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**PATTERNS AND VARIATION IN THE SEX RATIO AT BIRTH
IN THE REPUBLIC OF KOREA**

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In this paper, we examine sex ratio patterns at birth (SRB) among sub-areas of South Korea during the 1990s. We report higher than biologically normal SRBs at varying levels of geography, for three years in the 1990s. These high SRBs are mainly due to prenatal sex identification followed by female-specific induced abortion. This strategy has been implemented in the Republic of Korea following the country's dramatic reduction in fertility. Higher than biologically normal sex ratios at birth carry important implications for the society's males and females, particularly a few decades after their births, when young people begin to exercise marriage options. We estimate that approximately 25 years after 1990, around 2015, approximately 10 to 13 percent of marriage-age males in South Korea will be unsuccessful in their courtship pursuits. In 2015, there could be as many as 400,000 South Korean men of marriageable ages unable to find wives. We explore implications of this unbalanced marriage market for South Korea and its excess male population.

INTRODUCTION

The true sex ratio at birth (SRB) is a near biological universal. Countries with reliable demographic data report SRBs of approximately 105 to 106 male births for every 100 female births, with a narrow band of variability. The sex of a child is primarily a random event, with an approximate 0.513 probability of having a boy. To illustrate, in the United States in 1998 the SRB was 104.7, and has been invariant for decades (see Figure 1). This has not been the situation in South Korea, however.

We examine the patterns and variability in the SRB among the counties of South Korea for three time periods in the 1990s: 1990, 1994 and 1998. We are particularly interested in analyzing the SRB in South Korea because beginning in the 1980s, South Korea, along with Taiwan and China and a few other countries such as India (since the 1990s), have been reporting abnor-

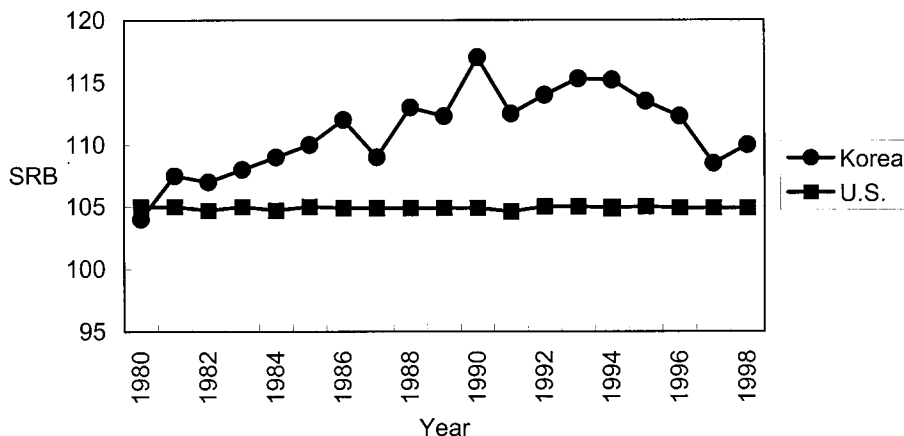


FIGURE 1. SEX RATIO AT BIRTH: SOUTH KOREA, AND THE UNITED STATES, 1980-1998.

mally higher SRBs than are biologically expected (Hull, 1990; Zeng et al., 1993; Park and Cho, 1995; Nair, 1996; Poston et al., 1997; Arnold, 1997; Clark, 2000).

Figure 1 shows time-series data for the sex ratio at birth for South Korea and the United States, from 1980 to the late 1990s. The U.S. shows an invariant pattern, with an SRB of approximately 105 yearly. This stability over time at 105 should be observed if there were no human interventions operating to disturb the biological norm.

In 1980, South Korea had an SRB just below 105; however, it began to increase in the early 1980s, reaching a value of 117.2 in 1990. By 1998, the Korean SRB had dropped to around 110, but was still significantly above normal levels.

The SRBs for the U.S. are biologically normal and are presumably sex ratios at birth that are not influenced by human interventions. In contrast, the SRBs for South Korea are higher than biologically normal, and likely represent various means of human interventions. Sex-selective abortion is believed to be a principal intervention leading to the higher than normal SRBs, although other factors may also be operating, such as the concealment of female births (Zeng et al., 1993).

We first review some of the literature dealing with abnormally high SRBs. We then consider the specific case of South Korea and describe the patterns of the SRB for its provinces and counties for three time periods in the 1990s. The SRB is very high in many counties, and low in a few others; we report and analyze this variability. In conclusion, we explore some of the implica-

tions for South Koreans of the presently abnormally high SRBs, particularly as they pertain to the marriage market.

Literature on Abnormally High Sex Ratios at Birth

Most societies have SRBs of around 105, meaning 105 boys are born for every 100 girls. This so-called biologically normal level of 105 is likely an evolutionary adaptation to the observation that females have higher survival probabilities than males. Since at every year of life males have higher age-specific death rates than females, 105 or so males are required at birth for every 100 females to ensure equality in the numbers of males and females when they reach marriageable ages in their twenties.

We distinguish between the sex ratio at conception (the SRC), referred to as the primary sex ratio, and the sex ratio at birth (the SRB), referred to as the secondary sex ratio. If there are no human interferences with the biological processes, then the SRB depends on the factors that produce the SRC. However, if human activities such as sex selective abortion are introduced, then these interventions will influence the SRB, and not the SRC. What do we know about these interventions?

South Korea, China, Taiwan and a few other countries have been reporting abnormally high SRBs since the 1980s (Arnold and Liu, 1986; Gu and Roy, 1995; Kim, 1997; Poston et al., 1997; Poston et al., 2000). Research indicates that the SRBs are even higher for higher order parities (Arnold and Liu, 1986; Poston et al., 1997; Zhang, 1997). In South Korea, for instance, Kim has noted that “high sex ratios at birth keep growing unacceptably as birth order progresses” (Kim, 1997: 20-27). In China, since the 1980s, the sex ratio at birth for the first child has been about normal, but has risen drastically for the second birth; “the higher the order of birth, the more abnormal the gender ratio” (Gu and Xu, 1994: 421). When SRBs in China are calculated by both parity and the sex of the previous child(ren), the average SRB across China’s provinces for third parity births where the first two births were girls was 208 (Poston et al., 1997: Table 2). For Taiwan, we see similar patterns. In 1990, the SRB for the first parity was normal; the second parity was a little higher than normal, and the SRBs for the third and fourth parities were above 110, with the fourth parity SRB at around 130 (Gu and Roy, 1995).

What are the proximate causes of these abnormally high SRBs? The literature indicates that all three countries seem to be showing, in varying degrees of importance, similar interventions leading to abnormally high SRBs, namely, prenatal sex identification followed by gender-specific abor-

tion, and, less so, the underreporting of female babies (Hull, 1990; Johansson and Nygren, 1991). The out-adoption of females seems to be a much less prominent cause, and female infanticide and abandonment are pretty much non-existent (see esp. Zeng et al., 1993).

However, these explanations fail to indicate the event or phenomenon causing South Korea to have such abnormally high SRBs since the 1980s. The most likely factor leading to these human interventions, which in turn produced abnormally high SRBs, is the dramatic reduction in fertility experienced by South Koreans. Figure 2 shows time series data for the total fertility rate for South Korea from 1955 to 2000. (The total fertility rate [TFR] is a summary cross-sectional measure of fertility and refers to the average number of children per woman.)

South Korea has experienced a dramatic reduction in its TFR, from 5.5 children per woman in 1955 to 1.5 children per woman in 2000. This transition is one of the most rapid and remarkable fertility reductions in the historical demographic record. However, why would such a rapid fertility reduction lead to abnormally high SRBs?

One reason is that South Korea (along with China and Taiwan) has a Confucian patriarchal tradition where son preference is strong and pervasive (Arnold and Liu, 1986; Gu and Roy, 1995; Kim, 1997; Park and Cho, 1995; Poston et al., 1997). When birth rates are low or are on the decline, and “where a strong preference for sons over daughters is already part of the culture, SRBs tend to be higher” (Poston et al., 1997: 59).

In South Korea, the decline in fertility has been primarily a result of vol-

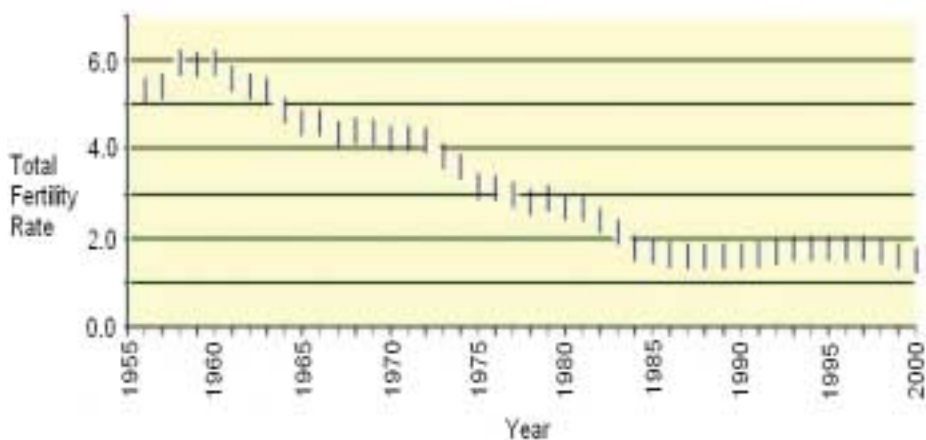


FIGURE 2. TOTAL FERTILITY RATES: SOUTH KOREA, 1955-2000.

untary reductions in family size following industrialization and government policies. Korea was largely an agricultural country when it was liberated from Japan in 1945. The Korean War (1950-1953) then devastated the economy, and the living standards of Koreans were among the lowest in the world. However, after the war, the Korean economy transformed itself from an agricultural to a semi-industrial economy, beginning with the five-year economic development plan implemented by the military government in 1962. As a result, Korea is now characterized by light manufacturing industries, and a firm foundation of heavy and chemical industries. The Korean transformation is regarded as a major example of success for economic development in an Asian country (Kim and Poston, 1992).

As a consequence of these social, economic and industrial transformations, the number of babies born per woman has quickly fallen to below replacement levels. Couples no longer have many children, if they so desire, due to newly emerging social norms. However, the deeply-rooted cultural influences of son preference still make it important for many families to have at least one son. Therefore, strategies and interventions are sought by many families to ensure that they will have a son (Freedman et al, 1994; Gu and Roy, 1995; Zeng, et al, 1993). We now turn to empirical analyses of the SRB among the counties and provinces/municipalities of South Korea.

DESCRIPTIONS OF THE SRB

For the provinces/municipalities and counties of South Korea, we have data on the numbers of male and female births for the three time-periods of 1990, 1994 and 1998. We first present descriptive data for Korea's provinces and municipalities. South Korea is subdivided into the six independent municipalities of Seoul, Pusan, Taegu, Incheon, Kwangju, and Taejon, and the nine provinces of Kyonggi-do, Kang-won-do, Chungchongbuk-do, Chungchongnam-do, Chollabuk-do, Chollanam-do, Kyongsangbuk-do, Kyongsangnam-do (includes Ulsan, which was separated from Kyongsangnam-do and became an independent municipality in 1997), and Cheju-do, for a total of fifteen separate and geographically exclusive subdivisions.

Table 1 presents descriptive data on the SRB for South Korea's six municipalities and nine provinces for the three years. Figure 3 summarizes these data for the six municipalities in the form of three box-and-whisker plots describing the SRB in each of the three time periods; Figure 4 does the same for the nine provinces. (A box-and-whisker plot presents a box extending from the 25th percentile to the 75th percentile, also known as the inter-quartile range [IQR]; the line in the middle of the box is the median value, or the

TABLE 1. DESCRIPTIVE DATA FOR THE SEX RATIO AT BIRTH: SIX MUNICIPALITIES AND NINE PROVINCES, SOUTH KOREA, 1990, 1994, AND 1998

	Mean	Std. Dev.	Minimum	Maximum
Municipalities, 1990	118.9	7.0	112.4 (Inchon)	130.4 (Taegu)
Municipalities, 1994	116.2	3.6	111.9 (Kwangju)	121.3 (Taegu)
Municipalities, 1998	110.7	3.4	107.9 (Kwangju)	116.5 (Taegu)
Provinces, 1990	118.8	6.3	112.1 (Kyonggi-do)	131.7 (Kyongsangbuk-do)
Provinces, 1994	115.8	4.2	110.0 (Chollabuk-do)	124.3 (Kyongsangbuk-do)
Provinces, 1998	110.7	2.3	108.3 (Chungchongbuk-do)	114.4 (Kyongsangbuk-do)

50th percentile. The top and bottom lines emerging from the box are the so-called whiskers, and they extend to the upper and lower adjacent values).

Among the municipalities, the SRB had a mean value in 1990 of 119, with a low of 112 in Inchon and a high of 130 in Taegu (Table 1 and Figure 3). The SRBs declined in value such that by 1998, the mean across the municipalities was 111. Taegu was the Korean municipality with the highest SRB in 1998, a value of 117.

The patterns among South Korea's nine provinces parallel those of the municipalities, ranging from a high average SRB value of 119 in 1992 to an average SRB value of 111 in 1998. The province of Kyongsangbuk-do had the highest SRB values in each of the three years, namely, SRB values of 132 in 1990, 124 in 1994, and 114 in 1998 (Table 1 and Figure 4). Kyongsangbuk-do's SRB values are so extreme in 1990 and in 1994 that they are located in the box-and-whisker plots above the upper whiskers (see the left and middle plots in Figure 4) and are referred to statistically as "outside values." This means that they are higher than any other SRB value located at or beneath the upper whiskers, which represent the "75th percentile plus 1.5 IQR." By 1998, Kyongsangbuk-do's SRB was still the highest of all the provinces, but it was now situated within the upper whisker of the box-and-whisker plot (see the right plot in Figure 4).

For a more detailed descriptive appraisal of the sex ratio at birth in South Korea in the 1990s, we now analyze the patterns and variation in the SRB among the counties. In 1990, South Korea was subdivided into 268 counties. By 1994 some counties had been combined, and some were created from

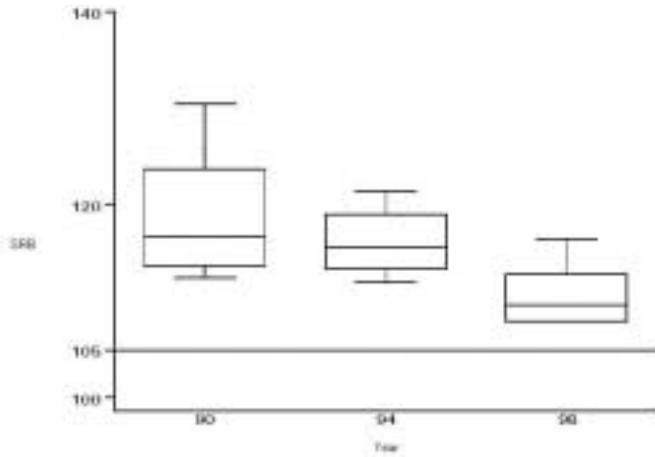


FIGURE 3. BOX-AND-WHISKER PLOTS FOR THE SEX RATIO AT BIRTH: SIX MUNICIPALITIES OF SOUTH KOREA.

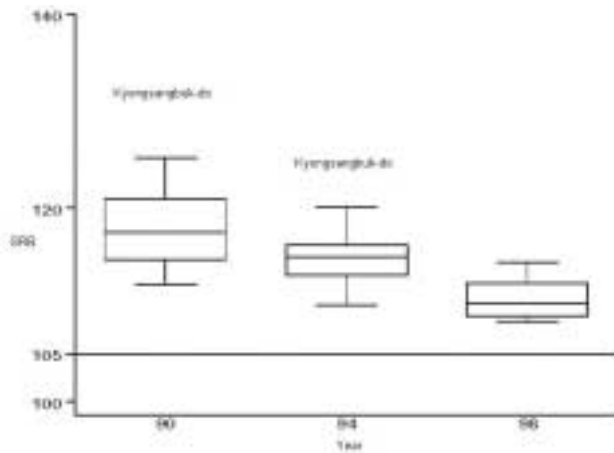


FIGURE 4. BOX-AND-WHISKER PLOTS FOR THE SEX RATIO AT BIRTH: NINE PROVINCES OF SOUTH KOREA.

others, resulting in a total of 274 counties. There were additional changes in county geography after 1994 so that by 1998 there were 247 counties. Table 2 presents descriptive data on the SRB for South Korea's counties for the three years. Figure 5 summarizes these county SRB data in the form of three box-and-whiskers plots, one plot for each year.

Among the counties, the SRB had a mean value in 1990 of 118, declining to 117 in 1994 and to 111 in 1998 (Table 2). These values and trends are almost identical to those of the provinces and municipalities (see Table 1). As with the SRB patterns among the provinces and municipalities, we also observe among the counties a general pattern of decline in the SRB between 1990 and 1998. The standard deviations of the county SRBs, however, are much higher than are those for the municipalities and provinces. This more substantial variation in county SRBs is seen in the minimum and maximum values shown in Table 2, and even more so in the three box-and-whisker plots presented in Figure 5.

Among the counties in 1990, the SRB ranged from a low of 89.2 in Ulung-

TABLE 2. DESCRIPTIVE DATA FOR THE SEX RATIO AT BIRTH: COUNTIES OF SOUTH KOREA, 1990, 1994, AND 1998

	Mean	Std. Dev.	Minimum	Maximum
Counties, 1990	118.4	11.7	89.2 (Ulung-gun)	161.9 (Happo-gun)
Counties, 1994	116.6	8.8	87.0 (Yangyaug-gun)	165.1 (Kyerong Branch Office)
Counties, 1998	111.1	8.0	75.9 (Unlung-gun)	144.3 (Kunwi-gun)

Note: There were 268 counties in South Korea in 1990, 274 counties in 1994, and 247 counties in 1998.

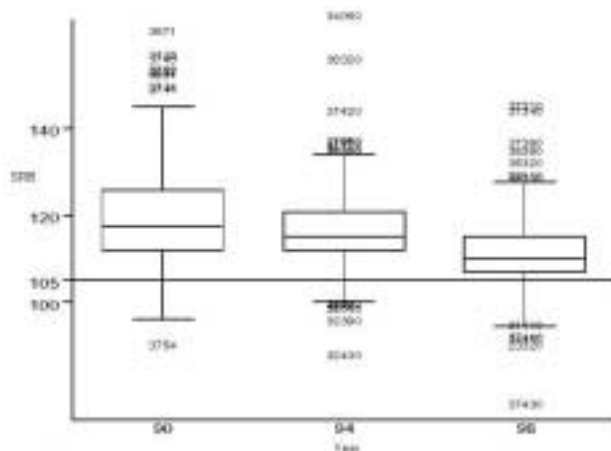


FIGURE 5. BOX-AND-WHISKER PLOTS FOR THE SEX RATIO AT BIRTH: COUNTIES OF SOUTH KOREA.

gun, a county in Kyongsangbuk-do Province, to a high of 161.9 in Hapcheon-gun, a county in Kyongsangnam-do Province. In 1998 the county SRBs ranged from a low of 75.9, again in Ulung-gun County, to a high of 144.3 in Kunwi-gun, a county in Kyongsangbuk-do Province (Table 2 and Figure 5).

We first consider some of the possible dynamics behind SRBs that are higher and lower than normal. In the Korean counties with high SRBs, the prime causative factor is most likely sex-selective abortion, and much less so the out-adoption of females and the concealment of female births. In South Korea since the late 1980s, ultrasound technology enabling the pre-natal determination of sex has been widely available. There is virtually no evidence of female infanticide causing the high SRBs. We hypothesize that these human interventions that disturb the SRB, are mainly due to norms and traditions among Korean families to have sons, and within a more recent normative context, to have few births.

However, there are also counties in Korea in the 1990s reporting SRBs below 100. In 1990, 7 counties had SRBs of less than 100, with 16 counties in 1994, and 12 counties in 1998. More counties reported SRBs greater than 100, than less than 100. We present three possible reasons for why counties would have SRBs that are lower than biologically normal. The first reason is not at all likely, the second reason is a little bit likely, and the third reason is the most likely.

One reason for counties to have SRBs that are lower than biologically normal is that couples desire daughters. Thus they would use ultra-sound methods to detect the sex of the fetus, and then abort it if it was male. It is doubtful that many Korean couples would prefer female births, and even less likely that they would revert to sex-selective abortion to prevent having male births. This is particularly so in South Korea, a country known for its son preference.

A second reason for lower than biologically normal SRBs is that couples may wish to have more than one or two births. If a couple wanted to have a second (or a third) birth, when "everyone else" was only having one or two, it is not inconceivable to suspect that such couples might be motivated to report the first birth as female, even if it was male, to allow them to be able normatively to have another baby. This is a strategy that could be followed by the occasional couple desiring to have more than the normatively prescribed number of one or two children in a low fertility society with high son preference. They would be more likely to break the norm and have another child if the first was thought to be boy, than the opposite. However, this is probably a more likely strategy in China, where permission must be

obtained for each birth, than it is in Korea (Smith, 1994; Smith et al., 1997; Merli and Raftery, 2000).

A third reason for lower than average SRBs is that in countries undergoing fertility transitions, once the transition is completed, "a clear negative association emerges between the sex ratio and family size" (Park and Cho, 1995: 64). That is, the sex ratio of children born in small families will be higher than that of those born in large families. For instance, in South Korea in 1991, the sex ratio of children in 1-child families was 136, but was 59 in 5-child families (Park and Cho, 1995: 65).

Park and Cho (1995: 65) note that "differential contraceptive use depending on sex composition of existing children alone can cause this kind of imbalance, if couples who happen to bear daughters early in their married lives tend to continue childbearing, while those who happen to bear sons early are motivated to stop." South Korean counties with lower than average SRBs often have higher than average numbers of children per family.

We also assume that lower than biologically normal SRBs may be partly related to factors such as age and sex composition of the population, migration, the proportion of older population, and the characteristics of industry in each county.

A statistical reason for the lower than normal SRBs is likely. The counties shown in Figure 5 reporting very low SRBs are usually counties with a small number of male and female births. Indeed the counties with SRBs less than 100 had many fewer births annually than the average number of births each year for all the Korean counties. In 1998, for instance, counties with SRBs less than 100 had an average number of 538 births, whereas the average number of births in 1998 for all Korean counties was 2,558. The counties with the lowest SRBs in the three years, Ulung-gun and Yangyaug-gun had 273 births in 1998.

DISCUSSION AND CONCLUSION

In this paper, our primary objective was to describe the patterns of the sex ratio at birth among the subareas of South Korea in the 1990s. At varying levels of geography for three years in the 1990s, we reported higher than biologically normal SRBs in Korea. We noted that these higher SRBs are mainly due to the proximate cause of prenatal sex identification followed by gender-specific induced abortion. This strategy has been implemented in South Korea following the country's dramatic reduction in fertility. In societies whose cultures are grounded in a Confucian ideology with heavy preferences for male children, when couples are no longer able to have the num-

ber and gender mix of children they desire, they will use human interventions to maximize the chances of realizing their fertility desires. The desire for many sons has been an integral part of South Korean and other East Asian societies for centuries. This desire is still present, although it has been declining recently.

Higher than biologically normal sex ratios at birth carry important implications for the society's males and females, especially two or more decades after their births, when young people begin to exercise marriage options. As we noted earlier, the SRB is biologically normal at about 105 because this excess number of males per 100 females at birth mostly guarantees that there will be near equal numbers of males and females when the groups reach marriageable ages. Abnormally high SRBs, however, will disturb this balance. Let us explore these implications in more detail.

Figure 1 indicated that in 1990, the SRB was near 118 in South Korea. This means that 25 years later, in 2015, there will be more than 10 percent of marriage-age males who will be unsuccessful in their courtship pursuits.

In the larger cities of South Korea, there has been an emerging situation in recent years that makes these concerns all the more relevant. In the past ten years, in big cities such as Seoul, Pusan, and Taegu, there has been an increasing tendency for marriage-age women with professional careers to voluntarily remain single, or to delay marriage for 10 to 15 years. These typically college-educated (and beyond) women have decided to remain single for numerous reasons. By remaining single, they feel that they will be better able pursue their professional careers, to manage their own financial and personal affairs, and to relieve their subjection to husbands and mothers-in-law, many of whom typically have traditional ideas about the roles and position of women. This phenomenon is beginning to disturb the male-female marriage-age equilibrium that is the product of SRBs from two to three decades ago that were approximately biologically normal. We speculate that the sex ratio imbalance at birth which Korean society experienced in the 1990s will aggravate the disturbance of male-female marriage-age equilibrium.

In South Korea in another 15 years, there will not be enough young women for young men to marry. This will be a particularly difficult situation because it will be happening in a society where virtually everyone is expected to marry, and where marriage is nearly universal. What will these young men do when they cannot find brides? Will many of them remain bachelors?

There are at least two extenuating circumstances that would modify this negative prognosis and provide possible alternatives. One is the immigra-

tion to South Korea of Korean women from the northeastern part of China, where more than two million Chinese of Korean ancestry reside (Suh and Schultz, 1990; Park and Han, 1990). Korean women of marriage-age could also migrate to South Korea from North Korea. Both strategies would of course enlarge the pool of wives. To date, there is little evidence of marriage migration to South Korea. However, in China and Taiwan, countries also suffering from abnormally high SRBs, there is some evidence of marriage migration underway (Davin, 1998; Fan and Huang, 1998). Polyandry is another consideration (see Cassidy and Lee, 1989), although there is no evidence of this in South Korea, even among the most traditional and isolated peoples.

Another possibility is that these Korean bachelors will never marry and will have no other alternative but to develop their own lives and livelihoods. They could well re-settle with one another in "bachelor ghettos" in Korea's big cities, where commercial sex outlets are more prevalent.

Our discussion of the social implications for South Korean society resulting from its higher than biologically normal SRBs is ironic. South Korea solved its burgeoning fertility problem of nearly six children per woman with a fertility transition that is among the most successful experienced globally. However, the success of the transition has been problematic. South Korea has limited via social norms the average number of children per family to below replacement levels. However, so pervasive is the desire for sons that many couples have introduced interventions to guarantee that sons would be born. This has resulted in abnormally high SRBs that are to a degree unprecedented. The speed of South Korea's fertility transition (from 5.5 children per woman in 1955, to 1.7 in 1985, and to 1.5 in 2000) has given the country little time to evolve to a more modern familial normative structure that places less of a premium on boys over girls. There is a growing awareness of these problems in South Korea, although the problems were not foreseen when the birth rates began to fall in the 1960s.

For example, in 1998, the Planned Parenthood Federation of Korea (PPFK) sponsored a year-long celebration focusing on "Love of Daughters" as a way of endeavoring to halt sex-selection. In 1998, the "Year of the Tiger," was selected for this campaign because the Tiger year associates girls with bad luck (Shin, 1998). By 1998 in South Korea, the long-term damage was already done. Campaigns such as that sponsored by the PPFK may have a modest impact on the SRB in the following years. However, the imbalanced sex ratio that will lead to an imbalanced marriage market cannot be retroactively adjusted.

We believe that these social issues resulting from the SRB imbalance in

South Korea since 1980s require greater attention. By describing the SRB patterns in South Korea, and by entertaining some of the implications, we hope that our paper contributes to a further discussion of this demographic eventuality.

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