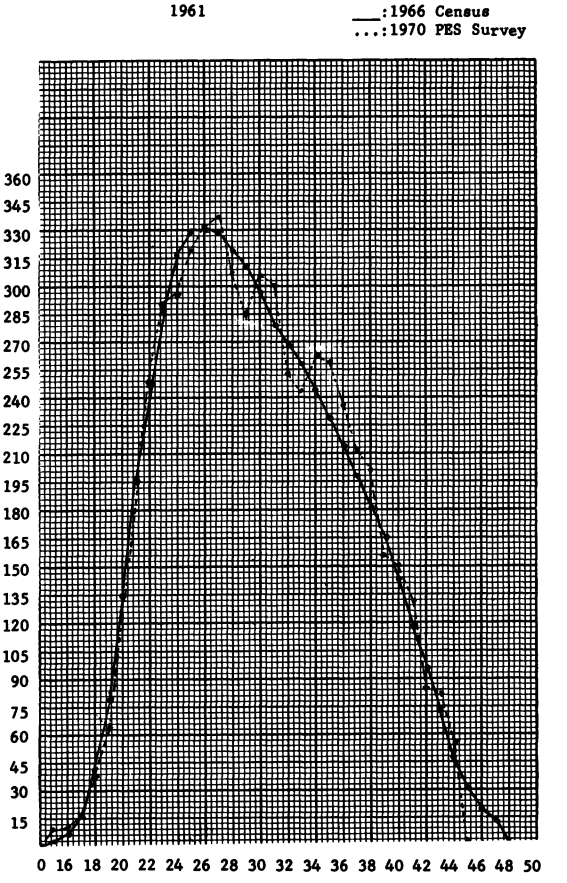

Fig. 1 Cont.

TABLE 1. Own children under 10 years old by exact age and approximate birth cohort of mother: Korea 1966 census

Exact age of women	Approximate birth cohort	Number of women	Own children up to 10 years old by age									
			0	1	2	3	4	5	6	7	8	9
15	1951	25539	7	0	0	0	0	0	0	0	0	0
16	1950	26029	21	7	0	0	0	0	0	0	0	0
17	1949	25219	89	33	9	0	0	0	0	0	0	0
18	1948	24966	285	123	45	11	0	0	0	0	0	0
19	1947	24568	698	327	118	48	26	0	0	0	0	1
20	1946	21170	1075	633	274	151	71	30	0	0	1	0
21	1945	20081	1867	1227	652	357	136	87	45	0	2	0
22	1944	20464	2997	1984	1329	808	366	172	107	58	2	1
23	1943	20979	4070	3158	2308	1658	917	440	240	106	90	0
24	1942	24058	6000	4959	4031	3066	2020	1254	617	314	157	95
25	1941	22945	6283	5669	4932	4209	2869	2033	1228	620	303	166
26	1940	21774	6247	5821	5648	5092	4008	3300	2293	1325	666	266
27	1939	22462	6358	6181	6295	6163	5357	4505	3683	2563	1438	704
28	1938	21263	5758	5793	5981	6145	5705	5204	4447	3505	2359	1306
29	1937	21887	5558	5636	6156	6503	6325	5892	5627	4787	3830	2421
30	1936	20047	4801	4804	5407	6017	5915	5956	5701	5214	4594	3305
31	1935	20409	4403	4633	5234	5989	5835	6003	6311	5858	5560	4161
32	1934	19303	3954	4063	4805	5334	5469	5756	5751	5794	5556	4564
33	1933	17531	3261	3481	3987	4698	4827	5131	5068	5186	5272	4363
34	1932	18761	3260	3419	4063	4790	4939	5308	5487	5451	5595	4846
35	1931	17028	2583	2824	3453	4064	4251	4718	4793	4876	4977	4388
36	1930	16173	2306	2482	2965	3604	3891	4193	4406	4462	4600	4114
37	1929	16975	2240	2427	2970	3553	3888	4158	4464	4535	4709	4179
38	1928	15134	1750	1928	2476	2952	3230	3660	3783	3872	4139	3671
39	1927	15031	1566	1779	2393	2686	3052	3408	3578	3743	3886	3527
40	1926	13897	1305	1436	1943	2386	2664	3006	3292	3323	3463	3268
41	1925	13665	1022	1258	1633	2234	2440	2741	3043	3137	3353	3049
42	1924	13386	808	1016	1445	1901	2176	2541	2844	2864	3178	2870
43	1923	13658	605	835	1249	1714	2081	2348	2659	2768	3068	2707
44	1922	12842	412	612	965	1305	1672	2057	2312	2438	2735	2518
45	1921	12141	239	411	659	1035	1316	1745	1994	2216	2378	2309
46	1920	11713	145	243	427	783	1077	1433	1728	1904	2162	2037
47	1919	9767	93	123	275	446	657	941	1247	1427	1584	1550
48	1918	10062	61	100	166	268	503	813	981	1175	1442	1407
49	1917	10642	53	80	121	187	308	572	811	1069	1277	1355
50	1916	10268	56	51	85	132	216	371	570	792	1023	1059
51	1915	9647	37	42	54	88	109	206	322	508	734	793
52	1914	8824	24	35	38	52	75	124	207	290	450	545
53	1913	9123	37	28	42	49	54	87	149	212	338	420
54	1912	9322	32	35	28	55	48	78	88	135	222	295
unknown	--	--	1911	1824	2176	2571	2787	3306	3613	3898	4595	4478

TABLE 2. Survival ratios for children aged 0-9 years and women aged 15-54 years based on the life tables, and for children only based on the Brass estimate of childhood mortality

i	0	1	2	3	4	5	6	7	8	9
	Part A. Survival ratios for children from birth to age i($^{L}i/^{l}o$).									
Brass estimate	.9479	.9414	.9321	.9220	.9118	.9041	.8964	.8887	.8810	.8733
Life tables	.9505[1]	.9315[2]	.9244[2]	.9181[2]	.9126[2]	.8761[3]	.8708[3]	.8666[3]	.8635[3]	.8482[4]
Age a	Part B. Survival ratios for women from age a-i+½ to age i($^{L}i/^{L}a-i+½$) based on the life tables.									
15...	.99935	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
16...	.99933	.99757	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
17...	.99917	.99725	.99563	.00000	.00000	.00000	.00000	.00000	.00000	.00000
18...	.99894	.99664	.99487	.99325	.00000	.00000	.00000	.00000	.00000	.00000
19...	.99875	.99605	.99390	.99213	.99052	.00000	.00000	.00000	.00000	.00000
20...	.99869	.99572	.99316	.99102	.98925	.98638	.00000	.00000	.00000	.00000
21...	.99872	.99566	.99285	.99029	.98816	.98315	.98089	.00000	.00000	.00000
22...	.99868	.99561	.99274	.98993	.98738	.98192	.97957	.97732	.00000	.00000
23...	.99868	.99556	.99266	.98979	.98699	.98102	.97832	.97599	.97374	.00000
24...	.99866	.99551	.99257	.98968	.98681	.98044	.97737	.97468	.97235	.96764
25...	.99862	.99537	.99240	.98946	.98658	.97992	.97660	.97354	.97086	.96602
26...	.99858	.99519	.99214	.98918	.98626	.97933	.97588	.97257	.96953	.96422
27...	.99857	.99508	.99191	.98887	.98592	.97869	.97517	.97173	.96843	.96262
28...	.99856	.99500	.99175	.98858	.98555	.97799	.97441	.97091	.96749	.96122
29...	.99855	.99492	.99161	.98837	.98522	.97717	.97356	.97000	.96651	.95991
30...	.99853	.99479	.99143	.98814	.98491	.97626	.97254	.96895	.96541	.95850
31...	.98848	.99457	.99114	.98779	.98451	.97527	.97135	.96765	.96408	.95684
32...	.99843	.99430	.99073	.98731	.98398	.97409	.97001	.96611	.96242	.95481
33...	.99836	.99399	.99025	.98669	.98328	.97262	.96843	.96437	.96049	.95235
34...	.99830	.99367	.98971	.98599	.98245	.97086	.96654	.96238	.95835	.94954
35...	.99826	.99340	.98924	.98531	.98160	.96897	.96449	.96020	.95606	.94659
36...	.99822	.99317	.98882	.98468	.98076	.96702	.96230	.95785	.95359	.94345
37...	.99815	.99288	.98838	.98406	.97994	.96503	.96000	.95531	.95089	.94006
38...	.99808	.99258	.98791	.98343	.97913	.96307	.95767	.95268	.94803	.93641
39...	.99803	.99229	.98742	.98277	.97832	.96115	.95535	.94999	.94504	.93254
40...	.99799	.99201	.98694	.98209	.97747	.95922	.95307	.94732	.94201	.92853
41...	.99795	.99177	.98651	.98147	.97665	.95723	.95079	.94470	.93901	.92444
42...	.99792	.99151	.98609	.98086	.97585	.95517	.94841	.94204	.93600	.92031
43...	.99788	.99124	.98566	.98027	.97507	.95306	.94596	.93927	.93295	.91615
44...	.99784	.99097	.98520	.96965	.97430	.95087	.94343	.93641	.92978	.91190
45...	.99765	.99045	.98451	.97878	.97327	.94855	.94076	.93340	.92646	.90748
46...	.99758	.99001	.98377	.97787	.97218	.94616	.93803	.93033	.92306	.90294
47...	.99787	.99026	.98369	.97750	.97163	.94397	.93547	.92744	.91983	.89841
48...	.99822	.99087	.98437	.97785	.97169	.94202	.93314	.92475	.91681	.89389
49...	.99844	.99131	.98519	.97873	.97224	.94022	.93095	.92217	.91388	.88932
50...	.99835	.99114	.98536	.97928	.97286	.93836	.92863	.91947	.91080	.88454
51...	.99792	.99017	.98437	.97863	.97259	.93617	.92601	.91641	.90737	.87949
52...	.99720	.98851	.98216	.97640	.97071	.93351	.92306	.91305	.90358	.87436
53...	.99632	.98640	.97904	.97275	.96704	.93013	.91954	.90925	.89939	.86909
54...	.99546	.98416	.97548	.96820	.96198	.92598	.91523	.90481	.89469	.86362

[1]/1966 Life Table; [2]/1964 Life Table; [3]/1959 Life Table; [4]/1955-60 Life Table.

TABLE 3. Estimated number of birth cohort of women (defined by age of woman at the time of the census) for 10 years preceding the census

Birth cohort	Age of women at census date	Calendar year									
		1966	1965	1964	1963	1962	1961	1960	1959	1958	1957
1951	15...	8	0	0	0	0	0	0	0	0	0
1950	16...	23	8	0	0	0	0	0	0	0	0
1949	17...	96	36	10	0	0	0	0	0	0	0
1948	18...	308	134	50	12	0	0	0	0	0	0
1947	19...	753	355	130	54	29	0	0	0	0	1
1946	20...	1160	687	301	168	80	34	0	0	1	0
1945	21...	2014	1333	717	398	154	100	52	0	2	0
1944	22...	3233	2155	1462	901	414	197	124	68	2	1
1943	23...	4391	3430	2538	1848	1036	504	278	124	107	0
1942	24...	6473	5386	4433	3417	2283	1436	715	389	187	115
1941	25...	6779	6157	5423	4691	3243	2328	1423	728	362	201
1940	26...	6740	6322	6211	5675	4530	3779	2657	1555	795	322
1939	27...	2860	6713	6923	6869	6055	5159	4267	3008	1716	853
1938	28...	6212	6291	6578	6849	6448	5959	5153	4114	2814	1583
1937	29...	5996	6121	6770	7248	7149	6747	6520	5619	4570	2934
1936	30...	5180	5217	5946	6706	6685	6821	6606	6120	5482	4005
1935	31...	4750	5032	5756	6675	6595	6874	7313	6876	6634	5043
1934	32...	4266	4413	5284	5945	6181	6592	6664	6801	6629	5531
1933	33...	3518	3780	4385	5236	5456	5876	5872	6087	6291	5288
1932	34...	3517	3713	4468	5339	5582	6078	6358	6398	6676	5873
1931	35...	2787	3067	3797	4230	4805	5403	5554	5723	5939	5318
1930	36...	2488	2696	3261	4017	4398	4802	5105	5237	5489	4986
1929	37...	2417	2636	3266	3960	4394	4762	5172	5323	5619	5065
1928	38...	1888	2094	2723	3290	3651	4191	4383	4545	4939	4449
1927	39...	1690	1932	2632	2994	3449	3903	4146	4393	4637	4274
1926	40...	1408	1560	2137	2659	3011	3442	3814	3900	4132	3961
1925	41...	1103	1366	1796	2490	2758	3139	3526	3682	4001	3695
1924	42...	872	1103	1589	2119	2459	2910	3295	3362	3792	3478
1923	43...	653	907	1374	1910	2352	2689	3081	3249	3661	3281
1922	44...	445	665	1061	1455	1890	2356	2679	2862	3263	3052
1921	45...	258	446	725	1154	1487	1998	2310	2601	2837	2798
1920	46...	156	264	470	873	1217	1641	2002	2235	2580	2469
1919	47...	100	134	302	497	743	1078	1445	1675	1890	1878
1918	48...	66	109	183	299	569	931	1137	1379	1721	1705
1917	49...	57	87	133	208	348	655	940	1255	1524	1642
1916	50...	60	55	94	147	244	425	661	930	1221	1283
1915	51...	40	46	59	98	123	236	373	596	876	961
1914	52...	26	38	42	58	85	142	240	340	537	661
1913	53...	40	30	46	55	61	100	173	249	403	509
1912	54...	35	38	31	61	54	89	102	159	265	358

TABLE 4. Reported female population in the census and estimated mid-year female population by birth cohorts (defined by age of women at the time of the census) for the 10 years preceding the census: Korea, 1966 Census

Birth cohort	Age of women at census	Reported in the 1966 census	Calendar year									
			1966	1965	1964	1963	1962	1961	1960	1969	1958	1957
1951	15	25539	25556	0	0	0	0	0	0	0	0	0
1950	16	26029	26046	0	0	0	0	0	0	0	0	0
1949	17	25219	25240	25330	0	0	0	0	0	0	0	0
1948	18	24993	25050	25095	25136	0	0	0	0	0	0	0
1947	19	24568	24599	24665	24719	24763	24803	0	0	0	0	0
1946	20	21170	21198	21261	21316	21316	21362	21400	21506	0	0	0
1945	21	20081	20107	20169	20226	20278	20322	20425	20472	0	0	0
1944	22	20464	20491	20554	20614	20672	20726	20841	20891	20939	0	0
1943	23	20979	21007	21073	21134	21195	21256	21385	21444	21495	21545	0
1942	24	24058	24090	24167	24238	24309	24380	24538	24615	24683	24742	24863
1941	25	22945	22977	23052	23121	23189	23257	23415	23495	23569	23634	23752
1940	26	21774	21805	21879	21947	22012	22077	22234	22312	22388	22458	22582
1939	27	22462	22494	22573	22645	22715	22783	22951	23034	23116	23194	23334
1938	28	21263	21294	21370	21440	21509	21575	21742	21821	21900	21978	22121
1937	29	21887	21219	21999	22072	22145	22215	22398	22481	22564	22645	22801
1936	30	20047	20077	20152	20220	20288	20354	20535	20613	20689	20765	20915
1935	31	20409	20440	20520	20591	20661	20730	20927	21011	21091	21169	21130
1934	32	19303	19333	19414	19484	19551	19617	19816	19900	19980	20057	20217
1933	33	17531	17560	17637	17704	17768	17829	18025	18103	18179	18252	18408
1932	34	18761	18793	18881	18956	19028	19096	19324	19411	19494	19576	19758
1931	35	17028	17058	17141	17213	17282	17347	17573	17655	17734	17811	17989
1930	36	16173	16202	16384	16356	16425	16490	16725	16807	16885	16960	17142
1929	37	16975	17007	17097	17175	17250	17323	17590	17682	17769	17852	18057
1928	38	15134	15163	15247	15319	15389	15457	15714	15803	15886	15964	16162
1927	39	15031	15061	15148	15223	15295	15364	15639	15734	15822	15905	16118
1926	40	13897	13925	14009	14081	14150	14217	14488	14581	14670	14753	14967
1925	41	13665	13693	13778	13852	13923	13992	14276	14372	14465	14553	14782
1924	42	13386	13414	13501	13575	13647	13717	14014	14114	14210	14301	14545
1923	43	13658	13687	13779	13857	13933	14007	14331	14438	14541	14640	14908
1922	44	12842	12870	12959	13035	13109	13181	13506	13612	13714	13812	14083
1921	45	12141	12170	12258	12332	12404	12474	12800	12906	13007	13105	13379
1920	46	11713	11741	11831	11906	11978	12048	12380	12487	12590	12689	12972
1929	47	9767	9788	9863	9929	9992	10052	10347	10441	10531	10618	10871
1918	48	10062	10080	10155	10222	10290	10355	10681	10783	10881	10975	11256
1917	49	10642	10659	10735	10802	10873	10946	11319	11431	11540	11645	11966
1916	50	10268	10285	10630	10421	10485	10554	10943	11057	11167	11273	11608
1915	51	9647	9667	9743	9800	9858	9919	10303	10418	10527	10632	10969
1914	52	8824	8849	8927	8984	9037	9090	9453	9560	9664	9766	10092
1913	53	9123	9157	9249	9318	9379	9434	9808	9921	10034	10144	10497
1912	54	9322	9365	9472	9556	9628	9690	10067	10185	10303	10419	10794

TABLE 5. Estimated age specific fertility rates per 1000 women for single year female birth cohorts (defined by age of women at the time of the census) for the 10 calendar years preceding the census

Birth cohort	Age of women at census date	Calendar year									
		1966	1965	1964	1963	1962	1961	1960	1959	1958	1957
1951	15...	0	0	0	0	0	0	0	0	0	0
1950	16...	1	0	0	0	0	0	0	0	0	0
1949	17...	4	1	0	0	0	0	0	0	0	0
1948	18...	12	5	2	1	0	0	0	0	0	0
1947	19...	31	14	5	2	1	0	0	0	0	0
1946	20...	55	32	14	8	4	2	0	0	0	0
1945	21...	100	66	36	20	8	5	3	0	0	0
1944	22...	158	105	71	44	20	10	6	3	0	0
1943	23...	209	163	120	87	49	24	13	6	5	0
1942	24...	269	223	183	141	94	59	29	15	8	5
1941	25...	295	267	235	202	139	99	61	31	15	9
1940	26...	309	289	283	258	205	170	119	70	35	14
1939	27...	305	297	306	302	267	225	185	130	74	37
1938	28...	292	294	307	318	299	274	236	188	128	72
1937	29...	274	278	307	327	322	301	290	249	202	129
1936	30...	258	259	294	331	328	332	321	296	264	192
1935	31...	232	245	280	323	318	329	348	326	313	236
1934	32...	221	227	271	304	315	333	335	340	331	274
1933	33...	200	214	248	295	306	326	324	335	345	287
1932	34...	187	197	236	281	292	315	328	328	341	297
1931	35...	163	179	221	262	277	307	315	323	333	296
1930	36...	154	166	199	245	267	287	304	310	324	291
1929	37...	142	154	190	230	254	271	293	300	315	281
1928	38...	125	137	178	214	236	267	277	286	309	275
1927	39...	112	128	173	196	225	250	264	278	292	265
1926	40...	101	111	152	188	212	238	262	266	280	265
1925	41...	81	99	130	179	197	220	245	255	275	250
1924	42...	65	82	117	155	179	208	234	237	265	239
1923	43...	48	66	99	137	168	188	213	223	250	220
1922	44...	35	51	81	111	143	174	197	209	236	217
1921	45...	21	36	59	93	119	156	179	200	217	209
1920	46...	13	22	39	73	101	133	160	178	203	190
1919	47...	10	14	31	50	74	104	138	159	178	173
1918	48...	7	11	18	29	55	87	105	127	157	152
1917	49...	5	8	12	19	32	58	82	109	131	137
1916	50...	6	5	9	14	23	39	60	83	108	111
1915	51...	4	5	6	10	12	23	36	57	82	88
1914	52...	3	4	5	6	9	15	25	35	55	65
1913	53...	4	3	5	6	7	10	17	25	40	49
1912	54...	4	4	3	6	6	9	10	15	25	33

TABLE 6: Estimated single-year age-specific fertility rate for Korea: 1957-66

Age of women*	Calendar year									
	1966	1965	1964	1963	1962	1961	1960	1959	1958	1957
15	1	1	1	1	3	3	4	5	6	7
16	2	3	4	5	6	7	10	10	11	11
17	8	10	10	14	14	17	21	23	25	25
18	22	23	25	32	34	41	45	50	55	54
19	43	49	53	65	71	79	90	100	101	100
20	77	85	96	114	117	135	152	159	165	160
21	129	134	152	171	172	197	211	218	233	214
22	183	193	209	230	236	249	263	272	289	255
23	239	245	259	280	282	288	305	311	322	280
24	282	278	294	310	310	317	334	333	338	292
25	302	293	306	323	325	330	341	338	343	296
26	307	296	307	329	323	330	330	332	337	293
27	298	286	300	327	317	330	326	326	329	286
28	283	269	287	314	311	320	321	317	319	278
29	266	252	275	299	299	311	309	305	312	270
30	245	236	259	288	285	297	298	293	300	265
31	227	221	242	271	272	279	285	282	286	257
32	211	206	228	253	260	269	270	272	278	245
33	194	188	210	237	245	258	263	260	270	230
34	175	172	195	222	230	244	254	246	258	218
35	159	160	184	205	218	229	239	230	243	213
36	148	146	175	192	204	214	223	216	226	200
37	133	132	162	183	188	198	205	204	210	182
38	118	119	141	167	174	181	188	189	191	162
39	107	105	123	146	156	165	170	168	167	144
40	91	90	108	124	131	144	149	143	144	124
41	73	74	90	102	110	118	122	118	120	99
42	56	59	70	83	88	96	94	96	95	77
43	41	44	49	61	64	73	71	70	69	57
44	28	29	35	39	43	48	48	46	47	41
45	17	18	24	24	28	31	31	30	33	0
46	12	12	15	17	18	19	-21	20	0	0
47	8	9	11	12	11	13	14	0	0	0
48	6	7	8	8	8	10	0	0	0	0
49	6	5	5	6	6	0	0	0	0	0
50	5	5	5	6	0	0	0	0	0	0
51	4	4	4	0	0	0	0	0	0	0
52	4	4	0	0	0	0	0	0	0	0
53	4	0	0	0	0	0	0	0	0	0
TOTAL	4511	4462	4921	5462	5559	5838	6006	5980	6121	5335

*Age at the time of birth

TABLE 7. Korea 1957-1966: Final estimates of fertility derived from the 1966 Census

Year	Total Fertility Rate	Age-specific fertility rate per 1000						
		15-19	20-24	25-29	30-34	35-39	40-44	45-49
1957	5342*	39	238	285	243	182	81	-
1958	6101*	40	266	329	279	210	97	-
1959	5941*	38	256	324	272	203	95	-
1960	5955*	35	251	326	275	206	97	-
1961	5786*	31	236	325	270	198	98	-
1962	5579	26	221	315	260	189	90	15
1963	5476	22	220	319	255	179	85	14
1964	4940	17	203	296	228	159	73	13
1965	4484	16	191	280	206	134	60	10
1966	4531	14	186	292	212	134	59	10

*Excludes the fertility rate of women 45-49 years of age.

TABLE 8. Estimated Total Fertility Rates[a] Based on the 1966 Census and the 1968 Fertility and Family Planning Survey, Korea: 1959-1966

Year	1966 Census	1968 Survey	Percent difference
1959	5,920	5,993	-1.2
1960	6,036	5,897	+2.3
1961	5,930	5,706	+3.9
1962	5,497	5,311	+3.5
1963	5,444	5,451	-0.1
1964	4,934	4,946	-0.2
1965	4,489	4,653	-3.5
1966	4,532	4,519	+0.3

[a]For the purpose of comparison, the total fertility rates are confined to the age range covered by the Fertility and Family Planning Survey; for example, the 1959 total fertility rate covers the age range from 15 to 39.