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Sex Preference Versus Number Preference: The Case of Korea

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ABSTRACT

This paper examines whether son preference has a strong positive effect on fertility rates. To test this hypothesis, Korea was used as a case because Korea still shows strong son preference but its fertility rates have reached below the replacement level. To reject the positive effect of sex preference on total fertility rates, number preference must be distinguished from sex preference. Statistical analysis shows that the existence of a son has a stronger effect on fertility behavior in Korea than the number of children. Through sex-selective technologies, abnormally higher sex ratios at birth have occurred since 1985. I argue that the fertility rates below the replacement level during the late 1980s are not permanent but a temporary phenomenon, through increased birth intervals and late ages at marriage.

Sex preference has generally been assumed to have a significant effect on fertility behaviors (i.e., Cain, 1993; Mason, 1993; Nugent, 1985). Nevertheless, many empirical studies have found weak or no effect of sex preference on such behavior (Arnold, 1987; Cleland, Verrall and Vlaessen, 1983; De Tray, 1984; Repetto, 1972), while evidence has been reported of a relationship between the sex composition of previous children and fertility behaviors (Das, 1987; Leung, 1987; Rahman and Da Vanzo, 1993). Moreover, in recent periods, the total fertility rates of some strong son preference countries, such as China and Korea, have dropped below the replacement level without a change in these nations' strong sex preferences, and these low fertility rates have sometimes been regarded as permanent, not temporary phenomena (Leete, 1987). These rates can be used as good examples of a weak (or nonexistent) effect of sex preference on fertility behavior (Arnold, 1987).

In order to reject the strong effect of sex preference on fertility behavior, based on statistical analysis of individual data or a case study, this effect must be distinguished from that of number preference (Ahmed, 1981; Coombs, Coombs, and McClelland, 1975; Coombs and Sun, 1978). Number preference may have more important effects on fertility behaviors than sex preference (Coombs and Sun, 1978). At the individual level, when a couple with sex preference has a large number of children but does not have a child of the desired sex, there are two options: stop childbearing, or continue childbearing until a child of the desired sex is born. In the former case, number preference may have a stronger effect on fertility behavior than sex preference. Therefore, the former choice can indicate a weak or nonexistent sex preference, while the latter represents a strong sex preference. At the societal level, if the desired number of children has declined in a sex preference country, then its fertility rates will decline, regardless of change in sex preference. Even in countries in which son preference is extremely strong, such as China and Korea, fertility rates have fallen below replacement levels without a change in sex preference.

In other words, lower fertility rates in some sex preference countries cannot be regarded as evidence for rejecting the strong effect of sex preference on fertility behaviors, particularly when number preference is not considered.

In addition, the fertility behavior that sex preference influences is not limited to the total fertility rate. In sex preference countries in which methods for controlling both the number of children and the sex of a child are largely available, other important demographic and social problems will be seen. For example, China recently experienced abnormally high sex ratios at birth in connection with its the one-child policy (Coale and Banister, 1994; Johanssen and Nygren, 1991; Zeng Yi et al., 1993).

It is well known that Korea is a strong son preference country (i.e., Arnold, 1985; Park, 1983). The strong son preference in Korea did not change until recent times (see Cho and Ahn, 1993). In spite of the existence of a strong son preference, the total fertility rate has rapidly declined from 6.0 in 1960 to 1.9 in 1990. The fact that the Korean fertility rate has remained below the replacement level tends to be regarded as a permanent phenomenon, rather than temporary. Nevertheless, we must note that the total fertility rate can be changed by fluctuation in the age-specific fertility rate during a survey year because of changes in the timing of childbearing. As a result, it is instructive to examine changes in the age specific fertility rate if we are to argue that the fertility rate in Korea will remain permanently below the replacement level and that sex preference has little effect on fertility behavior.

In the first section of this paper, changes in the timing of childbearing in recent periods are examined to see whether the fertility rate below the replacement level in Korea is permanent or temporary. If it is temporary, we must ask why it has occurred. Also, if a strong son preference does not have a significant effect on the overall fertility rate we must ask why, and must identify the resulting demographic problems. In the second section, the strong effect of son preference on fertility behavior is examined by means of sex preference measurement models based on the 1974 Korean National Fertility Survey. In this analysis, I shall examine the effect of the number of previous children on the next birth according to sex composition of previous children. In other words, if a Korean woman has only daughters, at which parity does she stop childbearing? The degree that Korean women having only daughters continue childbearing until a son is born is examined. This analysis will indirectly provide some clues to answer the following question: "If sex-selective technologies were not largely available in Korea, would the total fertility rates in the late 1980s have dropped below the replacement level?"

TOTAL FERTILITY RATES AND CHANGES IN AGE-SPECIFIC FERTILITY RATES

I argue that the effect of sex preference on total fertility rate must be distinguished from the effect of number preference. The decline in the total fertility rate in a country is more likely to be affected by a reduction in the desired number of children, rather than a change in sex preference. Moreover, number preference is more likely than sex preference to be changed by modernization. Through modernization, women are more likely to be concerned with the quality of children than the quantity, and to worry less about the mortality of their children during childhood; as a result, their desired number of children can easily decline. In contrast to number preference, sex preference is more likely to relate to cultural factors (see Arnold and Kuo, 1984; Basu, 1992; Lee, 1995). Thus, through modernization, the overall total fertility rate in a sex preference country can be rapidly lowered by a decline in the desired number of children, independent of a change in sex preference. Nevertheless, there is one important caution for this argument. Where the fertility rate is higher, sex preference may not have an important effect on the decline of the overall fertility rate. In sex-preference countries, most parents want one or two children, however, sex preference has an important deviant effect on the overall fertility rate, particularly in societies in which sex-selective technologies are largely available (Park and Cho, 1995).

The decline in the fertility rate in Korea can be explained in large part by the decline of number preference. In spite of inconsistencies between the ideal and actual number of children[1] (Westoff and Ryder, 1977), it is difficult to deny the assumption that a decline in the ideal number of children eventually leads to a decline in the actual number when methods to control fertility behavior are available (Cleland and Wilson, 1987). The ideal number of children in Korea has declined since the introduction of the family planning program in 1962, even though this number increased slightly from 1988 to 1991: 3.9 in 1965, 3.7 in 1971, 3.2 in 1974, 3.2 in 1976, 2.5 in 1982, 2.5 in 1985, 2.0 in 1988, and 2.1 in 1991. Even in the late 1980s, when the total fertility rate had remained below the replacement level, on average, Korean women wanted to have two children.

The total fertility rate is practically calculated as the sum of the five-year age-specific fertility rates for women, and these age-specific fertility rates are obtained from a hypothetical fertility history of a cross-sectional data source such as a census. Since the total fertility rate is based on the assumption that women will show the same age-specific fertility as that observed in a hypothetical or synthetic cohort of women, this rate will change if women at the youngest ages (i.e., 15-19) exhibit different fertility patterns (with regard to completed family size) from those of younger women (i.e., 20-24) in the future. For example, if a large percentage of women (especially at the prime childbearing age) began to delay the completion of their childbearing after 1985, then the total fertility rate in 1990 would be lower than the actual fertility rate.

In order to argue that the fertility rate below the replacement level is a permanent phenomenon in Korea, based on the total fertility rate, change in the age-specific fertility rates must be examined. As shown in Table 1, the age-specific fertility rates at ages 20-24 declined rapidly in the late 1980s, and the rates at ages 25-29 and 30-34 in 1990 were higher than those in 1985. These findings suggest that some important changes in the fertility behaviors of Korean women have occurred since 1985. Thus, Korean women have tended to delay their childbearing in their later ages since 1985.

Table 1: Age Specific Fertility Rates in Korea: 1960-1990.

Year	TFR	15-19	20-24	25-29	30-34	35-39	40-44	45-49
1960	6.0	37	283	330	257	196	80	14
1966	5.4	15	205	380	242	150	58	10
1970	4.3	18	185	307	197	101	44	13
1974	3.6	11	159	276	164	74	29	3
1980	2.8	8	168	263	93	24	5	-
1985	1.7	9	119	162	40	8	2	0.4
1987	1.6	3	104	168	39	6	3	-
1990	1.6	3	62	188	50	7	1	-

Source: Korea Institute for Health and Social Affairs, The 1991 National Fertility and Family Health Survey, 1992.

In particular, the age-specific fertility rate at ages 20-29 has an important effect on the overall fertility rate in Korea. The prime childbearing age in Korea was assumed to be the age interval between 20 and 29. The percentage of fertility among women in this prime childbearing age as a proportion of women of all reproduction ages was 67.9% in 1975, 79.9% in 1981 and 86.6% in 1984. Even though the percentage of fertility at ages 25-29 was slightly higher than that at ages 20-24, the difference was not large until 1984. For example, in 1984, the percentage of overall births at ages 20-24 was 40.7, and at ages 25-29, 45.9. This fact provides evidence that births of women at ages 20-24 explained a large percentage of the fertility rates of women of all reproductive ages in Korea until 1984. The percentages of fertility rates of women aged 30 and over were 28.3 in 1975, 17% in 1981 and 10.2% in 1984. (Lee, Sang-Hun, 1988). Thus, before 1985, most Korean women tended to complete their childbearing within a limited age interval, 20-29.

In 1990, women who were born in the baby boom cohort, from the late 1950s to the middle 1960s, reached their prime childbearing age. In spite of the arrival of baby boom women at their the prime childbearing ages, even the crude birth rates remained at similar levels during these periods: 16.4 in 1985, 16.5 in 1990, and 15.4 in 1992. The fact that these rates remained at a low level implies an important change in the fertility behavior of Korean women in the late 1980s, considering the previous trend for Korean women to complete their childbearing within a limited age interval. If women of the baby boom cohort were more likely to complete their childbearing before age 30, the crude birth rates in 1990 and 1992 must have been higher than that in 1985 because of the higher percentage of fertility among women of prime childbearing age. In other words, women born in the baby boom cohort began to exhibit a different fertility behavioral pattern after 1985, compared to women born before 1955.

The age-specific fertility rate can be changed by two important factors: marital status and birth intervals. First, if a large number of women at the prime reproductive age are not married, then the age-specific fertility rate at these ages may be lower. As seen in Table 2, women born during 1956-1964 (ages 15-24 in 1980) show higher percentages in their age structure than women born before 1955. The women born in the baby boom cohort began to reach the prime childbearing age (25-29) in 1985. Since a larger cohort of females reached marriageable age after 1985, a higher percentage of women had to remain single during the late 1980s. Considering that the mean age at first marriage was around 25 during 1985-1990, the lower percentage of married women aged 25-29 in 1990 can be largely explained by the excess of the number of females of marriageable ages. In Korea, the bridegroom was older than the bride, usually by four years. In the 1990 census, the number of females at ages 30-34 was about 40,000 greater than the number of males at ages 35-39. Thus, a higher percentage (22.4%) of women born during 1955-1959 remained single in 1990. This may be one of the important reasons for the rapid decline in the age-specific fertility rate at age 25-29 during the late 1980s.

Because of the increase in age at first marriage, the percentages of married women ages 20-24 rapidly declined, as shown in Table 2. In other words, women at younger ages began to delay their childbearing by marrying at later ages. Therefore, the fact that the total fertility rate fell below the replacement level in Korea can be largely explained by changes in the timing of births by women at younger ages, rather than by a decline in the average number of children women bear during their lives.

Table 2: Changes in Age Structure and Marital Status, 1970-90.

	Age Structure (%)			Marital Status (%)		
	1970	1980	1990	1970	1980	1990
15-19	20.7	20.8	17.9	2.8	1.6	0.5
20-24	16.8	20.1	17.2	42.3	33.8	19.2
25-29	15.2	15.6	17.3	88.4	84.9	77.6
30-34	14.8	12.4	16.5	94.6	94.3	92.5
35-39	12.9	11.1	12.1	91.9	93.4	92.3
40-44	10.6	10.7	10.1	84.8	90.1	90.4
45-49	9.0	9.3	8.9	76.9	83.1	86.3
Total	100.0	100.0	100.0	62.9	59.8	63.0

Source: Cho, Nam Hoon, Moon Sik Hong, and Moon Hee Seo. 1992. “Analysis of Factors Contributing to Fertility Decline in Korea.” Journal of Population, Health and Social Welfare 12(1). Pp.212-13.

Additional evidence that women born in the baby boom cohort delayed their childbearing to later ages is shown in Table 3. Displaying the trend in the fertility rate at ages 25-29 during the late 1980s, Table 1 indicates that age-specific rates increased slightly. In addition, Table 3 indicates that the fertility rate of married women ages 25-29 declined in 1987 and increased in 1990. This implies that a large number of women born in the baby boom cohort began to marry over time during the late 1980s, and that women were more likely to have their children in 1990 than in 1987. The fact that in the late 1980s a large percentage of women born in the baby boom cohort were not married and/or married at late ages may largely explain why the total fertility rate was achieved and maintained in the late 1980s. In the 1990s, with the delayed fertility rates of women born in the baby boom, the total fertility rate would have fallen below the replacement level in Korea.

Table 3: Trends in Marital Age-Specific Fertility Rates

Year/Age	20-24	25-29	30-34	35-39	40-44	45-49
1960	447	351	298	232	117	22
1970	450	356	223	122	53	8
1975	439	309	148	64	22	3
1980	458	292	103	28	7	1
1985	414	209	45	9	2	0.5
1987	271	192	41	6	4	-
1990	306	234	53	7	1	-

Source: Korea Institute for Health and Social Affairs, The 1991 National Fertility and Family Health Survey, 1992.

Table 4: The Percentages of Married Women (15-44) Who Were Practicing Contraception by Number of Children.

Number of Children	1976	1979	1982	1985	1988	1991
0	4.6	7.0	10.7	13.8	21.0	20.4

1	18.2	20.7	24.6	44.7	58.1	61.8
2	44.0	58.2	66.6	82.5	89.3	91.4
3	59.0	69.0	76.4	84.5	90.5	92.8
4 or more	52.8	63.9	68.2	78.8	86.4	88.0

Sources:
(1) National Fertility and Family Planning Survey by Each Year.
(2) Kim, Seung Kwon, 1992. "A Study of Contraceptive Failure Pregnancy and Induced Abortion in Korea". P. 128. Table 4.

Second, if the intervals between the first and second births and between the second and third births become longer, the age-specific fertility rates also become lower. In Korea, the important methods for spacing birth intervals and controlling fertility behaviors can be identified as contraceptive use and induced abortion. In the 1960s, when the family planning program was introduced, the contraceptive practice rate was low, about 10%; since then, the percentage of married women using contraception has continuously increased: 44.2% in 1976, 54.5% in 1979, 57.7% in 1982; 70.4% in 1985; 77.1% in 1988, and 79.4% in 1991 (Kim, 1992). The contraceptive practice rates at higher parity were much higher than those at lower parity, as shown in Table 4. Since 1985, about 80% of women having at least two children practiced contraception. In 1988 and 1991, about 60% of women having one child used contraception, while about 20% of them used it until 1982. These findings suggest that most Korean women do not want to have more than two children and that the interval between the first and second births increased since 1985[2]. Based on these findings, we understand that another fertility transition occurred with the change in the prime childbearing age since 1985.

Unlike the cases in other Asian countries, induced abortion has played an important role in the fertility decline in Korea. The availability of induced abortions is universal, and the legal and social attitudes toward abortion have been extremely tolerant. If induced abortions were not available in Korea, the overall fertility rate would be remarkably higher. For example, if induced abortions had not been available until 1984, the total fertility rate would have increased from 3.2 to 4.4 in 1976, from 2.7 to 4.0 in 1978, and from 2.1 to 2.7 in 1984 (Park, 1988). Based on Park's estimation, the estimated number of births averted by induced abortion in each year was 72,000, which was 5.7% of the total number of the births in 1963; 279,000 (32%) in 1975, 328,000 (37.5%) in 1978, and 275,000 (40.7%) in 1984. These estimates did not include births to unmarried women. If we consider the increase in the abortion rate among unmarried (especially younger) women and the high rate of contraceptive use after 1985, we can easily guess that "the yearly number of induced abortions is greater than the number of children born per year" (Cho, Seo, and Tan, 1990. p. 159) in recent periods. In other words, the Korean fertility rate since 1985 could not have dropped below the replacement level without great assistance from induced abortions.

Table 5: Trends in Married Women's Age-Specific Induced Abortion Rate: 1971-90.

Year	TMIAR (20-44)	20-24	25-29	30-34	35-39	40-44
1963	0.7	16	29	58	40	-
1971	1.7	28	50	111	94	46
1973	2.1	86	75	137	88	22
1976	2.3	63	86	158	153	75
1978	2.9	70	156	148	156	54
1984	2.1	91	146	115	40	20
1987	1.6	102	103	71	29	7
1990	1.9	186	112	60	21	6

Sources:
(1) National Fertility and Family Planning Survey by Each Year.
(2) Kim, Seung Kwon, 1992. "A Study of Contraceptive Failure Pregnancy and Induced Abortion in Korea". P. 125. Table 3.

The total induced abortion rate has increased from 0.7 in 1963, to 1.7 in 1971, 2.1 in 1973, 2.3 in 1976, and 2.9 in 1978, but decreased slightly to 2.1 in 1984, and 1.6 in 1987, and again increased to 1.9 in 1990, as shown in Table 5. The factors that caused the decline in induced abortion rates since 1978 may be the increased prevalence rate of contraceptive use and the increased sterilization acceptance rate. In spite of the trend toward increased contraceptive practice and sterilization acceptance, why did the total induced abortion rate during 1987-1991 increase? In particular, the induced abortion rate among married women aged 20-24 increased considerably.

One possible explanation for the increased induced abortion rate among women aged 20-24 is that women have tended to bear their children at later ages since 1985. Women whose ages were between 20 and 25 in 1985 were those born in the late baby boom cohort (between 1961 and 1965). Compared with women born before 1955, women born after 1956, especially after 1961, are more likely to have different individual characteristics. One of the important reasons for these different individual characteristics may be the change in educational policy. The pass examination for middle school was abolished in 1969, and that for high school in 1974. In 1982, the method of taking the pass examination for university admission was changed, in order to enroll a larger number of students. Because of these changes in educational policy, women born between 1961 and 1965 were more likely to enroll in high school than were women born before 1960. The school enrollment ratio of females was 35.8 in 1975, the year when women born between 1957 and 1960 were enrolled, and 62.2 in 1980, the year when women born between 1962 and 1965 were enrolled. Also, the number of female students enrolled in colleges and/or universities in 1985 (575,980) was more than twice that in 1980 (274,453), and more than five times that in 1975 (106,286). In addition, since these changes in educational policies brought young women into competition during their school lives, women born between 1961 and 1965 are more likely to have individualistic characteristics. They prefer the nuclear family system to the extended family system, and have become more independent of mothers-in-law. Also, they are more likely to be concerned with their own careers. Because of these factors, they are less likely to have their children at younger ages.

Based on these assumptions, young married women who have been more affected by western ideas are more likely to space their childbearing in their younger ages. In Korea, the main reason for induced abortion at younger ages may be birth spacing, not fertility termination. Also, the induced abortion rates were higher among highly educated women and in urban areas (Kim, 1992). As a result, the fertility rate in 1995 will increase, since a large number of the women born in 1961-65 delayed their births to later ages (i.e., around age at 30). The prime childbearing age will change, perhaps to 25-35. Based on these results, I expect that another small baby boom will occur in Korea, perhaps in the mid- or late 1990s, because a large percentage of women have delayed their childbearing to later ages.

We have considered the important role of induced abortion in the decline of the fertility rate in Korea. Now we will examine why Koreans accept a small ideal number of children in spite of their strong son preference, and then will ask what kinds of demographic problems have occurred as a result of the high induced abortion rate in Korea.

The fact that the total fertility rate in Korea remained below the replacement level during 1985-90 implies that the number of sons required to satisfy Korean parents' strong son preference became one in 1985. Thus, one son has usually been enough to satisfy their sex preference in recent periods.

Why are Koreans satisfied with one son? I think there are two important reasons. First, the infant mortality rate has declined to the point that most Koreans do not worry about insurance for the death of the first son. The infant mortality rate was 15.7 in 1985 and 12.8 in 1990.

Second, the typical Korean family system is a step-family household in which the elder son's family usually remains to care for his elderly parents. Since the eldest son usually had the responsibility to continue the family lineage and to care for the parents in their old age in the Korean family system, Korean parents would be satisfied with one son if they were not worried about the death of the first son. In addition, because of increased educational costs, parents began to consider the quality of the son, rather than the number of sons.

How have Koreans satisfied their strong son preference in the context of a fertility rate below the replacement rate? I argue that Koreans could satisfy their son preference in terms of small family size through sex-selective abortions. While contraceptives are more likely to be used for preventing the births of unwanted children and for delaying births, the purpose of induced abortions is to voluntarily eliminate an unborn child during pregnancy. In other words, since an induced abortion can occur after parents identify the gender of the fetus, it is more likely to be used to select a child of a particular sex. In Korea, sex-selective abortions have brought about abnormally high sex ratios in births in recent years. In the 1990 census, the sex ratio of children aged 0-5 was 111.2, and that of children age 0 was 112.5.

Table 6: Sex Ratio at Birth by Birth Order: 1979-88.

Year	Total	Birth Order			
		1st	2nd	3rd	4th
1980	103.9	105.7	104.2	102.7	99.1
1982	106.9	105.5	106.1	109.3	114.2
1983	107.7	106.0	106.3	112.5	122.1
1984	108.7	106.4	107.5	118.5	131.7
1985	110.0	106.3	108.2	131.7	157.2
1986	111.9	107.4	111.4	139.4	154.6

1987	109.0	104.8	109.2	135.7	147.4
1988	113.5	107.4	113.4	166.9	192.9
1989	112.1	104.3	112.6	185.0	208.6
1990	116.9	108.7	117.3	193.2	228.1
1991	112.9	106.1	112.8	184.7	212.3
1992	114.0	106.4	112.8	195.7	228.6

Source: Park, Chai-Bin and Nam-Hoon Cho. 1995. "Consequences of son preference in a low-fertility society: Imbalance of the sex ratio at birth in Korea." p.66. Table 6.

Sex ratios by the parities during 1979-1992 in Korea are shown in Table 6. Under normal circumstances, the sex ratio at birth is assumed to lie between 105 and 106 (Johanssen and Nygren, 1991). Since 1984, the sex ratios of births in Korea have become higher than normal. This implies that sex-selective abortions were more likely to occur in the late 1980s than the early 1980s. Thus, the increased induced abortion rate can be in large part explained by the increase in the sex-selective abortion rates. When we consider the sex ratios of births by birth order, the sex ratios at higher parities were much higher than normal. The sex ratio of third-order births rose from 102.7 in 1980, to 118.5 in 1984, to 170.5 in 1988, and to 195.7 in 1992. The sex ratio of fourth order births rose from 99.1 in 1980, to 131.7 in 1984, to 192.9 in 1988, and to 228.6 in 1992. Since 1984, a higher number of sex-selective induced abortions may have occurred among women having only two or three daughters. This finding indicates that women who did not have sons at lower parities were more likely to delay their childbearing processes through sex-selective abortions.

The sex ratio of second-order births also provides an interesting result. After 1985, this ratio became higher than normal; that was the year in which the overall fertility rate dropped below the replacement level. The finding that the sex ratio at the second birth began to be abnormally higher in 1986 implies that a large number of sex-selective abortions occurred at second births during 1985, and the percentages of women who wanted to stop their childbearing at two children but wanted to ensure having a son increased. These sex-selective abortions may be one of the reasons why the interval between the first and second births has increased. Thus, since 1985, if the first child is a daughter, a large percentage of women will space their childbearing to have a son as their second child, through sex selection. Also, if the first child is a son, then a large number of women will delay their childbearing because of the quality of the son, or because they want to enjoy their lives at younger ages. Sex-selective abortion may play a role in the longer intervals between first and second births. Through sex-selective medical technologies, moreover, Koreans have satisfied their strong son preference in the context of a small family size.

These phenomena are not limited to Korea. In China, the total fertility rate dropped below the replacement level during the early 1990s (Zeng et al., 1993); nevertheless, the sex ratio of births in 1992 was 118.5. This high sex ratio can be explained by Kristof's (1993) statement, "More than 12 percent of all female fetuses were aborted or otherwise unaccounted for." Even though the high sex ratio of births can in large part be explained by sex differential under reporting of births (Johanssen and Nygren, 1991), we cannot ignore the great impact of sex-selective induced abortion after prenatal sex discrimination (Zeng Yi et al., 1993). The sex ratios at third and higher birth orders in China[3] was abnormally higher than normal, even though these sex ratios were lower than in Korea. Also China showed higher mean sex ratios of second births during the late 1980s (Zeng et al., 1993). This implies that the percentage of one-child families is higher in China than in Korea. As in Korea, the strong effects of sex preference on fertility behavior led to another demographic problem, high sex ratios at birth, in China.

We see that the delay of childbearing by women born in the baby boom cohort largely contributed to continuing the low fertility rate between 1985-1990 in Korea. Because of the longer birth interval between the first and second child and sex-selective abortions, the lower fertility rate may continue. When women who have delayed their childbearing finish childbearing, the fertility rate may increase in Korea, perhaps in the mid- or late- 1990s. The positive effect of sex preference on the overall fertility rate can be remarkably reduced in a sex preference country if sex-selective technologies (i.e., abortions) are largely available, as in Korea and China. Because of voluntary prenatal sex determination, however, these countries are more likely to have abnormal sex ratios at births. In other words, if sex-selective technologies are not available in sex preference countries, then I assume that it is difficult for the total fertility rate in strong sex preference countries to fall below the replacement level, even as a temporary phenomenon.

MEASUREMENT OF SEX PREFERENCE

Measuring the Effects of Sex Preference on Fertility Behaviors

The methods of testing for the effect of son preference on fertility are based on attitudinal and behavioral survey data. Compared with behavioral measures, attitudinal measures are appropriate to measure individual sex preference, rather than the underlying sex preference structure (see Lee, 1995). Nevertheless, son preference in Korea is not determined by individuals' opinions, and is regarded as one important element of the family survival strategy whereby Koreans use the patriarchal system to maintain their interests (Lee, 1995). As a result, a behavioral model, rather than an attitudinal measure, is regarded as appropriate method for measuring son preference in Korea.

Among behavioral measures, one of the typical methods to test for the effect of sex preference on fertility behavior is the parity progression ratio (e.g., Das, 1987; De Tray, 1984; Park, 1983). This ratio is defined as the conditional probability of having a *(j+1)th* birth, given that a *jth* birth has occurred. This method assumes that if sex preferences influence fertility behaviors, then at any parity a couple with an undesirable sex composition of previous children is more likely to have an additional child than is a couple that already has the desired sex composition.

As in the case of attitudinal measures, several logical and statistical problems have been noted with this behavioral measure. The first problem arises in societies in which sex preferences are not relatively homogenous within the population. Parity progression ratios based on aggregate data are more likely to underestimate the existence of sex preference, since they fail to capture the important heterogeneous sex preferences of subpopulations (McClelland, 1979; 1983). Some researchers (Nag, 1991; Rahman and Da Vanzo, 1993) have provided evidence that even in strong son preference countries, parents usually desire to have at least one girl.

The second problem is that, as with attitudinal measures, number preference must be distinguished from sex preference in behavioral measures. At each parity, people may have different desired family sizes. If the desired family size is large, then fertility will not be affected by the sex composition of the first two or three children, even if the parents have a strong sex preference (Ben-Porath and Welch, 1976). Also, even when women are satisfied with the number and sex composition of their children, they can have additional children if they do not have access to methods of controlling fertility behavior. In order for sex preference to be independent of number preference in behavioral measures, respondents must have some ability to control their fertility behavior, and the variable related to number preference must be controlled in the model of sex preference.

The third problem is that the population does not have common attitudes about the next birth because of inaccurate subjective perceptions of the probabilities of the sex of the next child (McClelland, 1979; 1983). However, these psychological problems do not have an important effect on an additional birth when sex preference derives from the underlying social structure rather than from parental desires (Arnold, 1985).

Fourth, the progression ratio test cannot address “censored observations.” The omission of censored observations leads to biased estimators of the variables (here, sex composition of previous children) indicating sex preference in estimations of these two behavioral measures.

However, if a hazard model is used as the measurement of the effect of sex preference on fertility, then the methodological problem can be solved. Compared with the progression ratio test, one of the advantages of the hazard model is that right-censored observations are considered in the estimation of hazard rates; therefore, biases due to sampling selection are reduced. Also, a hazard model can easily capture both observed and unobserved heterogeneity of subpopulatio-ns. Since individual instead of aggregate data are used, independent variables can capture the observed heterogeneity of subpopulations. In addition, a hazard model with unobserved heterogeneity allows unobservable factors to reflect the effect of omitted variables (Heckman and Singer, 1984). Putting unobservable factors into a hazard model can reduce the bias due to the omitted variables, and test the robustness of the coefficients.

The heterogeneity of individual sex preference and the distinction between sex and number preference can be addressed as follows. In order to examine individual differences in sex preferences—that is, individuals who desire at least one girl—I will analyze the fertility rates of three groups with different sex compositions of previous children: those having only sons, those having son(s) and daughter(s), and those having only daughters(1). For example, given that a third birth occurred (at parity three), I will first compare the fertility rates of women having only three daughters with those of the other groups: the group having only three sons and the group having one or two sons. If the fertility rate of those having only three daughters is higher than that of the other groups, then we have evidence of son preference. Next, comparing the group having three sons with the group having at least one daughter and one son, I can examine individual differences in sex preferences. Thus, if the fertility rate of the group having three sons is higher than that of the group having one or two sons, then we have evidence that respondents want to have at least one daughter in spite of the existence of son preference.

When the independent variable indicating number preference is controlled in the sex preference measurement model, the independent effect of sex preference on fertility behavior can be observed. Moreover, the effect of the number of children born on the next birth may vary with the sex composition of previous children. Therefore, it is desirable to control the interaction terms between sex composition of previous children and the number of children in the sex preference measurement models.

Model Specification

The hazard rate of having an additional birth is the dependent variable. This hazard rate is defined in terms of the fertility transition probability. Let $P_j(t, t+\Delta t)$ denote the probability of having the *j+1* child in the time(birth) interval (t, t+Δt), given that the woman has not had *j+1* child at time(birth) interval t; this is a transition probability from birth *j* to birth *j+1*[4]. The limit of this transition probability as Δt approaches zero is called the instantaneous rate of fertility behavior at time t:

$$h(t) = \lim_{\Delta t \to 0} p(t, t + \Delta t)/\Delta t \qquad [1]$$

In order to check the robustness of the result, quadratic and Weibull hazard models are analyzed. Following Heckman and Walker (1987), the conditional hazard of fertility is defined as

$$h[t|X, \theta] = \exp[\alpha + \beta_k X_k + \gamma_1(t^{\lambda 1}-1)/\lambda_1 + \gamma_2(t^{\lambda 2}-1)/\lambda_2 + c\theta\ ] \quad [2]$$

where Xs are fixed covariates; α, β_k and c are a vector of parameters to be estimated; γ_1, γ_2, λ_1, λ_2 are duration dependence parameters; and θ indicates unobservable heterogeneity. We can obtain the quadratic hazard model by setting λ_1=1 and λ_2=2, $\{h(t)=\exp[\alpha+\gamma_1(t-1) +\gamma_2(t^2-1)/2 + X'\beta]\}$ and the Weibull hazard model by setting λ_1=0 and γ_2=0 $\{h(t)= t^{\gamma 1}\exp[\alpha+X\beta]\}$. Covariates include sex composition of previous children, parities, the difference between the expected and actual number of children parities, old age security, family line, women's education, women's ages in 1974, and interaction terms between sex composition of previous children and parities. All covariates are fixed variables.

In the usual hazard models, all heterogeneity is assumed to be captured by the included observed variables. However, even omitted variables that affect hazard rates and are uncorrelated with the included independent variables distort the parameter estimates of the hazard models, while in usual regression analyses, omitted variables that are related to the dependent variable and are correlated with the included independent variables distort the parameter estimates of the regression models. Thus, compared to the usual regression model, the mis-specification caused by omitted variables can produce a more severe problem in the hazard models. Here, the nonparametric maximum likelihood estimator (NPMLE) of a mixing distribution developed by Heckman and Singer (1984) is used to control unobserved heterogeneity. In Equation [2], c is a factor loading (structural) parameter and θ is a location parameter of the unobserved heterogeneity; θ denotes the cumulative density function of a random variable taking values in an interval [0,1]; θ represents an unobserved scalar heterogeneity component with the distribution function of unobservables; and θ is assumed to be distributed independently of included covariates. However, since models with unobserved heterogeneity are not nested, likelihood-ratio tests are not useful[5]. Maximum-likelihood parameter estimates in hazard models are obtained through the CTM program (Yi, Honore, and Walker, 1987), which is a computer software program for estimation of hazard models.

Data and Variables

Data

The data employed in this analysis were from the 1974 Korean National Fertility Survey, which was jointly undertaken by the Bureau of Statistics of the Economic Planning Board and the Korean Institute for Family Planning as part of the World Fertility Survey. The sample studied was the nationwide probability sample of 5430 ever-married women aged 15 to 49.

The analysis was limited to ever-married women interviewed who had two and more children. Because it was assumed that the effects of sex preference on fertility behavior differ at different parities, I first created five data sets separately at each parity, and then pooled these data sets to analyze the effects of sex composition of previous children at each parity[6].

To obtain the data for parity 2, I exclude 1,413 respondents who did not have at least two children or had missing values in the covariates, and 18 additional cases with pregnancies resulting in multiple births. The final sample at parity 2 included 3,999 ever-married women having at least two children. Among the 3,999 respondents, 3,099 women (77 percent) had a third birth. The same processes were executed to obtain the data sets for other parities, as shown in Table 7[7].

To create a pooled sample, the data set at each parity is combined. In a pooled sample, women having more than 6 children are included five times, women having 5 children are included four times, etc. Whereas the effect of sex preference on fertility behavior at each parity can be examined in a separate sample at each parity, the interaction terms between parity and sex composition of previous children can not be analyzed. One of the important purposes of this paper was to analyze the interaction between sex preference and number preference to examine whether the effect of the number of children born on fertility behavior varies with the sex composition of previous children. As a result, the pooled sample data were used so that two main effects (sex preference and number preference) and one interaction effect on fertility behaviors were analyzed in the models.

Table 7: Frequencies and Distributions of the Variables at each parity

Variable	Parity				
	parity 2	parity 3	parity 4	parity 5	parity 6+
Proportion having a next birth	3099(77%)	2224(69%)	1488(63%)	913(58%)	871(47%)
Sex Composition of Previous Child					
No sons	918(23%)	355(11%)	147(6%)	54(3%)	27(1.5%)
Sons and Daughters	2038(51%)	2478(76%)	2075(88%)	1465(93%)	1730(97%)
All sons	1043(26%)	417(13%)	147(6%)	60(4%)	29(1.5%)
Expectations of Old Age Security					
Expect to live together	1522(38%)	1314(40%)	1026(43%)	737(47%)	910(51%)
Expect to share earnings	1931(48%)	1625(50%)	1234(52%)	851(54%)	995(56%)
Expect to old support	3201(80%)	2660(82%)	1988(84%)	1363(84%)	1567(88%)
Eldest son or only son	2031(51%)	1683(52%)	1278(54%)	878(56%)	1018(57%)
Want More Children	3192(80%)	1381(42%)	494(21%)	78(5%)	44(2%)
Women's Schooling Years					
No Schooling	987(25%)	935(29%)	822(35%)	657(42%)	975(55%)
Elementary School (1-6 years)	2119(53%)	1729(53%)	1258(53%)	803(51%)	741(41%)
Above Elementary School(6+ years)	893(22%)	586(18%)	289(12%)	119(8%)	70(4%)
Wife's Age at 1974					
Ages below 30	1018(25%)	512(16%)	145(6%)	23(1%)	2(0%)
Ages 31-35	958(24%)	831(26%)	564(24%)	274(17%)	136(8%)
Ages 36-40	860(22%)	797(25%)	644(27%)	439(28%)	406(23%)
Ages 41-49	1163(29%)	1110(34%)	1016(43%)	843(53%)	1242(69%)
Living City & Town	2303(58%)	1769(54%)	1135(48%)	647(41%)	586(33%)
Sample Size at Each Parity	3999	3250	2369	1579	1786

Variables

In this study, the dependent variable was the hazard rate of an additional birth. There were three sets of main explanatory variables and several control variables in this analysis. The main explanatory variables are sex composition of previous children, parity, and the interaction terms between sex composition of previous children and parity, while the control variables were the difference between the expected number of children and the actual number of children, expectation of old age security, family lineage, women's age in 1974, and women's education.

Sex composition of previous children. In general, Koreans regard the first female child as an asset, since she usually takes care of her younger siblings and helps her mother at home. Since most Korean parents wanted to have more than two children in 1974, it was not important whether or not the first baby was a female. However, married women often experience social pressures from their husbands, parents-in-law, and even their own parents, if the second baby is another female. Thus, Korean women can be expected to exhibit higher fertility if the first and second babies are girls than if these babies are boys.

In order to examine the effect of son preference on fertility, I divided sex composition of previous children into three groups. The first group was one with only sons, the second group was one with children of mixed sex (for example, at parity 2, one son and one daughter), and the third group had only daughters. The reason for distinguishing the second group from the first group was due to the heterogeneity of individual sex preference. Sometimes we assume that parents with only sons may desire another child since they want a daughter, rather than an additional son. If the first group has higher fertility than the second group, then we can assume that many parents want to have at least one daughter, in spite of the existence of a strong son preference.

The distribution of sex composition of previous children at each parity is shown in Table 7. Because of genetic phenomena, the percentages of both the group having only sons and that having only daughters at each parity declined to the halves at higher parities, whereas the percentage of the group having at least one son (or one daughter) increased as the parity increased. Therefore, these data seemed to be suitable for analyzing the effect of the sex composition of previous children on fertility behavior.

Parity. In order to analyze different effects of son preference on fertility at each parity, the effects of parities on fertility must be controlled. In fact, there is a substantial amount of evidence that sex preference does not have equal importance at all parities (Ben-Porath and Welch, 1976; Bulatao, 1981). Thus, the effects of sex preference on fertility behavior are not equally important at all parities. For example, women having only five or six daughters are more unlikely to attempt bearing another child than are women having only two or three daughters. Also, we expect fertility rates to decrease as parities increase, regardless of the sex composition of previous children.

Difference between the expected number of children and actual children. At each parity, people may have different desired family sizes. If people have a large desired family size, then fertility will not be affected by the sex composition of the first two or three children, even though there is a strong sex preference (Ben-Porath and Welch, 1976). Therefore, I divided this variable into two category-one groups. In one group, coded as 0, the actual family size was less than the desired family size at each parity. In the other group, coded as 1, the actual family size was equal to or greater than the desired family size at each parity. At parity 2, about 80 percent (3,192 respondents) of the respondents wanted to have more than two children; however, at parity 6+, only about 2 percent (44 respondents) wanted to have more than six (or seven) children, as shown in Table 7. In this survey, the mean desired number of children was 3.2, while the average actual number of children was 3.6.

Old age security. The Korean WFS data included responses to three questionnaires measuring the different components of old age security at the individual level. The first factor was the expectation that children will share earnings. The specific question was "*Would you expect your children to give part of their wages to you when they start earning*?" The expectation of sharing earning was coded as 1 if respondents answered “yes”, and 0 if not. From Table 7, approximately 50 percent of the respondents did expect to share their children's earnings when the latter began start earning, while about 50 percent of the respondents did not. The percentages of women expecting to share their children’s earnings increase slightly (about 2 percent) as the parity becomes higher.

The second factor was the parents' expectation that children would live with them after marriage. The specific question was “*As a parent, would you expect any of your children to live with you after they are married?*” The expectation of living together was coded as 1 if respondents answered “yes,” and 0 if not. From Table 7, approximately 40 percent of the respondents did expect to live together with their children after their children married, while about 60 percent did not expect to live together. As in the case of the expectation of sharing their children's earnings, the percentage of expecting to live together after their children married increases slightly as the parity becomes higher.

The third factor was the expectation that children would support parents in the latters’ old ages. The question was “*Would you expect any of your children to support you in your old age?*” The expectation of support in old age was also coded 1 if respondents answered “yes,” and 0 if not. From Table 7, about 80 percent of the respondents did expect to receive old age support from their children, while 20 did not expect old age support. Similar to previous expectations of old age security, the percentage expecting support in old age from their children increased slightly as the parity became higher.

Family name. In traditional Korean society, having sons is the only way of guaranteeing the survival of the family lineage (family name). The family lineage refers to the success of the family name. If the husband is the eldest or only son, then the wife can be expected to have a stronger son preference than other wives. This variable was coded as 1 if the husband was the eldest son or only son, and 0 if not. As seen in Table 7, 51-57 percent of respondents' husbands were the eldest sons or only sons at each parity.

<u>Women's education.</u> Women's education is defined in terms of completed years of schooling. I divided wives' education into three categories. Low level of education stands for no schooling, middle level of education stands for under 6 years of schooling completed, and high level of education stands for 7 or more completed years of schooling. In general, education brings about a rational evaluation of the costs and benefits of having children, and leads to a break from the traditional Confucian ideas about old age security, the importance of the succession of the family line, son preference, etc. As a result, women with higher education level should have a lower hazard of having an additional birth at each parity. As seen in Table 7, as parity becomes higher, the percentage of women without education increases and that of women with higher education decreases.

<u>Women's Age in 1974.</u> Women's age is defined in terms of completed age in 1974. I divided wives' ages into four categories. The youngest age group was under 30 years old in 1974 (survey year), the next youngest was between 31 and 35 years old, and the next oldest age group was between 36 and 40 years old; the oldest age group was between 41 and 49 years old. As parity increases, the proportion of the youngest age group declines rapidly and that of the oldest age group inclines rapidly, as shown in Table 7.

<u>Residence.</u> Residence is defined in terms of types of place of residence. Villages, coded as 0, are regarded as rural areas, while cities and towns, coded as 1, are regarded as urban. From Table 7, the range of respondents living in rural areas was between 33 and 42 percent of the total sample size, while that of those living in urban areas was between 58 and 67 percent. As parities become higher, the percentage living in rural areas increases and that living in urban areas decreases.

Statistical Results

A simple relation between sex composition of previous children and fertility behavior was analyzed when parity was controlled, ignoring the other background variables. Certainly, the group having no son was expected to have higher fertility than other groups when parities are controlled. As seen in Model Q1 in Table 8, relative to the group with only daughters, the estimated ratio of the rate for the group with son(s) and daughter(s) is about 81.1 percent {exp(-0.209)*100}, while that of the rate for the group with only sons is about 78.0 percent {exp(-0.243)*100}. Similar results from the Weibull model are shown in Model W1 in Table 9. In both models, birth hazard rates decrease as parity increases. The quadratic hazard models show that birth rates first rise and then fall($\gamma_1>0$, $\gamma_2<0$).

Second, since the effects of sex preference on fertility behaviors may differ according to individual characteristics, several variables considering individual characteristics were included in Models Q2 and W2. As seen in Tables 8 and 9, when individual characteristics are controlled, the model fittings are improved since $G^2(M_{Q1}|M_{Q2}) = 1621$ and $G^2(M_{W1}|M_{W2}) = 2090$ is significant with df = 11 (p = 0.01).

Model Q2 and W2 indicate that those whose desired number of children is equal to or less than the number of actual children have lower fertility rates than those whose desired number of children is greater the actual number. Nevertheless, the coefficients of the sex composition of previous children remains significant: the difference between the fertility rates of the group having no son and that having at least one son increases slightly, compared the results with models ignoring individual characteristics.

Here, the quadratic hazard model (Model Q2) shows that the estimates about family lineage and old age support become nonsignificant, whereas the Weibull hazard model (Model W2) indicates that these coefficients are statistically significant at the 10% level. This finding indicates that the coefficients in the hazard model are very sensitive to the selected hazard models (Trussel and Richards, 1985). Also, it implies that expectations of old age security and family lineage at the individual level have different effects on fertility behaviors according to parities (Bulatao, 1981; Lee, 1995). For level of education, those without schooling have higher fertility rates than the other groups, while those with more than 6 years of schooling show the lowest fertility rates. For age at

Table 8: Parameter Estimates for Quadratic Birth Hazard Rates Models with Observed and Unobserved Characteristics

Variables	Model Q1	Model Q2	Model Q3	Model Q4	Model Q5[1]
Intercept	-24.90 (0.49)[2]	-25.05 (0.50)	-24.01 (0.50)	-26.84 (0.64)	-27.05 (0.64)
γ_1	24.81 (0.44)	24.77 (0.43)	24.77 (0.43)	31.29 (0.79)	31.29 (0.79)
γ_2	-96.98 (1.71)	-94.04 (1.72)	-93.99 (1.72)	-109.85 (2.52)	-109.85 (2.52)
Only Sons (Daughters)[1]	-0.248 (0.041)	-0.272 (0.042)	-0.191 (0.052)	-0.205 (0.061)	0.205 (0.061)
Daughter(s) and Son(s)	-0.209 (0.033)	-0.209 (0.034)	-0.134 (0.045)	-0.158 (0.052)	0.047 (0.052)
Parity 3	-0.228 (0.029)	-0.177 (0.031)	-0.055 (0.070)	-0.058 (0.082)	-0.306 (0.088)
Parity 4	-0.372 (0.033)	-0.368 (0.040)	-0.146 (0.112)	-0.117 (0.131)	-0.439 (0.136)
Parity 5	-0.480 (0.039)	-0.518 (0.047)	-0.100 (0.166)	-0.121 (0.201)	-0.469 (0.197)
Parity +6	-0.734 (0.040)	-0.861 (0.049)	-0.945 (0.265)	-1.169 (0.349)	-1.637 (0.427)
Live Together		-0.016 (0.024)	-0.014 (0.024)	-0.024 (0.030)	-0.024 (0.030)
Earning		0.012 (0.023)	0.011 (0.023)	0.014 (0.028)	0.014 (0.028)
Support		0.051 (0.032)	0.056 (0.032)	0.076 (0.039)	0.076 (0.039)
Eldest or only son		0.034 (0.022)	0.033 (0.022)	0.032 (0.027)	0.032 (0.027)
Schooling years (1 - 6)		-0.091 (0.026)	-0.090 (0.026)	-0.107 (0.031)	-0.107 (0.031)
Schooling years (beyond 6)		-0.379 (0.041)	-0.377 (0.041)	-0.440 (0.051)	-0.440 (0.051)
Age 31 - 35		0.815 (0.044)	0.817 (0.044)	0.970 (0.059)	0.970 (0.059)
Age 36 - 40		0.941 (0.044)	0.944 (0.044)	1.139 (0.060)	1.139 (0.060)
Age 41 - 49		1.075 (0.042)	1.078 (0.042)	1.292 (0.059)	1.292 (0.059)
Don't want more children		-0.361 (0.030)	-0.359 (0.030)	-0.431 (0.037)	-0.431 (0.037)

Table 8 (Continued)

Variables	Model Q1	Model Q2	Model Q3	Model Q4	Model Q5
City		-0.215 (0.024)	-0.217 (0.024)	-0.253 (0.029)	-0.253 (0.029)
Parity 3 and mixed sex			-0.139 (0.079)	-0.152 (0.092)	0.097 (0.097)
Parity 3 and sons (daughters)			-0.219 (0.102)	-0.248 (0.119)	0.248 (0.119)
Parity 4 and mixed sex			-0.257 (0.117)	-0.348 (0.137)	-0.027 (0.142)
Parity 4 and sons(daughters)			-0.208 (0.155)	-0.321 (0.186)	0.321 (0.186)
Parity 5 and mixed sex			-0.458 (0.170)	-0.557 (0.207)	-0.209 (0.202)
Parity 5 and sons(daughters)			-0.324 (0.233)	-0.347 (0.279)	0.347 (0.279)
Parity +6 and mixed sex			0.072 (0.268)	0.114 (0.351)	0.583 (0.427)
Parity +6 and sons(daughters)			-0.339 (0.415)	-0.469 (0.547)	0.469 (0.547)
c (factor loading)				2.274 (0.093)	2.274 (0.093)
cumulative distribution of θ				0.834 (0.015)	0.834 (0.015)
Likelihood ratio test $[G^2(M_c \mid M_s)]$ (degree of freedom)	587.2[(3)] (6)	1621 (11)	17.4 (8)		

Notes:
(1) The reference group about sex composition of previous children in Model Q1 - Q4 is the women having only daughters, while that in Model Q5 is the women having only sons. Variables in parentheses are variables which are included in Model Q5.
(2) Numbers in the parentheses are standard errors for these coefficients.
(3) Here, the simple model is model without covariates.

Table 9: Parameter Estimates for Weibull Birth Hazard Rates Models with Observed and Unobserved Characteristics

Variables	Model W1	Model W2	Model W3	Model W4	Model W5[1]
Intercept	2.119 (0.039)[2]	1.759 (0.060)	1.689 (0.064)	2.030 (0.096)	1.647 (0.101)
γ_1	0.500 (0.019)	0.608 (0.019)	0.610 (0.018)	1.421 (0.030)	1.421 (0.030)
Only Sons (Daughters)[1]	-0.265 (0.038)	-0.296 (0.039)	-0.202 (0.049)	-0.383 (0.080)	0.383 (0.080)
Daughter(s) and Son(s)	-0.222 (0.031)	-0.230 (0.031)	-0.146 (0.041)	-0.278 (0.068)	0.105 (0.070)
Parity 3	-0.247 (0.026)	-0.192 (0.029)	-0.059 (0.066)	-0.191 (0.109)	-0.411 (0.112)
Parity 4	-0.400 (0.031)	-0.404 (0.036)	-0.130 (0.104)	-0.319 (0.172)	-0.427 (0.165)
Parity 5	-0.527 (0.036)	-0.588 (0.044)	-0.115 (0.152)	-0.391 (0.274)	-0.534 (0.243)
Parity +6	-0.798 (0.037)	-0.969 (0.045)	-1.071 (0.252)	-1.139 (0.359)	-2.073 (0.373)
Live Together		-0.022 (0.023)	-0.019 (0.022)	-0.006 (0.037)	-0.006 (0.037)
Earning		0.021 (0.022)	0.019 (0.022)	0.001 (0.035)	0.001 (0.035)
Support		0.060 (0.030)	0.065 (0.030)	0.114 (0.047)	0.114 (0.047)
Eldest or only son		0.036 (0.020)	0.034 (0.020)	0.066 (0.033)	0.066 (0.033)
Schooling years(1 - 6)		-0.106 (0.024)	-0.105 (0.024)	-0.100 (0.039)	-0.100 (0.039)
Schooling years(beyond 6)		-0.420 (0.038)	-0.418 (0.038)	-0.508 (0.060)	-0.508 (0.060)
Age 31 - 35		0.905 (0.042)	0.907 (0.042)	0.966 (0.060)	0.966 (0.060)
Age 36 - 40		1.063 (0.042)	1.067 (0.042)	1.084 (0.060)	1.084 (0.060)
Age 41 - 49		1.221 (0.040)	1.223 (0.040)	1.298 (0.058)	1.298 (0.058)
Don't want more children		-0.404 (0.027)	-0.401 (0.027)	-0.454 (0.045)	-0.454 (0.045)
City		-0.243 (0.022)	-0.245 (0.022)	-0.307 (0.036)	-0.307 (0.036)

Table 9 (Continued)

Variables	Model W1	Model W2	Model W3	Model W4	Model W5
Parity 3 and mixed sex			-0.149 (0.073)	-0.205 (0.121)	0.015 (0.123)
Parity 3 and sons (daughters)			-0.247 (0.094)	-0.220 (0.153)	0.220 (0.153)
Parity 4 and mixed sex			-0.312 (0.109)	-0.318 (0.179)	-0.210 (0.173)
Parity 4 and sons (daughters)			-0.272 (0.144)	-0.108 (0.235)	0.108 (0.235)
Parity 5 and mixed sex			-0.517 (0.156)	-0.323 (0.278)	-0.180 (0.250)
Parity 5 and sons (daughters)			-0.374 (0.215)	-0.143 (0.363)	0.143 (0.363)
Parity +6 and mixed sex			0.090 (0.254)	0.055 (0.362)	0.989 (0.375)
Parity +6 and sons (daughters)			-0.335 (0.394)	-0.934 (0.514)	0.934 (0.514)
c (factor loading)				2.465 (0.045)	2.465 (0.045)
cumulative distribution of θ				0.530 (0.011)	0.530 (0.011)
Likelihood ratio test $[G^2(M_c \mid M_s)]$ (degree of freedom)	691.12[3] (6)	2090 (11)	22.52 (8)		

Notes:
(1) The reference group about sex composition of previous children in Model W1 - W4 is the women having only daughters, while that in Model W5 is the women having only sons. Variables in parentheses are variables which are included in Model W5.
(2) Numbers in the parentheses are standard errors for these coefficients.
(3) Here, the simple model is model without covariates.

1974, the youngest group has the lowest fertility rates, while the oldest group has the highest fertility rates. Also, those living in urban areas show lower fertility rates than those living in rural areas.

Third, the interaction terms between sex composition of previous children and parities were included in the model. In both the quadratic and Weibull models where the reference group is the group having only daughters, the coefficients of all parities except parity 6+ became statistically nonsignificant, while those of sex composition of previous children remained significant, when the interaction terms are controlled. This finding implies that Korean women having only daughters will not give up the strong desire of having a son until they have at least six daughters. When women have no son, the number of children born is not regarded as an important factor affecting the next birth in Korea. Based on this result, I argue that it is sex preference, not number preference that has stronger effect on fertility behaviors in Korea. Moreover, tests of model goodness of fit also support these results, since $G^2(M_{Q2}|M_{Q3}) = 17.4$ and $G^2(M_{W2}|M_{W3}) = 22.52$ is significant with df = 8 (p = 0.05).

Fourth, to test whether the coefficients of sex composition and parities are contaminated by the omitted variables, two support points were added to the mixing distribution and estimated the location(θ), as shown in Models Q4 and W4. In the quadratic model, 83.4% of women had higher fertility rates than 16.6% of women, while the relative ratio of the fertility rate of women having higher fecundity (53%) to that of women having lower fecundity (47%) was 11.8 {exp(2.465)} in the Weibull model. The absolute values of coefficients of sex composition of previous children increased when the unobserved heterogeneity was controlled. Also, the coefficients of all parities except parity +6 remained insignificant, and some coefficients of the interaction terms between sex composition of previous children and parities became insignificant. These results imply that the results on sex composition of previous children and parity are consistent, while the coefficients of interaction terms are not robust. When the unobserved heterogeneity was controlled, the coefficients of the other independent variables were also robust. Thus, the omitted variables do not have a significant effect on the estimations of the hazard models measuring sex preference in this study.

Finally, to examine the existence of individual differences in sex preferences, the reference group was switched from those having only daughters to those having only sons. In

Models Q5 and W5, the fertility rates of those having only sons were not significantly different from the rate of the group having son(s) and daughter(s). Unlike other countries where strong sex preferences exist (for example, Bangladesh, India, and Pakistan (Nag, 1991)), in Korea, individual differences in sex preferences have no effect on fertility. In addition, Models Q5 and W5 show that every coefficient for every parity is significant and coefficients decrease as parity increases. Thus, if women have at least one son, then the fertility rate decrease as parity increases, even though fertility rates do not decrease until parity six when women have only daughters. Again, the existence of a son has a greater effect on fertility behavior than the number of offspring in Korea.

CONCLUSIONS

In this paper, I have shown the strong effect of sex preference on fertility behaviors in Korea. In the first section, I argued the level of the total fertility rate in Korea, which fell below the replacement level during the late 1980s, is not a permanent but a temporary phenomenon reflecting the changed fertility behavioral pattern of women born in the baby boom cohort: delayed marriage and longer birth intervals between first and second births. Because of the rapid economic development since the late 1960s in Korea, women born in the baby boom cohort were more likely to obtain higher education and to be concerned with their careers, as a result, and to marry at later ages. In addition, because of the excess of females over males of marriageable ages, higher percentages of women born in the baby boom cohort remained single during the late 1980s. The delayed marriages of these women may have contributed to lowering the total fertility rate during the 1980s.

In addition, even women married at younger ages were less likely to bear children at younger ages in the late 1980s. Between 1987-1990, the age-specific induced abortion rate among married women ages 20-24 rapidly increased, while that of married women ages 25-34 changed slightly. In particular, the marital age-specific fertility rate at ages 30-34 was higher for the first time since 1960. The fact that a large percentage of Korean women began childbearing beyond age 30 in the late 1980s implies a change in the prime childbearing ages of Korean women.

It seems that women born in the baby boom cohort do not complete their childbearing within their limited short age intervals (perhaps before age 30), in contrast to those born before the baby boom cohort. When they have one child at a younger age (i.e., before age 30), they tend to delay their second child for a while: the birth interval between the first and second births has become longer.

One of the important factors making these birth intervals longer may be sex-selective abortion. Unlike in other Asian countries, induced abortions play an important role in the decline of the fertility rate in Korea. While most Koreans want to have a few children, they want have at least one son. When a woman's ideal number of children is one and her first child is a son, then she tends to stop bearing children. Nevertheless, since the ideal number of children is not fixed over her whole life, it can change. For example, a woman may have another child to provide companionship for her first child. Nevertheless, if the first child is a girl, then a woman will tend to have another child to try to have a son. Women whose ideal number of children is two and who have at least one son are more likely to complete their childbearing. However, if a woman wants to have two children and the first is a daughter, she is more likely to use sex-selective abortions in order to ensure that the second child is a son. Thus, compared with women having at least one son, women without sons are more likely to depend on sex-selective abortions beyond parity one. Among the pregnancies conceived since 1985, at parity two, more than 90 percent of women having at least one son ended their subsequent births by abortion, whereas 59 percent of women without sons depended on abortions to stop their subsequent births (Cho and Ahn, 1993).

In the decision about the induced abortion beyond parity one, by the way, a large percentage of women without sons may be more likely to depend on the results of tests of the sex of a fetus, such as amniocentesis and ultrasound: if the sex of a fetus is determined to be female, women without sons are more likely to depend on abortions to end their subsequent births. As shown in Table 6, the sex ratios at the third and fourth births in Korea are abnormally high. These deviant rates can not have occurred without the assistance of a high rate of sex-selective abortions. The abnormal high sex ratios at higher parity in Korea can be interpreted as the by-products of a society in which the strong desire of Korean women to have at least one son, within the small family norm, is satisfied by sex-selective techniques.

In the second section, I analyzed the relationship between sex preference and number preference. In the traditional society where sex-selective abortions were not available, how many successive daughters did Korean women have before they gave up having at least one son? To answer this question, I depended on hazard models with and without unobserved heterogeneity, based on the 1974 Korean WFS data.

The results provided evidence that son preference has an important effect on fertility behavior in Korea. The groups having only daughters show higher fertility rates than the other groups having at least one son. When women have only daughters, at parities below parity 6, the number of children does not have a direct effect on fertility behavior. Thus, women having only daughters do not give up the strong desire to have a son until they have at least six daughters. However, when women have at least one son, their fertility rates decrease as parity increases. Another interesting finding is that there is no evidence of a parental desire for at least one daughter in Korea. While Korean women without sons continued their childbearing to have at least one son until parity six when sex-selective technologies were not available, it seems that unwanted daughters (especially from parity two) have been aborted in recent periods, when sex-selective technologies have largely been available. In other words, if sex-selective technologies (especially abortions) were not largely available, then it might have been impossible for the total fertility rates during the late 1980s to reach below the replacement levels and remain there in Korea, because of the strong effect of sex preference on fertility behavior.

Since old age security and family lineage are regarded as the important reasons for wanting sons in Korea, I assume that the relationship between sex composition of previous children and fertility behavior may be weakened (or may disappear) when old-age security and family lineage are controlled. However, the coefficients of sex composition of previous children remained significant and did not decrease. These results indirectly suggest that the value of sons cannot be measured by individual data since it is a macro concept, not a micro concept. Thus, the value of sons must be defined and measured at the societal level (Lee, 1995).

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Endnotes

1. Inconsistencies between the ideal and actual numbers of children were found in Korea. From the results of the National Fertility Survey conducted in 1985, the percentage of cases in which the ideal number of children was equal to the actual number of children was 33.1, the percentage of the ideal number of children being less than the actual number of children was 44.3%; in the other 22.6% of cases the actual number of children was smaller than the ideal. The actual number of children among reproduction ages women, especially women who had terminated their childbearing, was higher than the ideal number of children in Korea (Kim, Eung-Suk and Seung-Wook Lee, 1988). Since these results were based the retrospective data, inconsistencies were exaggerated to some extent. The fact that older women showed greater inconsistency than younger women reflects that the latter has more ability to control their fertility behavior than the former, and that the ideal number of children can be changed over one’s life.

2. In Korea, it is argued that the purpose of contraceptive use is largely the termination of childbearing, rather than the spacing of childbearing (Kim, Seung-Kwon, 1992). The increased percentage of contraceptive use by women having one child may be interpreted as reflecting an increased percentage of women whose ideal number of children is one. Nevertheless, since Korean women, on average, want to have two children, it is more reasonable to assume that a large number of them with one child had used contraception for the spacing of births. Compared with the early 1980s, in the late 1980s women had greater ability to control the spacing between the first and second births.

3. In China, the sex ratios at third birth order were 114.3 in 1985, 123.2 in 1986, 118.9 in 1987, and 124.6 in 1989. The sex ratios beyond the fourth parities were 121.5 in 1985, 124.7 in 1986,121.2 in 1987, and 131.7 in 1989. The main reason why China had lower sex ratios at higher parities than Korea may be the difference in the availability of sex selection technologies.

4. The analysis used information on birth intervals between *jth birth* and *(j+1)th birth*, where j is 2, 3, 4, 5, and 6 and higher. Nine months were subtracted from all birth intervals to remove the period of gestation, which is regarded as fixed. Thus the birth intervals refer to the times between one birth and the next conception resulting in birth. Birth intervals were measured by months. The last birth interval was censored at 51 months.

5. However, Heckman and Walker (1987, 1992) suggested the counting-process goodness-of-fit tests as a criteria for non-nested models.

6. Primarily, I analyzed five data sets to analyze hazard models at each parity. Comparing the results of separate data sets with the results of the pooled sampling data, the two results were very similar. The only important exception is that the coefficient of family lineage was significant at parity 3 when the other variables were controlled, while the coefficient of family

lineage was not significant for the pooled sample.

7. Since the last birth interval was censored at 51 months, I did not regard births with birth intervals beyond 50 as births. Therefore, the sample size at parity 3 was 3,250, while respondents with third births numbered 3,099. The difference (151 = 3,250 - 3,099) represents births with birth intervals beyond 50.

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