
On Substituting Sex Preference Strategies in East Asia: Does Prenatal Sex Selection Reduce Postnatal Discrimination?

Author(s): Daniel Goodkind

Source: *Population and Development Review*, Vol. 22, No. 1 (Mar., 1996), pp. 111-125

Published by: Wiley on behalf of Population Council

Stable URL: <https://www.jstor.org/stable/2137689>

Accessed: 29-08-2024 16:32 UTC

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at <https://about.jstor.org/terms>



JSTOR

Wiley, Population Council are collaborating with JSTOR to digitize, preserve and extend access to *Population and Development Review*

On Substituting Sex Preference Strategies in East Asia: Does Prenatal Sex Selection Reduce Postnatal Discrimination?

DANIEL GOODKIND

A LARGE AND GROWING literature suggests that parental preferences for a particular distribution of children by sex manifest themselves in discriminatory practices (for book-length expositions, see Williamson 1976; Bennett 1983). In East Asia, the most recent evidence of such discrimination has been a rising sex ratio (number of males per 100 females) at birth. In China, this phenomenon is due in part to the one-child policy, which has provoked parents to engage in some combination of the following: unreported outadoption of daughters, other misreporting of birth histories or family composition, and female infanticide (Hull 1990; Johannson and Nygren 1991; Zeng et al. 1993; Coale and Banister 1994). In addition, as these authors have discussed, recent advances in prenatal sex testing technologies have also played a contributing role. The combination of such technologies with falling desired family size has resulted in the excess induced abortion of female fetuses. Indeed, sharply rising sex ratios at birth in Korea and Taiwan, societies whose fertility policies are less restrictive than China's, indicate the voluntary use of prenatal sex testing in other parts of East Asia as well (see Chang 1994; Hong 1994; Park and Cho 1995; Gu and Roy 1995). This practice is particularly frequent at later birth orders when parents have borne only daughters, because couples still desire at least one son in their smaller families.

The use of such technologies leading to sex-selective abortion has been cited with alarm by many observers and by some governments and international agencies as evidence of growing discrimination against females. For instance, in the Program of Action adopted by the International Conference on Population and Development in Cairo, paragraphs 4.15 and 4.16 note "the increasing use of technologies to determine foetal sex" and char-

acterize prenatal sex selection (along with the practice of female infanticide) as “harmful and unethical” (UN 1994; see also Cohen and Richards 1994). For this and related reasons, Korea and other countries have recently attempted to ban prenatal sex testing and have legislated substantial penalties for those providing or receiving such information (Hong 1994; Park and Cho 1995). Such legislation, however, addresses only the most recently available strategy through which parents can discriminate against their daughters. As is well known, two postnatal strategies have always been available, and often applied, for that purpose: female infanticide (Scrimshaw 1978; Hanley and Yamamura 1977; Hausfater and Hrdy 1984; Lee, Wang, and Campbell 1994) and neglect of young daughters (e.g. Miller 1981; Choe 1987; Das Gupta 1987; Muhuri and Preston 1991; Kishor 1993). At least implicitly, critics of prenatal sex selection view sex preference strategies as *additive*; that is, they see the new technology as yet another weapon allowing parents to discriminate against daughters.

However, none of the recent literature on rising sex ratios at birth considers an alternative possibility; namely, that sex-selective abortion may represent the *substitution* (whether deliberate or de facto) of prenatal for postnatal discrimination. Yet such a substitution hypothesis is intuitively plausible. If parents increasingly have the option of sex-selective abortion, daughters actually carried to term would more likely be wanted, and the result might be a *decline* in postnatal discrimination.

In addition to being plausible, the substitution hypothesis is implicitly supported by empirical evidence. In several Asian contexts, daughters’ survival probabilities tend to be better if they have no other female siblings than if they have only female siblings (Muhuri and Preston 1991; Kishor 1993). In the past, such a survival advantage of daughters with no female siblings was the result of random factors determining the sex of siblings. It seems no less likely that daughters without female siblings will maintain that survival advantage when parents themselves control the sex distribution of their children through prenatal sex selection.

Moreover, the likelihood of an analogous substitution has already been established with respect to two postnatal sex preference strategies—infanticide and neglect of young daughters. After reviewing the history of infanticide throughout the world, Scrimshaw (1984: 462; quoted in Hull 1990) observed that “the decline of infanticide may result in more suffering for older infants and children, and even adults, than when an infant’s fate was determined swiftly, early and irrevocably” (see also Scrimshaw 1978). More recently, Lee, Wang, and Campbell (1994) provided empirical support for the substitution of postnatal sex preference strategies as reflected in the practices of eighteenth- and nineteenth-century Chinese parents. Lineage records of Qing Dynasty nobility suggest that female infanticide was common, but the survival chances of daughters completing their first month of life were quite good.

To the extent that a substitution of prenatal for postnatal sex preference strategies is occurring today, rising sex ratios at birth could therefore be a reason for guarded relief as well as worry. This note uses vital registration and other data to investigate the validity of the substitution hypothesis. It compares trends in sex ratios at birth with trends in the sex ratios of infant and early childhood deaths in East Asia. In several instances, evidence suggests an interaction between them. The results suggest the need for further reflection on the prevalence and relative evils of both prenatal and postnatal discrimination before judging the morality of sex-selective abortion.

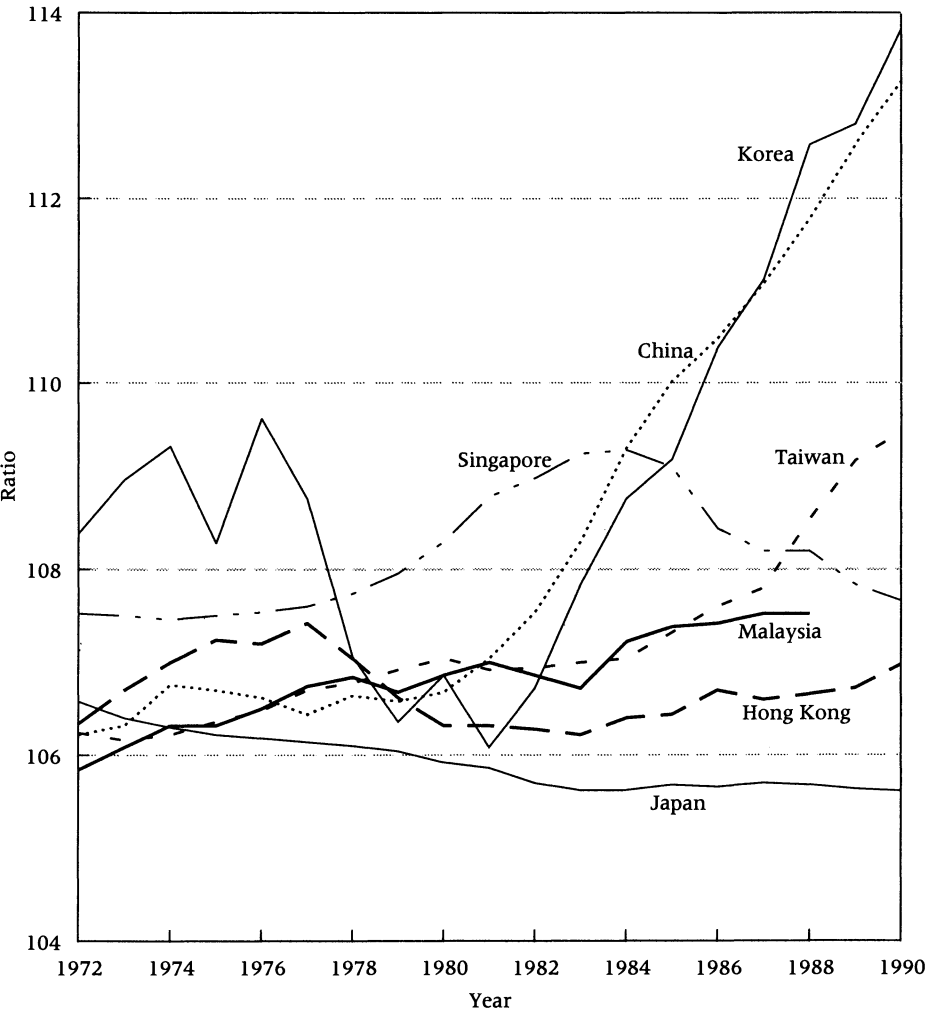
Rising sex ratios at birth as an indicator of sex selection

Ideally, evidence for the substitution hypothesis should come from families in which parents actually resort to prenatal sex selection. At present, however, such an investigation cannot be performed. Calculations of the relative survival probability of daughters in cases where parents had used a prenatal sex test would require a special survey with a very large sample. The 1988 Korean National Fertility and Family Health Survey (NFFHS) was one of the largest ever to include questions on prenatal sex testing, but among the 22,094 pregnancies recorded, only 275 prenatal tests were reported, 56 of which were followed by the birth of a daughter (Hong 1994). Denominators based on these prenatal tests are far too small to compute statistically reliable survival ratios, given that less than 2 percent of Korean newborns fail to reach their fifth birthday.

At the aggregate level, however, an indirect test of the substitution hypothesis is possible in societies that fulfill two conditions: (1) demonstrated discrimination against daughters, as measured by abnormally low male-to-female ratios (m/f) of infant and early childhood mortality, followed by (2) a sharp rise in the ratio of males to females at birth. The substitution hypothesis would gain support if the sex ratio of mortality rose (i.e., discrimination against daughters declined) shortly after increases in the sex ratio at birth. Before formally addressing the substitution hypothesis, this section briefly reviews evidence regarding the validity of these sex ratio measures as proxies for discrimination against daughters.

Figure 1 depicts five-year moving averages of the sex ratio at birth between 1970 and 1992 in Confucian societies¹ of East Asia: Korea, China, Taiwan, Singapore (Chinese only), Peninsular Malaysia (Chinese only, data available through 1990), Hong Kong, and Japan. The data are derived from high-quality and complete vital registration records, with the exception of those from China, which come from sample surveys, and Korea, which come from incomplete vital registration (note that fertility levels, with the possible exception of China, were below replacement in all these societies

FIGURE 1 Sex ratios at birth (number of males per 100 females) in East Asia: Five-year moving averages, 1970–92



NOTE: Ratios for Malaysia and Singapore refer to Chinese populations only.
SOURCES: See "Sources for Figures" in References.

by 1992). Previous research suggests that sex ratios at birth normally range from about 105 to 106 males per 100 females (e.g. Johannson and Nygren 1991). Figure 1 demonstrates that in East Asia these ratios tended to rise sharply above that range beginning in the early 1980s as sex-testing technologies became more widespread. Such ratios have recently exceeded 113 in Korea and China, 109 in Taiwan, 107 among Chinese in Singapore and Malaysia, and 106 in Hong Kong. The clear exception is Japan, where these ratios actually declined over the same interval. The Japanese anomaly has led to speculation as to whether other Confucian societies in East Asia may

eventually experience a decline in the sex ratio at birth as they catch up to Japan's level of development, or whether preexisting cultural differences will persist between Chinese and Japanese societies (e.g. Gu and Roy 1995).

Of course, the sex ratio levels depicted in Figure 1 are not necessarily perfect barometers of the strength of son preferences from country to country. For instance, as much literature has shown, sex ratios tend to be most distorted at later birth orders as childbearing becomes more discretionary (e.g. Park and Cho 1995). Thus, the overall sex ratio at birth reflects to some extent existing distributions of births across parities.

In addition, many other deficiencies in the sex ratio at birth as an indicator of son preference have been insufficiently recognized in recent literature. First, we do not know the overall availability of prenatal sex-testing technologies, nor the ability of parents to obtain such test results and a subsequent abortion. Thus, if 90 percent of Country A's population had access to the results of such tests and a subsequent abortion compared with only 40 percent of Country B's, sex preferences in Country B could be stronger than in Country A despite a lower sex ratio at birth. Second, to the extent that some individuals prefer a balanced family composition (or even daughters), the sex ratio at birth, as an aggregate measure, reflects some cancelling out of son preferences (McClelland 1983); indeed, parents sometimes use sex-selective abortion against male fetuses if they have had one or more sons but no daughters (Zeng et al. 1993; Anderson and Silver 1995). Third, the force of biological factors in affecting the sex ratio at birth may shift over the course of development. For instance, since male fetuses tend to be more frail and hence over-represented among spontaneous abortions and stillbirths, improvements in maternal nutrition favoring fetal survival may contribute to rises in the sex ratio at birth (Hassold, Quillen, and Yamane 1983; Waldron 1987). Fourth, sex-selective underregistration of births may occur due to institutional or cultural reasons (e.g. D'Souza 1978), resulting in the inaccurate measurement of the sex ratio at birth. Perhaps the best-known example of this is found in China, where the one-child policy has created disincentives for reporting the birth of daughters, who thereafter may be adopted out but remain unregistered (Hull 1990; Johansson and Nygren 1991; Zeng et al. 1993). These four factors may explain why there were already notable differences in the level of sex ratios at birth in East Asia even before prenatal sex testing became available in the 1980s (see Figure 1).

Despite these deficiencies in the sex ratio at birth as an indicator of sex preferences, there is direct evidence that sharp rises in this measure reflect the availability and use of sex-selective abortion. In Korea, for instance, ultrasound machines are now being manufactured (Hong 1994), and other methods of fetal sex determination have also become available since the 1980s such as amniocentesis and chorionic villus sampling. The

latter technique can identify the fetal sex 8–9 weeks after conception (Brambati 1992), well within the first trimester of pregnancy when most abortions occur. According to the aforementioned 1988 Korean survey, parents prenatally determined the sex of a child in 1.6 percent of all pregnancies.² About 2 percent of prenatal tests indicating a male fetus were followed by an abortion, compared to over 60 percent following tests indicating a female fetus (Hong 1994).³

Compared with using the sex ratio at birth, there is somewhat less ambiguity in regard to using the sex ratios of infant and child death rates as proxies for discrimination against daughters. In general, demographers have found that child mortality ratios (m/f) below 1 are reliable indicators of postnatal discrimination (Choe 1987; Makinson 1994; note that the underreporting of daughters' deaths that sometimes occurs in son-prefering societies would tend to *raise* the sex ratio of child deaths). However, cross-sectional evidence indicates that the sex ratio of infant and early childhood mortality may increase slightly over the course of development (Makinson 1994; Hill and Upchurch 1995). Time-series data for Japan and Taiwan corroborate this tendency, at least until replacement-level fertility is reached. This tendency may signal a decline in discrimination against daughters with modernization. It could also be attributable in part to the aforementioned selectivity effects. In other words, over the course of economic development, male fetuses may be relatively more likely to survive gestation, but due to their continuing fragility they may thereafter be less likely to survive infancy or young childhood (Hassold, Quillen, and Yamane 1983). Whatever the explanation for this tendency, it should be recognized that sex ratios of infant and child death rates may increase over time for reasons unrelated to the substitution hypothesis.

The substitution hypothesis examined

The substitution hypothesis posits that, in countries exhibiting strong preferences for sons, a rise in the sex ratio at birth should be accompanied by a rise in the sex ratios of child mortality (i.e., a decline in discrimination against daughters). Table 1 presents data on these measures for the societies in which sex ratios at birth have risen most markedly—Korea, China, and Taiwan. The table also lists an expected sex ratio of infant and early childhood death rates from a model life table for an East Asian population (United Nations 1982). Discrimination against daughters is generally assumed to take place when these ratios fall below 1 (or below 1.1 for infants, because male infants tend to be weaker than their female counterparts).

One finds convincing evidence of discrimination against young daughters in Korea prior to the 1980s. Sex ratios of infant and child mortality reached values of .76 and .53 in 1978–79. These figures may seem very

TABLE 1 Measures and sex ratios (m/f) of infant and early childhood mortality (${}_1q_0$ and ${}_4q_1^a$), sex ratios at birth (percent), and total fertility rates (TFR) in Korea, China, and Taiwan, selected years

	Male		Female		Sex ratio of			TFR
	${}_1q_0$	${}_4q_1$	${}_1q_0$	${}_4q_1$	${}_1q_0$	${}_4q_1$	birth ^c	
Far East standard^b	.0328	.0084	.0326	.0079	1.01	1.05	105–6	—
Korea								
1960–65	.0551	.0311	.0518	.0383	1.06	0.81	N.A.	5.7
1965–74	.0473	.0163	.0413	.0181	1.15	0.94	108.4	4.4
1978–79	.0314	.0091	.0410	.0171	0.76	0.53	106.7	3.0
1990	.0109	.0046	.0105	.0039	1.04	1.16	113.8	1.6
China								
1973–75	.0489	.0354	.0427	.0362	1.14	0.98	106.7	4.5
1981	.0381	.0158	.0361	.0175	1.05	0.90	107.1	2.6
1990	.0282	.0093	.0327	.0098	0.86	0.95	113.3	2.3
Taiwan								
1930	.1810	.1040	.1500	.1200	1.20	0.87	105.2	6+
1950	.0420	.0960	.0380	.1040	1.11	0.93	105.1	6.0
1965	.0243	.0192	.0219	.0188	1.11	1.02	105.8	4.9
1970	.0196	.0093	.0167	.0082	1.13	1.13	106.2	4.1
1980	.0118	.0056	.0098	.0048	1.20	1.17	107.0	2.7
1990	.0062	.0032	.0055	.0028	1.13	1.14	109.5	1.7

N.A. = not available.
^a ${}_1q_0$ indicates the probability of death from age 0 to age 1 year. ${}_4q_1$ indicates the probability of death from age 1 to age 5 years.
^bThese q values come from model life tables with life expectancies at birth of 65 years for males and 70 years for females (United Nations 1982).
^cSex ratios at birth are five-year averages, except for Taiwan 1930 and 1950, which are annual figures.
 SOURCES: Mortality—Korea: Choe (1987) for 1960–74; Economic Planning Board for 1978–79; National Statistical Office for 1990; (latter two reported in *Korea Statistical Yearbook*, Republic of Korea, 1988 and 1990). China: Banister (1992). Taiwan: *Taiwan-Fukien Demographic Factbook*, 1965–90 (author-adjusted ${}_nM_x$ figures); Yang (1995) for 1930 and 1950. Fertility—see “Sources for Figures” in References.

low, but preference for sons has been especially strong in Korea, and the rapid decline in Korean fertility over the 1970s may have increased parental tendencies to discriminate against daughters within their smaller families. However, following the introduction of prenatal sex-testing technologies in the 1980s and associated rises in the sex ratio at birth, discrimination against daughters was no longer evident in the sex ratio of early childhood mortality, a finding consistent with the substitution hypothesis. Of course, the level of child mortality has fallen greatly over time, from over 80 per thousand (${}_5q_0$) in the early 1960s to under 16 per thousand around 1990 for both sexes. Thus, the most recent sex ratios of child mortality are based upon very small probabilities of death for each sex, separated by only one death per thousand. Even so, the marked improvement in daughters’ rela-

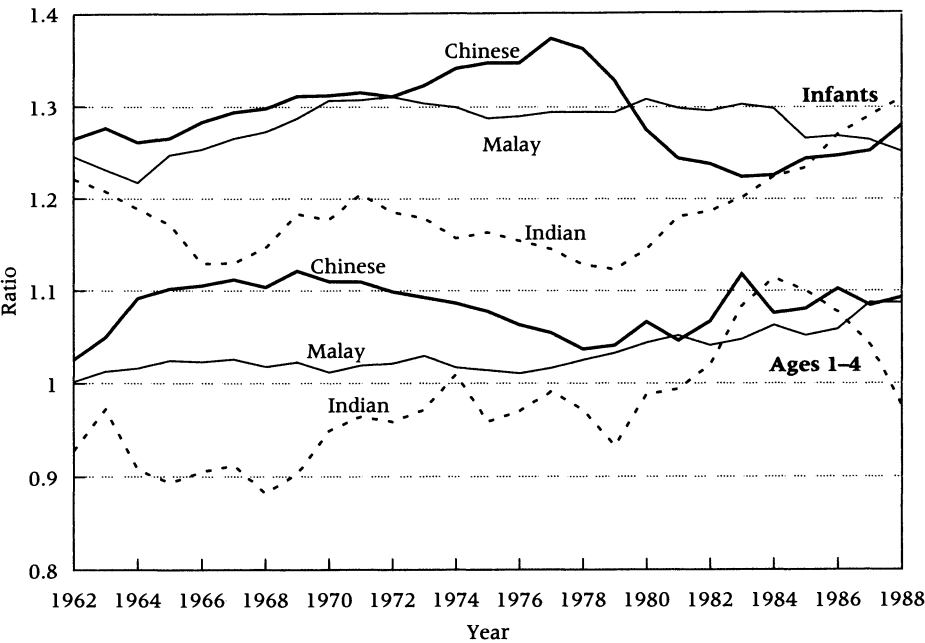
tive survival chances cannot be dismissed simply because child mortality overall has become very low.

In China, one also sees evidence of excess early childhood mortality among females in the 1970s and 1980s. Following the rise of the sex ratio at birth in the 1980s, there was a slight rise in the sex ratio of early childhood death rates (from .90 to .95), which might support the substitution hypothesis, although there was also an apparent *decrease* in the sex ratio of infant death rates (from 1.05 to .86). In fact, the survival probabilities of female infants relative to males have declined since the early 1970s. When these rates are adjusted for underreporting of female deaths, even greater discrimination is indicated (Banister 1992). Thus, the apparent rise in both prenatal and postnatal discrimination in China suggests that sex preference strategies were additive, rather than substitutes for each other. China, however, may well be a special case. The country's one-child policy likely creates, to borrow a term from the family planning literature, an "unmet need" for discrimination against daughters, which parents seek to fulfill with whatever means are at their disposal.⁴

The mortality patterns found in Taiwan are different from those found in Korea and China. Excess Taiwanese female mortality in early childhood was notable in the 1930s and 1950s, but evidently disappeared by the 1970s, even before prenatal testing became widely available. Thus, Taiwan does not fulfill one of the two preconditions necessary for testing the substitution hypothesis. Of course, the fact that sex-selective abortion would now occur in a society *without* concurrent postnatal discrimination raises some important qualifications regarding the substitution hypothesis. Evidently, not all discriminatory practices are equally acceptable and substitutable across time and cultures.

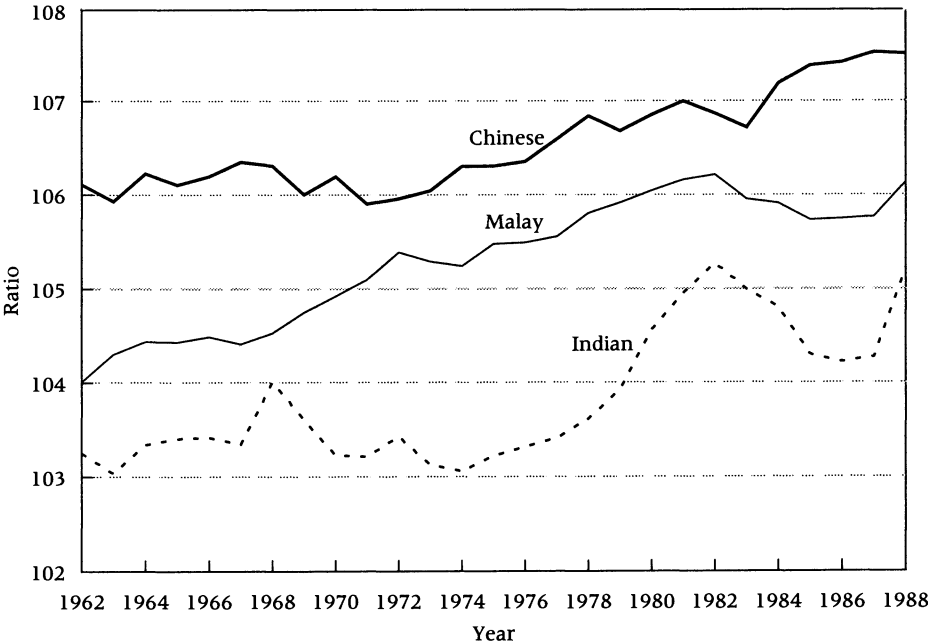
The likelihood that parental sex preference strategies may be culture specific becomes even more apparent in the case of Peninsular Malaysia, where annual birth and death statistics are available for all three major ethnic groups—Malays, Chinese, and Indians. Figures 2 and 3 present five-year moving averages of sex ratios of infant and early childhood death rates as well as sex ratios at birth for each ethnic group between 1960 and 1990 (data on ethnic differentials are not currently available after 1990). Of the three ethnic groups, only Indians evinced discrimination against female infants and young children, a practice common to other South Asian societies (Das Gupta 1987; Muhuri and Preston 1991; Kishor 1993). After the late 1970s, however, the sex ratio at birth among Malaysia's Indians rose steadily from a rather low ratio of 103 to 105—the latter figure within the typical range.⁵ It is unclear to what extent this rise was due to sex-selective abortion; the sex ratio of third and higher-parity births was only about 5 percent higher than for first and second births in 1987.⁶ Whatever caused this rise in the sex ratio at birth among Indian Malaysians, the subsequent

FIGURE 2 Sex ratios of infant and early childhood death rates (m/f) in Peninsular Malaysia by ethnic group: Five-year moving averages, 1960–90



SOURCES: See “Sources for Figures” in References.

FIGURE 3 Sex ratios at birth (number of males per 100 females) in Peninsular Malaysia by ethnic group: Five-year moving averages, 1960–90



SOURCES: See “Sources for Figures” in References.

rise in the sex ratio of infant and early childhood mortality in the mid-1980s suggests a decline in discrimination against daughters consistent with the substitution hypothesis. In this ethnic group, however, there has been a downturn in the sex ratio of early childhood mortality in the late 1980s, a trend more supportive of the additive, rather than substitution, hypothesis (a finding that might be attributable in part to the small number of annual deaths on which the calculation must rely).

Figures 2 and 3 further highlight the conceptual flaws in a literature that has overlooked the interaction between prenatal and postnatal discriminatory strategies. One might expect that the low sex ratio of child death rates among Indians, to the extent that it represents discrimination against daughters, would be mirrored by a high sex ratio at birth. However, the sex ratio at birth among Indians was *lower* than for any other ethnic group, which according to recent literature might suggest the least discrimination. Conversely, Chinese parents evinced no postnatal discrimination against daughters but exhibited consistently *higher* sex ratios at birth from the early 1960s to the present. Such seemingly contradictory findings might be explained by aforementioned deficiencies in these measures as proxies of sex preferences or by actual ethnic differences in the cultural acceptability of prenatal versus postnatal discrimination against daughters. More speculatively, there could be a dynamic connection between the observed sex ratios and the evolution of the relevant cultural values. For instance, if Indian sex ratios at birth indeed tended to be low, postnatal strategies aimed at increasing the proportion of surviving sons could have become more socially acceptable.

In addition to the indicators of discrimination against daughters discussed above, a variety of other indicators can be derived from survey data. These include the sex ratios of last births as well as the likelihood of contraceptive use or the length of birth intervals following a particular distribution of children by sex in a family (e.g. Rahman and DaVanzo 1993). Unfortunately, as in the case of the vital registration-based indicators just examined, such survey-based measures often do not correlate well with each other at the national level (Arnold 1992; Goodkind 1995). Again, their incongruence could be due either to problems in data quality or to the genuine variation across time and cultures in parental strategies for achieving a particular sex distribution of children. The substitution of certain sex preference strategies for others may cause these indicators to move in directions that appear contradictory, but in fact are not. Attempts to draw broad conclusions from single indicators of sex preference, frequently found in the literature, are often misleading. To cite one of many recent instances, Pong (1994) contends that "sex preferences" in Malaysia have been strong among Chinese but much weaker among Indians. This claim rests upon a single measure of sex preference behavior—parity progression ratios based on prior distribution of births by sex. But parental sex preferences regard-

ing the distribution of children by sex also encompass postnatal discrimination; and, as we have just seen, Indian Malaysians prior to the 1980s exhibited far greater discrimination of this type against daughters than did Chinese Malaysians.

Conclusion

Fertility levels have fallen amid growing technological sophistication permitting greater choice for parents regarding the sex of their children. Accordingly, the social, demographic, and moral parameters of sex preference strategies have drawn increasing attention. Measuring the extent to which parents discriminate against daughters (the most common manifestation of sex preferences) in their family formation is, however, difficult. Prior literature has investigated contemporary patterns in prenatal and postnatal strategies of discrimination against daughters but has largely ignored the relationship between these two practices. Yet understanding that relationship is important, since prenatal sex selection that discriminates against female fetuses may entail lessened postnatal discrimination. This note has argued that it is plausible to expect such substitution and has presented empirical evidence providing support for the substitution hypothesis. Although the findings herein are preliminary and require qualifications, they appear weighty enough to call for consideration in future policy deliberations.

This argument should not be construed as a valid excuse for governments to avoid implementing social and economic policies that might reduce all forms of discrimination against daughters. They can and should pursue such policies whenever possible. At the same time, the preferences underlying parental discriminatory practices cannot be changed immediately through government decrees (see also Powledge 1983⁷). To the extent that prenatal and postnatal strategies are substitutable, a ban on the use of prenatal sex testing, if effective, could result in an increase in postnatal parental discrimination against daughters. The increase in early childhood mortality that could occur would be small in absolute terms—indeed, in Confucian Asia fewer than 20 per thousand female newborns currently fail to reach their fifth birthday.

Nevertheless, even if early childhood female mortality in East Asia were to increase by only a small fraction following a ban on prenatal sex testing, that increase should not be ignored. Furthermore, in other regions of the world the potential impact of a such a ban on sex testing could be much greater. In South Asia, for example, upward of 100 per thousand female newborns do not reach their fifth birthday (Makinson 1994), and pronounced postnatal discrimination against daughters is even more extensive than in the East Asian societies examined here. Given that fertility is still declining in many parts of South Asia, future declines in fertility presage an “unmet need” for sons and a corresponding market for prenatal

sex testing and sex-selective abortion (Miller 1981; Luthra 1994). An effectively implemented ban on prenatal sex testing then would require the balancing of difficult moral equations. For instance, if 1000 mothers had to carry pregnancies to term that otherwise would have been aborted after sex testing and ten of the daughters born were to die due to subsequent postnatal neglect, would that be more socially acceptable than 1000 sex-selective abortions? What if only one of the 1000 daughters born was to subsequently die of neglect? Sound public policy concerning prenatal sex testing must take into account the likelihood of such alternative outcomes and weigh their moral acceptability.

Notes

This note evolved over the course of the author's postdoctoral research at the Australian National University between 1992 and 1994. Initial drafts benefited from conversations with Terence Hull, Monica Das Gupta, Ronald Freedman, Cameron Campbell, and participants at the International Symposium on Issues Related to Sex Preferences for Children in the Rapidly Changing Demographic Dynamics in Asia, held in Seoul, Korea, in November 1994, sponsored by UNFPA and the Korean Institute of Health and Social Affairs.

1 By Confucian societies, I mean those that share the common heritage of the Chinese language and the influences of Confucianism, Buddhism, and Taoism. These include Chinese, Japanese, Korean, and Vietnamese societies. Vietnam does not yet have the vital registration data necessary for computing sex ratios at birth, and thus it is not included in Figure 1.

2 According to a recent Taiwanese survey, 83 women out of 11,789 surveyed, about 0.8 percent, indicated having had a prenatal test prior to a birth, stillbirth, or miscarriage (Chang 1994).

3 These figures reflect my adjustments after accounting for relative underreporting of female sex-selective abortions. The overall figure might be higher if absolute underreporting were taken into account (Goodkind 1995).

4 As Banister (1992) indicated, male and female infant mortality measures from China are suspect. Estimates of time trends in sex ratios of infant death rates in China have varied

so widely in various censuses and surveys that inferences must be made with great caution (compare Hull 1990: Table 7 with Johansson and Nygren 1991: Figures 10 and 11), especially given incentives for misreporting under China's restrictive population policies.

5 To determine the effect of aforementioned biological changes on spontaneous changes in the sex ratio at birth, I calculated the sex ratio of all deliveries (i.e., live births and stillbirths). The sex ratio at birth calculated on this basis still exhibited a rise among Chinese and Indians, but became flat for Malaysians (not shown).

6 There was, however, an even sharper rise in the sex ratio at birth among Indians in neighboring Singapore, from below 103 to above 110 over the same time interval, which suggests the likely use of prenatal sex selection there.

7 As Powledge (1983) mentioned, we should note that other technological advances may mitigate the necessity of sex-selective abortion in the future. Beernink, Dmowski, and Ericsson (1993), for instance, report a study of 1,407 births in the United States and elsewhere in which parents tried to use albumin sperm separation techniques to conceive a child of a particular sex. The success rate varied from 69 to 76 percent, depending on whether a son or daughter was desired and on the procedure performed. Although these results indicate some degree of success, the procedures are clearly far from foolproof.

References

- Anderson, Barbara A. and Brian D. Silver. 1995. "Ethnic differences in fertility and sex ratios at birth in China: Evidence from Xinjiang," *Population Studies* 49: 211–226.
- Arnold, Fred. 1992. "Sex preference and its demographic and health implications," *International Family Planning Perspectives* 18: 93–101.
- Banister, Judith. 1992. "Implications and quality of China's 1990 census data," paper presented at the International Seminar on China's 1990 Population Census. Beijing, October.
- Beernink, F. J., W. P. Dmowski, and R. J. Ericsson. 1993. "Sex preselection through albumin separation of sperm," *Fertility and Sterility* 59: 382–386.
- Bennett, Neil G. (ed.) 1983. *Sex Selection of Children*. New York: Academic Press.
- Brambati, Bruno. 1992. "Prenatal genetic diagnosis through chorionic villus sampling," in Aubrey Milunsky (ed.), *Genetic Disorders and the Fetus: Diagnosis, Prevention, and Treatment*. Baltimore: Johns Hopkins University Press.
- Chang, Ming-Cheng. 1994. "Son preference and sex ratio in Taiwan," paper presented at the International Symposium on Issues Related to Sex Preference for Children in the Rapidly Changing Demographic Dynamics in Asia, sponsored by the United Nations Population Fund and Korean Institute of Health and Social Affairs, Seoul, 21–24 November (conference volume forthcoming).
- Choe, Minja Kim. 1987. "Sex differentials in infant and child mortality in Korea," *Social Biology* 34: 12–25.
- Cleland, John, Jane Verrall, and Martin Vaessen. 1983. "Preferences for the sex of children and their influence on reproductive behavior," *World Fertility Survey Comparative Studies: Cross National Summaries* No. 27. Voorburg, Netherlands: International Statistical Institute.
- Coale, Ansley J. and Judith Banister. 1994. "Four decades of missing females in China," *Demography* 31: 459–480.
- Cohen, Susan A. and Cory L. Richards. 1994. "The Cairo consensus: Population, development, and women," *International Family Planning Perspectives* 20, no. 4: 150–155.
- Das Gupta, Monica. 1987. "Selective discrimination against female children in rural Punjab, India," *Population and Development Review* 13: 77–101.
- D'Souza, Stan. 1978. *Sex Biases in National Data Systems*. New York: United Nations Statistical Office.
- Goodkind, Daniel. 1995. "Abnormal sex ratios at birth in Confucian Asia: A summary of interpretive puzzles," unpublished paper.
- Gu, Bao-Chang and Krishna Roy. 1995. "Sex ratio at birth in China with reference to other areas of East Asia: What we know," *Asia-Pacific Population Journal* 10, no. 3: 17–42.
- Hanley, Susan B. and Kozo Yamamura. 1977. *Economic and Demographic Change in Pre-Industrial Japan, 1600–1868*. Princeton: Princeton University Press.
- Hassold, T., S. D. Quillen, and J. A. Yamane. 1983. "Sex ratio in spontaneous abortions," *Annals of Human Genetics* 47: 39–47.
- Hausfater, Glenn and Sarah Blaffer Hrdy (eds.). 1984. *Infanticide: Comparative and Evolutionary Perspectives*. New York: Aldine.
- Hill, Kenneth and Dawn M. Upchurch. 1995. "Gender differences in child health: Evidence from Demographic and Health Surveys," *Population and Development Review* 21: 127–151.
- Hong, Moon Sik. 1994. "Boy preference and imbalance in sex ratio in Korea," paper presented at the International Symposium on Issues Related to Sex Preference for Children in the Rapidly Changing Demographic Dynamics in Asia," sponsored by the United Nations Population Fund and Korean Institute of Health and Social Affairs, Seoul, 21–24 November (conference volume forthcoming).
- Hull, Terence H. 1990. "Recent trends in sex ratios at birth in China," *Population and Development Review* 16: 63–83.
- Johansson, Sten and Ola Nygren. 1991. "The missing girls of China: A new demographic account," *Population and Development Review* 17: 35–51.

- Kishor, Sunita. 1993. "‘May God give sons to all’: Gender and child mortality in India," *American Sociological Review* 58: 247–265.
- Lee, H. T. 1982. *Causes of Son Preference in Korea: A Socio-demographic Analysis*. Research Report to the World Health Organization.
- Lee, James, Wang Feng, and Cameron Campbell. 1994. "Infant and child mortality among the Qing nobility: Implications for two types of positive checks," *Population Studies* 47: 395–412.
- Leung, Siu F. 1988. "On the test of sex preference," *Journal of Population Economics* 1: 95–114.
- Luthra, Rahmi. 1994. "A case of problematic diffusion: The use of sex determination techniques in India," *Knowledge—An Interdisciplinary Social Science Journal* 15, no. 3: 259–273.
- Makinson, Carolyn. 1994. "Discrimination against the female child," *International Journal of Gynecology and Obstetrics* 46: 119–125.
- McClelland, Gary H. 1983. "Measuring sex preferences and their effect on fertility," in Bennett 1983: 13–46.
- Miller, Barbara D. 1981. *The Endangered Sex: Neglect of Female Children in Rural North India*. Ithaca: Cornell University Press.
- Muhuri, Pradipt K. and Samuel H. Preston. 1991. "Effects of family composition on mortality differentials by sex among children in Matlab, Bangladesh," *Population and Development Review* 17: 415–434.
- 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," *Population and Development Review* 21: 59–84.
- Pong, Suet-Ling. 1994. "Sex preference and fertility in Peninsular Malaysia," *Studies in Family Planning* 25: 137–148.
- Powledge, Tabatha. 1983. "Towards a moral policy for sex choice," in Bennett 1983: 201–212.
- Rahman, Mizanur and Julie DaVanzo. 1993. "Gender preference and birthspacing in Matlab, Bangladesh," *Demography* 30: 315–332.
- Scrimshaw, Susan C. M. 1978. "Infant mortality and behavior in the regulation of family size," *Population and Development Review* 4: 383–403.
- . 1984. "Infanticide in human populations: Societal and individual concerns," in Hausfater and Hrdy 1984: 439–462.
- United Nations. 1982. *Unabridged Model Life Tables Corresponding to the New UN Model Life Tables for Developing Countries*. New York.
- . 1994. *Report of the International Conference on Population and Development*, A/CONF. 171/13, 18 October.
- Waldron, Ingrid. 1987. "Patterns and causes of excess female mortality among children in developing countries," *World Health Statistics Quarterly* 40, no. 3: 194–210.
- Williamson, Nancy E. 1976. *Sons or Daughters: A Cross-Cultural Survey of Parental Preferences*. Beverly Hills: Sage.
- Yang, Li-Shou. 1995. "Social change and preferences for gender of children among women in Taiwan," unpublished doctoral thesis, University of Michigan.
- Zeng Yi et al. 1993. "Causes and implications of the recent increase in the sex ratio at birth in China," *Population and Development Review* 19: 283–302.

Sources for figures

China

Sources reported in Gu and Roy (1995) for 1988–92; Zeng et al. (1993) for 1982–87; and Johansson and Nygren (1991) for 1970–81.

Hong Kong

Hong Kong Monthly Digest of Statistics, 1970–92. Census and Statistics Department, Hong Kong.

Japan

Vital Statistics, 1970–92. Statistics and Information Department, Minister's Secretariat, Ministry of Health and Welfare.

Korea

Vital Statistics Report, 1993. National Statistics Office, Seoul (in Korean).

Malaysia

Vital Statistics, 1960–90. Peninsular Malaysia, Department of Statistics, Kuala Lumpur.

Singapore

Report on the Registration of Births, Deaths, and Marriages, 1970–92. Republic of Singapore.

Taiwan

Taiwan-Fukien Demographic Factbook, 1964–92. Republic of China, Ministry of the Interior.