KOREA JOURNAL OF POPULATION AND DEVELOPMENT
Volume 26, Number 1, July 1997

THE EFFECTS OF SEX-SELECTIVE ABORTION ON FERTILITY LEVEL IN KOREA*

TAI-HUN KIM
Korea National University of Education

The relationships between fertility level and sex ratio was analysed with the estimation of the number of sex-selective abortions and the number of births controlled by abortion.The number of live births which experienced sex screening was estimated as 71,949. Among the 71,949 boys who experienced the sex screening , the normal live births found as male fetuses at the tests of the sex screening are estimated as 37,022. The rest (34,927) are the boys who were born after repeated induced abortion when the fetus was known to be a girl at the first sex screening . The proportion of the boys experienced sex screening to the total male births was 6.8%.The total number of births controlled by sex selective induced abortions for male births is estimated as 43,550 births, which reduced the total number of births by 2.15%. The contribution rates of fertility reduction resulted by sex selective induced abortions among the births of mothers aged 35 years and over or among the third or later births are significantly high: 7.21% and 14.97% each.

INTRODUCTION

If parents continued to bear children until they reached the desired sex combination of children or desired number of sons, sex preference would be a major barrier to fertility reduction (Han and Lee 1977; Cho 1982; Lee 1982; Park and Cho 1994, p. 87). Sheps (1963) has shown that, theoretically, the expected average family size would be 3.88 if couples continued childbearing until two sons were born.

However, couples have relatively less control over the sex of the children than they do over the number of children, since the sex of children is determined through biological rather than behavioral processes. For this reason, as more couples in recent years tend to rely on sex-selective induced abortion to accomodate both a preference for boys and a small family-size norm, a distortion of the sex ratio at birth is emerging in Korea (Cho et al. 1994, p. 84). To accommodate both sex preference and the desire for a small family, a new demographic phenomenon of the distortion of sex ratio at

* This paper was supported by non-directed research fund, Korea Research Foundation. An earlier version of this paper was presented at the International Workshop on Fertility, Son Preference and Child Mortality of Koreans in Korea and China (November 6-8th, 1996), which was jointly organized by the Population Association of Korea and Hanyang University.

birth is emerging at four different levels: in the general population, in the mother's age at birth, in the family size, and in the birth order. At the aggregate population level, a rising trend has been recorded in the sex ratio. At the birth order level, a rapidily rising sex ratio is reported. At the mother's age and the family level, depending on the age of mother at birth and the size of family, different sex ratios have been observed; young mothers and large families are presenting low sex ratios and elder mothers and small families have high sex ratios (Park and Cho 1994, p. 88).

The two principal means of altering the sex ratio at birth are sex-selective abortion and differential contraceptive use, depending on the sex distribution of existing children. Differential contraceptive use alone will not change the population sex ratio, nor will it cause variations in the sex ratio among birth orders, as long as the probability of a male birth is constant (see table 2, Assumption 1). Use of contraceptive technology, however, can change mother-age specific and family-size specific sex ratios. It can alter the sex ratio of the last-born child (Park 1983; Park and Cho 1994, p. 88).

In this paper, we present empirical evidence for the levels and their changes of the sex ratio in Korea. And the relationships between fertility level and sex ratio will be analysed with the estimation of the number of sex-selective abortions and the number of births controlled by abortion. The data and detailed methods will be shown just before the analysis in each section, if necessary.

SEX-SELECTIVE ABORTION AS A DETERMINANT OF FERTILITY LEVEL

The level of sex ratio in a society becomes higher or lower according to the degree of mortality and migration differentials by age and sex. Sex ratio at birth, however, is generaly constant because of the lack of effects on any external factors. The sex ratio is generally 103 to 105 in developed countries and 105 to 107 in developing countries. Therefore, 105 is considered the average world ratio.

The sex ratio at birth in Korea has changed from 103.9 (1980) to 116.8 (1990) (see table 1). Since 1982, the ratio in Korea has been above the world average, and has been above the average level of developing countries since 1984. The sex ratio in 1990 was 116.8, which is higher than the world average by 11.8 points.

The sex ratio in Korea was originally not so high. As shown in table 1, the sex ratio at birth for the first child was between 105 and 109, and even the

TABLE 1. SEX RATIO AT BIRTH BY BIRTH ORDER, 1980-1992

Birth order	1980	1982	1984	1986	1988	1990	1992
Total	103.9	106.8	108.3	111.8	113.4	116.8	114.0
1st	105.7	105.4	106.1	107.3	107.4	108.7	106.4
2nd	104.2	106.0	107.2	111.3	113.3	117.2	112.8
3rd	102.7	109.2	116.9	138.7	166.3	191.9	195.6
4th & higher	99.1	113.7	128.1	150.6	185.7	218.9	229.0

Source: Birth registration data of Korea Statistical Office.
1980-82: Cumulative registration data by end of 1989.
1984-92: Cumulative registration data by end of 1992.

ratio in 1990 which marked the highest after 1980, was only 108.7. Also the ratio for the second child was under 110 until 1984. Since the late 1980s the ratio has jumped to over 110. The sex ratio at birth for the third and later born children is extremely high: often reaching 150 to 200, or even higher.

In Korea, the ideal number of children has dropped to under 2.0, and the total fertility rate (TFR) has dropped to 1.6 which is under the replacement level of 2.1. Thus, we can assert that a couple wants a third or later child because of their strong desire to have at least one boy. When an effective sex-selective abortion is available, they will try to have a boy. This is the reason why the sex ratios of third or later births are so high. Furthermore, when a small family size is strongly desired, a couple will try to have a boy within their ideal number of children. For this reason, the recent sex ratio of the second children is also increasing sharply.

The Korean government began to punish medical practitioners who engage in sex predetermination when the 'Medical Law' was revised in 1987 and 'The Presidential Decree of Medical Administration Measure Standard' was passed in 1990, because more boys were born selectively after sex determination. The sex ratio at birth still remained at a high level: 114.0 in 1992. Although the ratio in 1992 is lower than that in 1990 (116.8), the level increased during 1990, the Horse Year in the Chinese zodiac cycle, in Korea (Joo and Kim 1994). In Korea, girls born in the Horse Year are popularly believed to destroy their husbands in the future. Thus, some believe that many girls born in that year were registered as being born in the following year to prevent them from suffering the stigma of being born under the zodiac sign of the Horse (Park and Cho 1994, p. 105).

The small ideal family size and the strong son preference effect the sex structure of the population by sex and the reduction of the fertility level. The ideal family size for women under age of 30 remained at the level of 1.8-1.9 children in the second half of 1980s. The ideal family size itself was

lower than the fertility replacement level. Considering the increase in the proportion of the unmarried population and age at first marriage, the total fertility rate in Korea remained at 1.63 in 1988 and later. Furthermore, the strong son preference helped the fertility level to stay low in the late 1980s, when the fertility level became extremely low, although the son preference kept the fertility higher before 1980s.

Since the ideal number of children is less than 2, and son preference is still strong, a woman will stop bearing children when she has a boy, and she will try to have another child if she has only girls. In a society where the desire for a small family is strong, a woman will try to have a boy before the number of her children ever born is over her ideal number of children, and she will not wait to have a boy while she continues the bearing. This pushes up the sex ratio at birth higher and pulls down the average fertility level (Kim 1992).

In table 2, the theoritical number of children by birth order is shown when women stop bearing after having a boy. Four hyphotheses were adopted in the model (Assumption 1): 1) the number of mothers is 16; 2) the sex ratio at

Table 2. HYPOTHESIZED NUMBER OF BIRTHS BY ORDER UNDER THE ASSUMPTIONS ON THE CHILDBEARING AFTER HAVING A BOY

<Assumption 1>
1) No. of mothers: 16.
2) Sex ratio at birth: 100.
3) Cessation of childbearing after having a boy.
4) The maximum number of children is four.

<Assumption 2>
1) No. of mothers: 16.
2) Sex ratio at birth: 100.
3) Cessation of childbearing after having a boy.
4) Male selective childbearing at the third child.

Birth order	Assumption 1		Assumption 2	
	No. of births	Childbearing	No. of births	Childbearing
1st birth	8 boys	Cessation	8 boys	Cessation
	8 girls	Continuation	8 girls	Continuation
2nd birth	4 boys	Cessation	4 boys	Cessation
	4 girls	Continuation	4 girls	Continuation
3rd birth	2 boys	Cessation	4 boys	Cessation
	2 girls	Continuation	–	
4th birth	1 boy	Cessation	–	
	1 girl	Cessation	–	

Results:	(Assumption 1)	(Assumption 2)
1) Total number of births:	30 children	28 children
2) Sex ratio at birth:	100.0	133.30
3) Average number of births per mother:	1.875 children	1.75 children

Sources: Kim (1993, p. 6; 1995, p. 60).

birth is 100.0; 3) a mother stops having children when a boy is born and continues to have another child when a girl is born; and 4) she also stops child bearing even when the fourth child is a girl.

According to the hypothesis of Assumption 1 in table 2, 16 mothers had 30 births in total, 15 boys and 15 girls. Since a couple prefers to have a boy and a small family, the couple try to have a boy in a small number of births. Therefore, if the second child, which is near to the ideal number of childern (1.8-1.9), is also a girl, let us assume that the mother can have a boy selectively and stop her pregnancy (Assumption 2). Thus, in table 2, the two girls for the third births would be changed into two boys and there would be no fourth child. The results under Assumption 2 are: 1) the total number of children is 28, which includes 16 boys and 12 girls; 2) the sex ratio is 133; 3) the average number of children per mother is 1.75, which is lower than the predicted1.875 children of hypothesis 1 by 0.125 children. In a society where the sex screening is available, the sex ratio might be distorted and the fertility level might be low.

As shown in table 2, the generalization of sex discrimination leads to lower fertility and speeds up Korean population reduction. When we extend the population projection, which is the estimation up to 2021 by the Korea Statistical Office under the same assumptions, until 2090, the Korean total population will decrease by 1% per year from 2050 (Kim 1995, p. 72, table 3-11). Additionally, the size of the population will also change significantly. The proportion of the dependant population aged 0-14 years will drop by 16% in 2020 and only 13.7% in 2050, when the total population will decrease by 1% every year. And the poportion of the aged population, aged 65 years and over, will change more dramatically from 5% in 1990 to 12.5% in 2020 and to 24.4%, a quarter of the total population, in 2050.

ESTIMATION OF NUMBERS OF SEX-SELECTIVITY AND SEX-SELECTIVE INDUCED ABORTION

From the results of 1994 National Fertility and Family Health Survey conducted by Korea Institute of Health and Social Affairs (Hong et al. 1994, pp. 150-153) we can confirm that sex discrimination, as a social problem, has been quite serious. Among the respondent women who have experienced the sex-selective tests, the number of women who's pregnaneies ended with live births are compared with those terminated through induced abortion in table 3. 94.6% of male fetuses were live births, but only 81.1% of female fetuses were live births. 17.4% of female fetuses were terminated by induced abortion.

TABLE 3. PROPORTION OF PREGNANCY BY SEX AND BY TYPE OF PREGNANCY TERMINATION, 1993

Sex	Live birth[1)]	Still birth	Spontaneous abortion	Induced abortion	Still Pregnancy	Total (N)[4)]
Total	88.4	0.3	0.1	9.7	1.6	100.0 (1,308)
Males[2)]	94.6	0.3	0.2	3.2	1.8	100.0 (709)
Females[3)]	81.1	0.3	–	17.4	1.3	100.0 (598)

Source: Hong et al. (1994, p. 150, Table V-13)

Notes: 1) Included the twins (live birth + still birth).
2) Included the twins (male + male and male + female).
3) Included the twins (female + female).
4) Number of pregnancy tested sex screening.

Table 4 shows the proportion of the women who had sex screening experiences. This includes the cases which the mother herself asked for sex discrimination and those determined through medical treatments. 14.5% of the total respondent women knew their fetus' sex before birth. Since never pregnant women were included in the total respondants, the proportion of pregnant women would increase. 3.0% of the women had two or more experiences of sex screening. This proportion also increased if they were compared with only the women who experienced two or more pregnancies.

Considering sex screening by age, 14.0% of the women aged 15-24, 21.8% for those aged 25-29 years, and 19.3% for those aged 30-34 years have had sex detemination. But, only 10.6% and 3.2% of those aged 35-39 and 40-44, respectively have each experienced it.

This phenomena is observed because younger women tend to have their desired number of children by sex. One reason women in their late 30s and

TABLE 4. PROPORTION OF CURRENTLY MARRIED WOMEN BY AGE AND TIMES OF EXPERIENCIES OF SEX DISCRIMINATION, 1993

Age	Non experienced	Experienced			Total (No. of women)
		Sub-total	Only once	Two or more	
Total	85.8	14.5	11.5	3.0	100.0 (5,182)
15-24	86.0	14.0	12.2	1.8	100.0 (315)
25-29	78.2	21.8	17.5	4.3	100.0 (1,143)
30-34	80.7	19.3	14.6	4.7	100.0 (1,487)
35-39	89.4	10.6	8.4	2.2	100.0 (1,343)
40-44	96.8	3.2	2.9	0.3	100.0 (893)

Source: Hong et al. (1994, p. 152, Table V-14).

over have had fewer sex screening than younger women is that the medical techniques for sex screening were not available during their prime childbearing years.

From the discussion above, we conclude that the strong son preference is still effective on pregnancy and childbirths. Since the son preference is still strong among young women in prime childbearing age groups, the distortion of the sex ratio at birth will continue in the furture. Although the elder elegible women have strong son preferences, their effects on sex ratio at birth will be small, because most of them have finished their child bearing.

With several assumptions, we can estimate the times of sex screening and sex-selecitive induced abortions. Considering that there may be some errors (such as delay, omission) on the birth registration data, three year registration data for the period of 1989-91 was adopted for the estimation. The hypotheses for the estimation are as follows: the normal sex ratio at birth is 106, which is the average sex ratio at birth of the first children born in 1980-84; the results of the sex screenings are exactly correct; there are no spontaneous abortions or miscarriages; and unwanted female fetuses only were aborted. Therefore, the total number of sex screenings were estimated at about 72,000 cases in 3 years (see Appendix), which is equal to 3.6% of the total births (about 1,980 thousand births).

If we assume that there are no sex screening for girls and sex ratio at birth is 106, the total number of boys not determined through sex screening would be estimated at 981,903, as shown in table 5. Thus, the number of live

TABLE 5. ESTIMATION OF THE TOTAL MALE BIRTHS EXPERIENCED SEX DISCRIMINATIONS, 1989-91

Sex discrimination	Boys (%)	Girls	Total (%)
Not tested	981,903 (93.2)[1)]	926,324	1,908,227 (96.4)
Tested	71,949 (6.8)[4)]	–	71,949 (3.6)
. Normal births[2)]	37,022		
. Birth after induced abortion[3)]	34,927		
Total	1,053,852 (100.0)	926,324	1,980,176 (100.0)

Sources: 1) The cumulative birth registration data by the end of 1992.
2) Joo and Kim (1994, p. 69).

Notes : 1) Estimated based on 106 of sex ratio (average sex ratio of the first births born in 1980-1984) and total female births (926,324).
2) Estimated number of boys conformed by sex discrimination.
3) Estimated number of boys who were pregnant again after induced abortions of female fetuses after sex discrimination.
4) Total estimated number of boys who experienced any sex discrimination.

births after sex screening would be 71,949, which is the difference between the total registered male births (1,053,852) and the male births which have not been predicted by sex screening (981,903).

Among the 71,949 boys who were identified through sex screening, the normal live births who were found to be male fetuses at the sex screenings are estimated at 37,022, and the rest (34,927) are the boys who were born after repeated induced abortion when the fetus was identified as a girl at the first sex screening.

The proportion of the boys determined by sex screening to the total male births was 6.8%, which means 68 boys among 1,000 boys. Therefore, we can assume that sex screening is widly adopted in Korea and is the main determinant of the unbalanced sex ratio at birth.

We can assume that a boy was able to be born through repregnancy after the abortion of a female fetus. If the result of the sex screening is perfect and there are no other spontaneous abortions and no miscarriages, we can estimate that the number of induced abortions for male childbirths after the sex screening are about 67,877 during the 3 years from 1989. Thus, the total estimated number of the sex screenings became 104,899, which includes 37,022 for the original male childbirths and 67,877 for the changes in the sex from girls to boys using sex screening and induced abortions. This means that about 35,000 pregnant mothers have had sex screenings each year. Furthermore, since a mother decides her own induced abortion after at least two or more medical tests, the number of induced abortions based on the number of medical tests has increased to about 70 thousand every year. If we consider that even female fetuses identified by sex screening were born normally, any pregnancy is not followed by induced abortion, and the male fetus identified by sex screening was terminated by spontaneous abortion or miscarriage, the total number of medical tests for sex screening would be increased further. Furthermore, we have used the sex ratio of the first births as the natural sex ratio. If there are any male selective births among the first births, the total number of sex screening tests and induced abortions would be greater than estimated above (Joo and Kim 1994, pp. 50-52).

If family size is limited in a society with a strong son preference, beyond a certain number of births the births, of female babies must be suppressed so that the desired number of sons may be attained within the ideal family size (Park and Cho 1994, p. 93). Therefore, when a mother has one or two daughters and tries to have a son within the ideal family size, the time would be the second or third birth and after the mother reaches her thirties.

According to the same method and calculating procedures adopted above, the total number of sex screenings and the number of boys born

TABLE 6. ESTIMATION OF MALE BIRTHS EXPERIENCED SEX DISCRIMINATIONS BY MOTHER'S AGE AND BIRTH ORDER, 1989-91

Mother's age & birth order	Total	Not tested	Tested		
			Sub total (% to total)	Normal birth	Births after induced abortions
Total	1,053,852	981,903	71,949 (6.83)	37,022	34,927
<Mother's age>					
24 & under	288,951	283,022	5,929 (2.05)	3,051	2,878
25-29	570,746	535,631	35,115 (6.15)	18,069	17,046
30-34	167,261	142,256	25,005 (14.95)	12,867	12,138
35 & over	26,469	20,577	5,892 (22.26)	3,032	2,860
<Birth order>					
1st	545,011	543,575	1,436 (0.26)	739	697
2nd	416,167	386,746	29,421 (7.07)	15,139	14,282
3rd	92,621	51,545	41,076 (44.35)	21,136	19,940

Sources: Same as Table 5.

Notes: 1) 'Total' includes 'Unknown'.

2) Others are as same as those of table 5.

3) See Appendix for the calculation method.

selectively after sex screenings and induced abortions by mother's age and birth order are estimated and shown in table 6.

The proportion of the boys identified throug sex screening to the total male births is increasing rapidly with the age of mothers. For mothers aged 24 years or less, only 2.1% (5,929 boys) of their total male births were identified through sex screening. However, the proportion for the male births of mothers aged 30-34 years has risen to 15.0% (25,005 boys) to the total male births (167,261 boys). Furthermore, 22.3% of male births are identified through screening when the mother is 35 or older.

On the other hand, the male births identified through sex screening by birth order were estimated. Since we have used 106 as the natural sex ratio for this estimation, which is the average ratio in 1980-84, we could find few cases in which sex screening was used among the boys born as the first birth. However, among the second and later born boys, the proportion identified through sex screening is increasing rapidly, and reaching an extremely high level: the proportion of second births was 7.1%, and that for the third or later ones was 44.4%.

Therefore, we can summarize that male selective births by sex screening and induced abortion are general among women aged 30 years and over and for the third or later male birth. The main reasons for this are that the

boy preference in Korea is still strong, although the society has been changing for the last 40 years, and that the technique of sex screening has been used widely since the technique was introduced. Therefore, the continuous pregnancy for one or more male births in the past has changed into repeated pregnancy for a boy, selection of male fetuses by sex screening, and induced abortion. These have caused a sex imbalance in the population, and a reduction in the number of births in Korea.

THE EFFECTS ON FERTILITY LEVEL OF SEX-SELECTIVE INDUCED ABORTION

Although induced abortion is illegal as a general rule in Korea, it has been adopted as a method of family planning since the 1960s, and, has led to the reduction of the population increase rate. The effects on the fertility level of induced abortion can be estimated by two methods. One is the estimation of potential fertility without any induced abortion, using the fertility rates by age of currently married women and the rates of induced abortion. The other is to estimate the effects when the total numbers of births and that of induced abortions in a year are multiplied by the birth control index of induced abortion (KIPH 1991, p. 577).

Since the number of the male births after induced abortions of female fetuses is as estimated in table 6, we can estimate the total number of induced abortions if we assume a woman will have an abortion repeatedly until she bears a male fetus. Then, we can estimate the birth control index using the following method.

We can estimate the number of births controlled by the induced abortions using the Renewal Process Model (Keyfiz 1970).

If a couple doesn't have any birth control after marriage, the wife can be pregnant after a given period. After the pregnancy and amenorrhea periods, she will reach the fecund period again.

Using this model we can calculate the actual number of birth controls from the ratio of the period between the first and the next fecund points in the case of live birth, and the period between the points in the case of induced abortion. We assume that there is no miscarriage, and that spontanous abortion and pregnancy probability is constant (see Han 1973, pp. 69-70).

If the pregnancy probability for a month is p, the number of pregnancies in the first month becomes np (n = total number of currently married women), n(1-p)p in the second month, and $n(1-p)^2p$ in the third month. Thus, using binomial distribution theory the cumulative pregnancy

probability by the rth month of the fecund period is equal to ${}_rC_1 * n(1-p)^{r-1}p$.

That is, the average period in month (N) from the begining of the fecund period to the pregnancy is calculated by

$$\begin{aligned} N &= [np + 2n(1-p)p + 3n(1-p)^2p + ...] / n \\ &= p + 2(1-p)p + 3(1-p)^2p + ... \end{aligned} \quad (1)$$

If we differenciate both sides of the following equation;

$$(1 - x)^{-1} = 1 + x + x^2 + ...$$

we can get the result of

$$(1 - x)^{-2} = 1 + 2x + 3x^2 + ... \quad (2)$$

If we let x = 1-p, equation (2) becomes to

$$p^{-2} = 1 + 2(1 - p) + 3(1 - p)^2 + ...$$

That is, $1 / p = p + 2p(1-P) + 3p(1-p)2 + ... = N$ (3)

which means that the average number of months (N) from the begining of the fecund period to the pregnancy is equal to the reciprocal (1 / p) of the pregnancy probability for a month (p).

Therefore, we can get the number of births controlled by the induced abortion from the following equation:

$$R = [(1 / p) + a] / [(1 / p) + S] \quad (4)$$

where, R: number of births controlled by an induced abortion.

p: prenancy probability for a month.

S: pregnancy period (9 months) and amenorrhea period after birth (5months).

a: average period from pregnancy to induced abortion and recoveryperiod (1 month).

According to a survey in Korea (Koh 1972, p. 6), the pregnancy probability for a month is p=0.09. Although the average period from the pregnancy to induced abortion in general is two months (Han 1972, p. 70), the period to the induced abortion for boy selectivity would be longer, such as four or five months.

Three kinds of techniques are currently used to determine the sex of a fetus. Not all of these can be applied in the early stage of pregnancy. The earliest, but rarely used, is chorionic villi sampling, which can be performed during eight to twelve weeks of pregnancy. Amniocentesis is frequently

used; but the test is applicable only at about 16 weeks of pregnancy. The most often used method in Korea appears to be the ultrasonar technique. It is the least expensive and simplest method, but it is effectively applicable even later than amniocentesis (Park and Cho 1994, pp. 105-106). Thus, a selective induced abortion based on the results of these tests can be done after at least four or five months of pregnancy.

Therefore, we have adopted four months, which is the shortest period, for the average pregnancy period terminated by the induced abortion for a boy selectivity.

From equation (4), the birth control index of induced abortion for a boy selective pregnancy (R), which is the number of births controlled by an induced abortion, is

$$R = [(1/0.09) + 5] / [(1/0.09) + 14] = 0.6416$$

where, $a = 4 + 1 = 5$.

$S = 9 + 5 = 14$.

TABLE 7. ESTIMATED NUMBER OF BIRTHS CONTROLLED BY AND CONTRIBUTION RATES OF FERTILITY REDUCTION RESULTED BY INDUCED ABOUTIONS OF FEMALE FETUSES TO HAVE MALE BIRTHS BY MOTHER'S AGE AND BY BIRTH ORDER, 1989-91

Classi-fication	Total no. of births (1)	Male births after induced abortions (2)	Total no. of induced abor-tions for male births (3)	No. of births controlled by induced abortion (4)	Contribution rates of fertility reduction(%) (5)
Total	1,980,176	34,927	67,877	43,550	2.15
<Mother's age>					
24 & under	555,953	2,878	5,593	3,588	0.64
25-29	1,076,058	17,046	33,127	21,254	1.94
30-34	301,465	12,138	23,589	15,135	4.78
35 & over	45,881	2,860	5,558	3,566	7.21
<Birth order>					
1st	1,057,818	697	1,355	869	0.08
2nd	781,022	14,282	27,756	17,808	2.23
3rd & higher	141,248	19,940	38,751	24,863	14.97

Sources: Same as Table 5.

Notes: (1) Registration data.

(2) Male births after induced abortions are estimated in Table 6.

(3) Total number of induced abortions for male births is estimated by (2)/{1-(100/206)}.

(4) No. of births controlled by induced abortion can be calculated from (3)*0.6416.

(5) Contribution rates of fertility reduction equals to [(4)/{(1)+{4)}]*100.

The effects on fertility level of the induced abortion decided after sex screening for a male birth are shown in table 7. The effects are estimated by mother's age and by birth order.

The total number of births controlled by sex selective induced abortion for male births becomes 43,550 births, which reduced the total number of births by 2.15%.

Since the proportion of induced abortions of female fetuses for male births is higher among the births of the older mothers and among the later births, the contribution rates of fertility reduction are also proportional to the the mother's age and birth order. Among the births of mothers aged 24 years or less or among the first births, the effects on fertility reduction of the induced abortions decided after sex screening are not clear.

The contribution rates of fertility reduction resulted by sex selective induced abortions among the births of mothers aged 35 years and over or among the third or later births are significantly high; 7.21% and 14.97% each.

Using the fertility rates and induced abortion rates by age group of currently married women, we can estimate the spontaneous fertility rates and the contribution rates of fertility reduction, the results of which are in table 8. These are the contribution rates of the total induced abortions including those as a means of family planning and those for sex selective births. In 1988, the contribution rate to the reduction of total fertility rate was 23.5%, and the rates by age, group increased with the mother's age, from 16.4% (20-24 years of age) to 71.4% (35-39 years of age).

The contribution rates of fertility reduction by total induced abortions are as high as 10 times those by sex selective induced abortions. For example, 2.15% of the total and 4.78% for mothers aged 30-34 years in table 7 are compared with 23.5% and 47.4% each in table 8. That is, the proportion of

TABLE 8. THE ESTIMATED EFFECTS ON AGE SPECIFIC FERTILITY RATES AND TOTAL FERTILITY RATES OF THE INDUCED ABORTIONS, 1971-88 (CONTRIBUTION RATES OF FERTILITY REDUCTION, %)

Age	1971	1976	1978	1982	1988
20-24	3.5	7.8	8.8	8.0	16.4
25-29	6.5	14.2	23.0	22.7	22.0
30-34	19.7	37.6	37.5	43.9	47.4
35-39	28.2	59.7	73.0	70.5	71.4
40-44	36.9	66.1	65.1	89.3	50.1
TFRX	13.2	24.1	26.8	25.0	23.5

Source: Korea Institute for Health and Social Affairs (1991: 578, Table 18-4).

the effects on the fertility reduction of the sex selective induced abortions is about 10% to those of the total induced abortions. 10% of the fertility reduction which resulted from total induced abortion are the effects of sex selective induced abortions.

SUMMARY

We presented empirical evidence for the levels and their changes of the sex ratio in Korea, and the relationship between fertility level and sex ratio was analysed with the estimation of the number of sex-selective abortions and the number of births controlled by abortion.

In Korea, the ideal number of children has dropped to under 2.0, and the total fertility rate (TFR) has reached 1.6, under the replacement level of 2.1, and continued at the same level. When any effective sex-selective abortion is available, couples will try to have a boy. This is the reason why the sex ratios of third and later births are so high. Furthermore, when a small family size is strongly desired, a couple will try to have a boy within their ideal number of children. For this reason, the recent sex ratio of the second children is also increasing sharply.

In a society where the value of small family size is strong, a women will try to have a boy before the number of her children ever born is over her ideal number of children, and she will not wait to have a boy while she continue to bear. This pushes up the sex ratio at birth and pulls down the average fertility level.

If we assume that there is no sex discrimination against girls and that the sex ratio at birth is 106, the total number of boys not determined through sex screening in Korea was estimated at 681,903 (table 5). Thus, the number of live births determined through sex screening was estimated at 71,949. Among the 71,949 boys identified through sex screening, the normal live births found as male fetuses at the screenings are estimated at 37,022. The rest (34,927) are boys born after repeated use of induced abortion when the fetus was identified as a girl at the first sex screening. The proportion of the boys identified through sex screening to the total male births was 6.8%, which means 68 among 1,000 boys. Therefore, we can confirm that sex screening is widly practiced in Korea, and is the main reason for the unbalanced sex ratio at birth.

The male selective births by sex screening and induced abortion are generally practiced among women aged 30 years and over and for the third or later male births. The main reasons for this are that the boy preference in Korea is still strong although society has been changing for the last 40 years,

and that the sex screening has been widely used since the technique was introduced. Therefore, continuous pregnancy for one or more male births in the past has been changed into the repeated pregnancy for a boy selected by sex screening and induced abortion in the present. These have been causing sex imbalance in the population and reduction of the number of births in Korea.

When we assume that a woman, who has experienced induced abortion for a boy, aborts repeatedly until she bears a male fetus, the total number of births controlled by sex selective induced abortions for male births is estimated at 43,550, which reduced the total number of births by 2.15%. Among the births of mothers aged 24 years or less or among the first births, the effects on fertility reduction of induced abortions decided after sex screening are not clear. However, the contribution rates of fertility reduction caused by sex selective induced abortions among the births of mothers aged 35 years and over or among the third or later births are significantly high: 7.21% and 14.97% each.

The contribution rates of fertility reduction resulting in total induced abortions are as high as 10 times those by sex selective induced abortions. That is, the proportion of the effects on the fertility reduction of sex selective induced abortions is about 10% of those of total induced abortions. Ten percent of the fertility reduction resulted by total induced abortion are the effects of sex selective induced abortions.

REFERENCES

Cho, D. H. 1982. “Changes in Boy Preference and Attitueds toward Children.” (in Korean). Journal of Population and Health Studies. 2(1): 190-203.

Cho, Nam-Hoon, and Moon-Hee Seo. 1991. “Recent Changes in the Population Control Policy and Its Future Directions in Korea.” Fertility Control Experiences in the Republics of Korea and China. Proceedings of the Third Workshop on Comparative Study of Population and Family Planning in ROK and ROC, July 9-17, 1991, Taiwan.

Cho, Nam-Hoon, Moon-Sik Hong, and Il-Hyung Kim. 1994. “Effects of Induced Abortion and Son Preference on the Imbalance of Sex Ratio in Korea.” Journal of the Population Association of Korea 17 (2): 78-97.

Han, S. H. 1973. A Study on Induced Abortion in Korea (in Korean). Korea Institute of Family Planning.

Han, S. H., and S. B. Lee. 1977. “An Analysis for Factors Affecting Parity Progression.” (in Korean). Journal of Family Planning Studies 4: 55-69.

Hong, M. S., S. Y. Lee, Y. S. chang, Y. H. Oh, and H. B. Kye. 1994. 1994 National Fertility and Family Health Survey (in Korean). Korea Institute of Health and Social Affairs.

Joo, H. J., and Tai-Hun Kim. 1994. “The Imbalance in Sex Ratio and Its

Implications." (in Korean). Population Problem Studies 28: 49-71.
Keyfitz, N. 1970. "Births Averted by Induced Abortion." The Algebra of the Birth Rate Mimeo, East-West Population Institute.
Kim, Tai-Hun. 1993. "The Effects on Korean Society of Low Fertility and Strong Son Ferference." (in Korean). Journal of Korea Population Association 16 (2): 1-23.
———————. 1995. Value of Children and Socio-Economic Development. (in Korean). Civil Economic Ecucation Center, Korea Development Institute.
KIPH (Korea Institute of Population and Health). 1991. Population Policy 30 Years. (in Korean). Korea Institute of Population and Health.
Koh, E. R. 1972. An Analysis of Pregnancy Probability, Birth Interval and Pregnancy Wastage of Women not Experienced any Contraception. Population and Development Studies Center, Seoul National University.
Lee, Hung-Tak. 1982. "Fertility Impact of Sex Composition and Sequence among Korean Women." Journal of Population and Health Studies 2 (2): 127-144.
Lim, Jong-Kwon, Song-Yung Lee, and Hwa-Ok Bae. 1986. "Induced Abortion Prevalence in Korea." Fertility Control Experiences in the Republics of Korea and China. Proceedings of the Second Workshop in Comparative Study of Population and Family Planning in ROK and ROC, June 26 - July 4 1986, Seoul.
Park, Chai Bin. 1983. "Preference for Sons, Family Size, and Sex Ratio: an Empirical Study in Korea." Demography 20: 333-352.
Park, Chai Bin, and Nam-Hoon Cho. 1994. "Gender Preference and Sex Imbalance in the Population and Their Implications in Korea." Journal of the Population Association of Korea 17(1): 87-114.
Sheps, M. C. 1963. "Effects of Family Size and Sex Ratio of Preference Regarding the Sex of Children." Population Studies 17: 66-72.

TAI-HUN KIM is professor of demography at Korea National University of Education in Korea. He earned his Ph.D. in Demography from Australian National University. He is now working on the demographic changes in Korean rural areas. He is also working on the population projection in Korea.

<Appendix>

Estimation of Male Live Births and Cases of Induced Abortions Resulted by Sex Screening, 1989-1991

We have used the cumulative birth registration data by the end of 1992. The assumptions and process of the calculation for the estimation of male live births and number of induced aboutions resulted by sex screening are as follows:

1. Assumptions

1) There is no way to relatively increase the number of boys except only boy selection using sex discrimination and induced aboution of female fetuses.
2) Sex screening is adopted for only having more boys.
3) There are not any spontaneous abortions or still births.
4) The accuracy of the sex screening is perfect.
5) If a female fetus is found by sex screening, its mother has an induced abortion and pregnant repeatedly until the fetus is a male.
6) The sex ratio at birth is 106 (average of the first births born in 1980-84), which is constant.

2. Process of the Calculation

1) Cases of birth registration in 1989-91 cumulated by the end of 1992.
   -Total 1,980,176 (A)
   -Boys 1,053,852 (B)
   -Girls 926,324 (C)
2) Estimated sex ratio 106 (D)
   (Average sex ratio of the first births in 1980-84)
3) No. of boys in the case of no sex screening
   [C * (106 / 100)] 981,903 (E)
4) Estimated no. of boys born selectively after sex screening
   (B-E) 91,949 (F)
5) Estimated no. of boys conformed as male fetuses from sex screening
   [F * (106 / 206)] 37,022 (G)
6) Estimated no. of boys born as the results which mothers are pregnant repeatedly (F-G) 34,927 (H)

7) Estimated total no. of induced abortions until mothers have a male fetuses H / (1-100 / 206)] 67,877 (I)
8) Average per year (1989-91)
   -Estimated no. of boys experienced sex screening
   (F / 3) 23,983
   -Estimated total cases of induced abortions
   (I / 3) 22,626
   -Induced abortion rate for male childbirths to the total female fetuses
   {[I / (C+I)]*100} 6.8 %