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Son preference, female demographic deficit and Singapore's fertility transition

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Introduction

Over the past two decades or so, demographers have noted worrying trends in the sex ratio at birth in some of the most populous countries in Asia, most notably India, China and the Republic of Korea. Increasing numbers of male births relative to female births have prompted discussions of 'missing' women or girls (Sen 1992, 2003; Croll 2000). Despite the different cultural contexts in which this phenomenon has been identified, there is some measure of agreement that fertility decline and strong son preference have commonly combined to provide the major impetus for sex selection (Li *et al.* 2000). Thus female demographic deficit is associated with discrimination in favour of boys through such practices as sex-selective abortion, infanticide and neglect leading to excessive female foetal, infant and child mortality (Croll 2002).

Unsurprisingly given its small population size (4.02 million at the last census in 2000), Singapore has rarely featured in these discussions. Yet the rapid decline in fertility since independence in 1965 and the dominance of the Chinese in the ethnic composition of the resident population (76.8 percent in 2000) suggest that Singapore too may have experienced an increasing imbalance in sex ratios at birth. Indeed Goodkind (1996) cites the Chinese in Singapore as having ratios above the normal range in the early 1980s. And Wongboonsin and Ruffolo (1995:53) identified Singapore among the South-East Asian countries where people follow "(t)he general Oriental pattern of a preference for sons". In the latter study, the authors placed Singapore with Malaysia and Viet Nam, a group of countries showing trends towards 'boy bias', which they contrasted with a second group comprising Indonesia, the Philippines and Thailand where no sex bias was apparent. However, they did not base this conclusion on a detailed examination of sex ratios at birth in Singapore. Although there is ample evidence that son preference has been, and possibly remains, deeply ingrained in Singaporean culture, whether or not this has resulted in the growing female demographic deficit apparent in other countries of the region requires further investigation.

In this paper, I examine recent demographic trends in Singapore within three time periods defined by the trend in total fertility rates: (1) the fertility transition, a period of rapid fertility decline between 1965 and 1986; (2) the temporary fertility revival, a short-lived increase in fertility from 1986 to 1993; and (3) the resumption of fertility decline from 1993 to the end of the study period in 2000. My primary research question is whether the secular fertility decline in post-independence Singapore was accompanied by the intensification of active discrimination against daughters, leading to the significant female demographic deficit seen in other countries in Asia. The analysis focuses on the detail of trends in the sex ratio at birth, or secondary sex ratio, and their interpretation.

Pre-conditions for bias in sex ratios at birth

The two main pre-conditions – rapid fertility decline and strong son preference – found to be the catalysts of female demographic deficits in the populations of, for example, China and the Republic of Korea were also present in Singapore in the 1960s and 1970s. The total fertility rate fell from 4.7 births per woman in 1965 to below replacement level by 1977, then to an historic low of 1.4 in 1986 (Drakakis-Smith and Graham 1996). The government maintained a strongly anti-natalist “stop at two” policy during this period, and the Abortion Act of 1974 meant that women were able to terminate unwanted pregnancies on request and this created at least the potential for sex-selection prior to birth.

By the early 1980s, Singapore's anti-natalist policies had become a victim of their own success (Anderson 2004) and were replaced by a cautious, but ambitious, pro-natalism with a new slogan: “Have three or more if you can afford it”. The government offered new incentives to women to start reproduction earlier and to shorten birth intervals in the hope of increasing the population by 40 per cent over 25 years (Palen 1986). Women contemplating a termination were now required to go for counselling first. However, the new population policy has proved far less effective than its anti-natalist predecessor and after a modest rise in the late 1980s, fertility appears to have resumed a long-term decline. In 2002, the total fertility rate reached another historic low of 1.37, significantly below generational replacement level.

Figure 1 illustrates the fertility trend in Singapore between 1970 and 2002 in relation to the population policies in force over that period. Of particular note is the sharp decline in the period up to 1986 and the more gradual decline from the early 1990s onwards.

At the same time, a preference for sons appears to have been strong in Singapore society. There is a considerable body of evidence on the patriarchal nature of the Chinese family (Pyle 1997), as well as on the gendered nature of state discourses (Heng and Devan 1995; Yeoh and Willis 1999; Kong and Chan 2000). As Lee (1998) has pointed out, Chinese women were not seen as equals to Chinese men in Singapore, and the traditional female subservience still prevails. In the realm of family reproduction, the Confucian ideal of obedience gave sons a special responsibility for the welfare of their parents later in life and for continuing the family line (Graham *et al.* 2002).

Croll (2000) used ethnographic evidence to good effect in her discussion of endangered daughters, as did Murphy (2003) in her work on rural China. There are multiple and complex resonances between the voices of Chinese women they quote and the voices of Chinese Singaporean women in a recent study conducted by myself and colleagues at the National University of Singapore. Our study involved in-depth interviews, carried out during 2001 and 2002, with 21 well-educated married women of child-bearing age, their husbands and their mothers and/or mothers-in-law (Graham *et al.* 2002). The older women (the grandparent generation) had their own children prior to 1984, mostly in the period of dramatic fertility decline when government policies encouraged much smaller family sizes. The younger women (the parent generation) began their childbearing in 1990 and a few had not had children by the time of the interviews. All, however, entered their main childbearing years in a very different policy context to their older relatives. As women who had achieved higher educational qualifications, they were and are an important target group for the government's pro-natalist incentives (see Figure 1).

The themes that emerge from the life stories of the grandparent generation demonstrate the multiple ways in which son preference impinged on their lived experiences. Speaking of the birth of their own children, these women gave voice to the different values attached to the birth of a son and the birth of a daughter. Most had limited the size of their family in line with the official anti-natalist message of the time but the perceived need for a son sometimes overrode the desire for a small(er) family, a phenomenon identified in many parts of Asia. Interestingly these women saw the need for a son as a response to pressure from other family members, from which they distanced themselves to varying degrees. This is illustrated by one woman who had her first child, a son, in 1965:

My ideal was to have a boy as my first child. Later on, if I were to have girls, I didn't have to be bothered. I wouldn't have to be worried because during our time, for the older folk, they preferred the boys, particularly because ...[my husband] is a Hokkien. He likes boys.

Another woman, who gave birth to two daughters in the early 1970s, recalled the reaction of her mother-in-law to the birth of her third child, a son:

[She was] very happy. She treated me well. Waited on me like I was an emperor. During the confinement I did not have to do anything. She will bring everything into the room for me. When I gave birth to [second daughter] she did not even come into the room. She was from China, my mother-in-law came from China. ...My own mother should not have been like that because big family, many people so do not have this sort of thing.

The association between smaller family size and what Li *et al.* (2000) called *sex-selection pressure* is evident. These authors also noted the variability in *son-preference potency* (the probability that a woman has a sex-selected son) in their pioneering work on modelling China's demographic future. Thus son-preference potency may be interpreted as the product of motivation (sex-selection pressure) and opportunity (the ability to practice gender discrimination). In Singapore, it appears, there was sex-selection pressure. If women had the opportunity to practice gender discrimination around birth, then, as fertility declined, we could expect to see an increasing imbalance in favour of males in sex ratios at birth.

Sex ratios at birth during the fertility transition

Official data from the vital registration allows the reconstruction of sex ratios at birth for the resident population as a whole and for each of the main ethnic groups. Figure 2 presents the results in graphic form for the period 1965 to 2000. Given the small numbers involved for the ethnic minority groups, and the possibility of stochastic variation, I have used the 3 year moving mean to reveal the temporal trend. The expected increase in sex ratios at birth up to the early 1980s is confirmed as national rates rose from around 105 male births per 100 female births in 1966 to over 108 male births per 100 female births by 1983. Moreover, for births to Chinese fathers, sex ratios were above the national average for most of this period, reaching levels of over 109 male births per 100 female births in the early 1980s. It would seem that, for the national population, son-preference potency intensified towards the end of the period of rapid fertility decline.

More surprising, perhaps, is the earlier, and apparently more dramatic, response of the Malay population to reducing family size. In the late 1960s, their total fertility rate was around 4 births per woman, higher than that of the Chinese. It then fell precipitously to below replacement level in the mid-1970s, shadowed by an equally marked increase in the proportion of male births from a low of 102 per 100 females in 1965 to a high of over 110 per 100 females by 1976 (Figure 3). The small number of annually recorded births to Malay fathers (5,470 in 1976) suggests that ratios may be subject to random variation. However, it can be noted that the increasingly masculine sex ratios at birth revealed by the official data pre-date the general availability of reliable technologies for sex identification in early pregnancy that have been implicated in many explanations of later aberrant sex ratios at birth in Asia (Hull 1990; Park and Cho 1995; Gu and Roy 1995; Ganatra *et al.* 2001). As one of the older women in our ethnographic study commented in relation to the births of her own children in the early 1970s, "If it's a boy, then boy. Or girl. There was no such thing as ultrasound then".

For the presumed tension between an emerging small family norm and preferred family sex composition to impact on aggregate sex ratios at birth, a mechanism is required that allows parents to exercise their preferences. There was an intensification of male bias in sex ratios at birth during the period of fertility transition in Singapore. Nevertheless, before we assume this to be evidence for active discrimination against daughters, we need to look more closely at the opportunities for putting motivation into practice and at the alternative, or additional, possibility of a non-motivational explanation for this increasing bias in favour of males.

The implications of sex ratio imbalances

The received wisdom from the growing demographic literature on the subject is that, before the spread of foetal sex-identification technologies in the early 1980s, increasingly masculine sex ratios at birth must be associated more with the under-registration, neglect or infanticide of infant daughters than with pre-birth selective abortion (Goodkind 1996). In the context of the well-ordered bureaucracy of Singapore and the absence of any disincentives for reporting female births as in China, the first of these seems unlikely. Whether the practice of infanticide or selective abortion can be inferred from trends in secondary sex ratios is a moot point, although it is common practice in the demographic literature. Sex ratios at birth of 116.9 in the Republic of Korea and 114.7 in China in 1990 (Gu and Roy 1995) have been confidently interpreted as revealing the persistence of preference for sons over daughters and the opportunity for parents to practice gender discrimination. In Singapore, however, national rates have never exceeded 110 males per 100 females and have fluctuated mainly within a relatively narrow range between 105 and 109, with a high of 109.4 in the individual year 1982.

It is widely accepted that sex ratios at birth in any large population show an excess of males over females and vary within a range assumed to be biologically 'normal'. The certainty with which gender discrimination can be inferred from the statistical trend alone must therefore depend on the extent to which actual ratios deviate from this 'normal' range. Hull (1990) takes 106 males per 100 females as a reference point for normality and Johannson and Nygren (1991) suggest a narrow range of between 105 and 106 as normal, whereas others prefer a wider band of between 104 and 107 (Lai 2005). The latter corresponds roughly to the range found in Europe and North America where gender discrimination is considered to be minimal. Rates marginally above 107 may be taken as suggestive of the effects of son preference but

they are not conclusive since the biological basis of sex ratio variation is as yet poorly understood (Wells 2000). The difficulties of deriving a secure standard against which "excess" female mortality might be judged were discussed by Hill and Upchurch (1995: 129) in their study of child mortality who comment, "It is impossible to be sure that gender-specific discrimination is entirely absent from any population". Equally, in the absence of supporting contextual evidence, it is impossible to be sure that sex ratios at birth slightly above the conventional limit of 'normality' reveal active discrimination against daughters.

If we assume that rates above 108 male births for every 100 female births are more likely to be indicative of widespread daughter discrimination, then there are only four years in the early 1980s when the national sex ratio at birth in Singapore exceeded that level, although the ratio for the Chinese population shows a slightly more sustained imbalance. The margin of doubt is such that supporting evidence is needed before these apparently abnormal sex ratios can be confidently interpreted. Two questions thus arise. First, is there evidence of opportunity, as well as motivation, which could have resulted in an intensification of son-preference potency at this time? Secondly, is there a competing biological mechanism that might explain the 'abnormal' ratios?

By 1980, the total fertility rate had fallen to 1.74 births per woman, an historic low plausibly contributing to a heightening in sex-selection pressure. Abortion was available on demand from the mid-1970s, and the abortion ratio increased rapidly to reach over 40 percent of live births in the early 1980s (Figure 4). The corresponding peaks in the male-to-female ratio at birth must be recognised as a continuation of a trend recorded over the previous decade, but their timing may be significant. The introduction of new medical technologies would have provided at least the possibility of foetal sex-identification and it is likely that, as sex-selection pressure intensified, some women would have taken advantage of the opportunity and undergone a sex-selective abortion. Yet, in the absence of clinical evidence on sex-selective abortion, there are reasons to doubt that selective foeticide was the sole, or even perhaps the main, explanation of the excess of male births beyond the 'normal' range.

Although the abortion ratio rose to very high levels over the period of the fertility transition, there is no indication of a step change at the time when reliable methods of foetal sex-identification became available, suggesting that it was responding more to general anti-natal pressures than to sex-selection pressure. Moreover, by 1980 the trend towards greater masculinity in sex ratios at birth was already well established. Thus there may have been an underlying biological cause not directly connected to gender preferences. Goodkind (1996) noted that the force of biological factors can change over the course of development. The 1970s was a decade of unprecedented economic growth in Singapore and living standards improved significantly. Infant mortality rates fell by over 48% for males and 38% for females, narrowing the gender gap (Figure 4). Data on the sex of stillbirths are not generally available but improvements in maternal nutrition, for example, may have disproportionately advantaged male foetuses and contributed to rises in secondary sex ratios (Waldron 1998). In a recent study of trends in sex ratios at birth in India, Jayaraj and Subramanian (2004) demonstrated that an intensification of imbalance in sex ratios at birth can result from a gender-neutral reduction in overall foetal wastage since the primary sex ratio is assumed to be around 130 males per 100 females. This they linked to enhancements in women's wellbeing and it is possible that better maternal health also contributed to the relatively greater improvement in male, compared to female, survival in the first year of life in Singapore. The relationship between trends in male infant mortality and sex ratios at birth in the same time interval provides some indirect support for this possibility in Singapore. However, data that would

allow us to estimate the contribution of better male survival between conception and birth to increases in the secondary sex ratio are not available.

It seems likely that a number of factors combined to produce the unbalanced sex ratios at birth of the early 1980s. Sex-selective abortion may well have been one of them but, if so, the significant downward trend in sex ratios at birth after 1983 is all the more surprising. If son preference was motivating discrimination against daughters prior to birth and new technologies were providing the opportunity for selective abortions, then either motivation or opportunity, or both, must have changed significantly in a relatively short space of time.

The temporary fertility revival: a return to 'normality'?

Whatever the causes of the rising proportion of male births in recorded live births during the period of rapid fertility decline in Singapore, the trend after 1983 was quite different to that experienced in other countries in the region. At the national level fertility remained below replacement level yet sex ratios at birth also declined, at least initially, to levels within the normal range, reaching a low of 106.4 males per 100 females by 1990. In the same period equivalent ratios exceeded 114 males per 100 females in both China and the Republic of Korea (Gu and Roy 1995). This comparison is, however, misleading as ratios vary geographically within these large populations and lower ratios in urban areas are common (Das Gupta *et al.* 2003). A more appropriate comparison is between the city-state and other more prosperous urbanised populations in the region. Figure 5 compares sex ratios at birth for Singapore with those for the provinces of Beijing and Shanghai, and Taiwan. Although the excess of male births over female births in Singapore in 1981 and 1990 was greater than that for the other three populations, it was lower than comparable figures for Taiwan in 1990. Most strikingly, the extraordinary increase in female deficit between 1990 and 2000 evident in the case of Beijing and Shanghai is absent in Singapore. We know that Singapore's total fertility rate continued to decline into the new millennium yet it appears that the effect on sex ratios at birth was small relative to that for the urbanised populations of China.

The emergence of such a dramatic increase in male excess at birth in Beijing and Shanghai provinces is most plausibly related to the use of sex-determination technologies prior to higher order births and the selective abortion of female foetuses, especially after a woman has given birth to one or two daughters. In China and Korea greater imbalance in favour of boys has been found for third and higher order births relative to first and second births (Park and Cho 1995). Gender-specific data on live births by parity is not released for Singapore and, to my knowledge, there are no sample studies based on primary data collection. However, in 1995 the *Statistics Singapore Newsletter* published an analysis of sex ratio by birth order that compared ratios for Singapore with those for China and South Korea between 1982 and 1993 (Koh 1995). The data used in the article are reproduced in Figure 6 and support the author's conclusion that, in contrast to China and South Korea, Singapore does not appear to have widespread gender-specific birth control. Thus he was able to claim that population projections for the year 2010 indicated that the sex ratio would be within the biological range.

There are a number of factors that could explain the relative lack of daughter discrimination at higher birth orders in Singapore during this time period. The first, and possibly most influential, factor is the policy context. Pro-natalism began to replace anti-natalism in government thinking from 1983, heralding the introduction of new population policies in 1987, which encouraged the better off to have larger families (Graham 1995). Despite the

failure of these policies to produce a sustained increase in fertility, they created a climate in which families of three or four children were no longer seen as a threat to economic progress. This is in stark contrast to the highly negative connotations associated with “illegal births” at higher parities in China (Hemminki *et al.* 2005) where the main reason for defying the strong anti-natalist policies is to produce a son. This pre-selection of couples going on to have higher order births does not seem to have been present in Singapore, or at least not to the same degree. However, as others have pointed out (Coale and Banister 1994), female deficit at birth in the South Korean population showed an increase similar to that in China but there was no one child policy to blame. Nevertheless, and again in contrast to Singapore, negative views of higher order births associated with poverty at the family level and lack of economic progress at the national level may have been prevalent. If the strength of the impact on secondary sex ratios in South Korea is surprising, as well as disturbing, the apparent absence of an equivalent impact in Singapore cannot, I think, be explained by the more favourable policy context alone.

The second factor relates to the role of the state in Singapore. Strong government control over many aspects of life in the city-state has been credited with the country's economic success and development. The power of the central bureaucracy over the lives of Singaporeans extends to the attempted micro-management of fertility for the common good. It is clear from the article mentioned above (Koh 1995) that the Ministry of Health was well aware of the threat posed by imbalances in the sex ratio at birth to future marriage patterns. In 1987, the abortion regulations were amended to introduce mandatory counselling prior to and following a termination, as well as a requirement that, save in exceptional circumstances, a pregnant woman must wait forty-eight hours after receiving counselling before she can give consent. This tightened control over the process of abortion and may have reduced the scope for sex-selective intervention. It is impossible to estimate the influence of such indirect government control on sex ratios at birth but the abortion ratio has declined steadily, if not dramatically, since the introduction of compulsory counselling.

The third factor to consider is the strength of son preference among couples in Singapore during the 1980s and 1990s. If this had diminished over time, then it may explain some of the difference between sex ratios at birth in Singapore and those in China and South Korea. For Singapore, there is little direct evidence on which to base any analysis. The results of the Fifth National Family Planning and Population Survey in 1992 recorded 31 per cent of married women aged 15-44 years as having no preference for either sons or daughters (Koh 1995), suggesting that the majority still preferred sons. Our own ethnographic research among well-educated Chinese Singaporeans of the parent generation pointed to a variety of gender preferences in family composition, from ‘one of each’ to a tendency for wives to prefer daughters and husbands to prefer sons. However, two characteristics of the thinking of the younger generation were notable (Graham *et al.* 2002). First, the wishes of the grandparent generation for a grandson were recognised but tended to be marginalised as ‘traditional’. Couples viewed fertility decisions as matters to be settled between themselves and claimed not to be influenced by either the expectations of their elders or government policies. Secondly, economic and practical considerations meant that small family sizes were favoured over continuing the family name by providing a male heir. The narratives of some of the younger women from our ethnographic work illustrate their thinking. One mother, with two daughters born in the early 1990s, explained,

I don't have [a gender preference] but that time my husband said that he hoped to have a son lah. Be it the first one or the second one, he hoped to have one. .. But, um, you know that they prefer but if there isn't any, they are not old-fashioned thinking in that sense that they must keep on trying, in that sense lah. But myself I do not have a preference.

Another mother, whose first child is a daughter and whose second child was born in 2000, declared her disappointment that it was a boy!

I had her [her daughter] and when I was going to have the second one, I was hoping and hoping it will be a girl... Maybe I thought because it is more economical. Her clothes will go on to the second one. I don't have to spend money all over again. So that was the idea but after some time when I realised that it's actually a boy. I got used to the idea okay, it's a girl and a boy. I don't know why. Again I guess it's because of my background. Two boys in a family, enough. I want a girl. I prefer girls. Girls are closer to their mums I guess.

This ethnographic evidence hints at a considerably greater flexibility in the kinship system amongst Chinese Singaporeans compared to patterns found in China and South Korea (Das Gupta 2003), although the extent to which these 'non-traditional' attitudes are common across the Singaporean population is unknown. However, it may be that significant increases in female participation in higher education and salaried employment in the last decade have contributed to a diminution in son preference in some groups, as reflected in our group of well-educated women. The limited evidence supports this conclusion but births to university-educated mothers, for example, comprised just over 18 per cent of all live births in 2000. Unless attitudes in other groups have also changed, the overall diminution of sex-selection pressure could be small.

The resumption of fertility decline and the puzzle of rising sex ratios at birth

After a period of decline in the decade between 1983 and 1993, sex ratios at birth began to climb again to a level above the 'normal' range. This is a particular puzzle in that it appears to undermine the hypothesis that a weakening of son preference explains the previous decline. All the available evidence points to an improvement in the status of women compared with a decade before, which in turn leads to the expectation that daughters would become more valued. A similar paradox is apparent if Fong's (2002) optimistic analysis of the impact of China's one-child policy on the empowerment of urban daughters is contrasted with the increasingly masculine sex ratios at birth in the provinces of Beijing and Shanghai.

Singaporean women are better educated and more likely to be employed outside the home than they were ten years ago. Female labour force participation rates for 25 to 29 year olds rose from 75.6 percent in 1991 to 84.5 percent in 2001. More females than males now attend institutions of higher education and the sex ratio of university graduates fell from 95.9 males per 100 females in 1996 to 92.4 males per 100 females in 2001. The total fertility rate also fell to a new low. Croll (2002: 17) concluded from her survey of the demographic literature that "the phenomenon of "missing girls" occurs alongside economic development and the improved status of women and is more likely to be correlated with declining fertility than any other common factor." Singapore is more urbanised and economically prosperous than most

other countries in the region. Nevertheless, there is a temporal coincidence between the trends in sex ratios at birth and fertility rates, even to the extent that a short-term rise in the latter was negatively mirrored in a declining male excess at birth in the late 1980s. The explanation of this coincidence is less easy to identify. If sex-selective abortion is the main mechanism producing abnormal gender imbalances at birth then we are forced to accept the perhaps implausible conclusion that the rate of sex-selective abortions *increased* over the 1990s, at a time when the government was vigorously promoting its *pro*-natalist message.

In 2000, the sex ratio at birth peaked at 108.99 males per 100 females, slightly below the level recorded in 1982 but above the 'normal' range. It is difficult to formulate a satisfactory hypothesis that might explain this return to aberrant male excess at birth. Although the opportunity for pre-natal sex-determination may have increased over time, the number of abortions performed annually has continued to decrease and there is no direct evidence of sex-selective foeticide. In one study of a sample of women who had their pregnancies terminated, the reasons given were predominantly socio-economic (Singh *et al.* 2002) but the reporting form does not list son preference among possible reasons. Establishing any increase in the motivation of pregnant women to seek sex-identification of the foetus and then to choose to abort daughters is equally problematic.

The alternative to accepting a motivational explanation involving an increase in son-preference potency is to look for a biologically-based explanation of recent trends. As Goodkind (1996) warned, sex ratios at birth may not always be good proxies for discrimination against daughters. However, the biological causes that plausibly contributed to sex ratio imbalances during the period of rapid fertility transition are less likely to be part of the explanation of more recent imbalances. Infant mortality rates for males and females were already low when the sex ratio at birth exceeded 107 in 1995, being 4.6 and 3.3 per 1,000 respectively. Male infant mortality did improve disproportionately over the next five years, but the scope for a markedly differential improvement in the survival of male foetuses was probably limited. Nevertheless, a less sinister explanation than that of sex-selective abortion should not be rejected out of hand. In a study of human sex ratio variation, Martin (1994) found that rates of coital frequency can impact on sex ratios at birth, with greater frequency being associated with higher male excess at birth. He admits that the basis of this connection remains obscure but argues that variation produces more variation in a process that may generate systematic historic oscillations in a population's age/sex structure even when vital rates are stable. For Singapore, whether or not changes in coital frequency have contributed to the recent rise in sex ratios at birth either directly or indirectly, through their impact in the past, is unknown. In the absence of a convincing alternative, however, this is a hypothesis that merits further research.

Conclusion

The period of rapid decline in fertility in post-independence Singapore saw the emergence of sex ratios at birth that increasingly favoured males over females and that has been interpreted as evidence for active discrimination against daughters in other more populous countries of the region. Son preference appears to have been prevalent at least among the majority Chinese population and the liberalisation of abortion laws, coupled with the availability of medical technologies that allowed sex-identification in early pregnancy, may have added opportunity to motivation resulting in an increase in sex-selective abortion. The alternative, or perhaps additional, explanation is that improvements in male foetal survival resulted in an

increasingly masculine sex ratio at birth. In any event, abnormal sex ratios prevailed only for a short period of time and at a level not far above the conventional range of normality. In the absence of clinical evidence on the gender of deliberately and spontaneously aborted foetuses, the relative contributions of human intervention and biological process must remain uncertain.

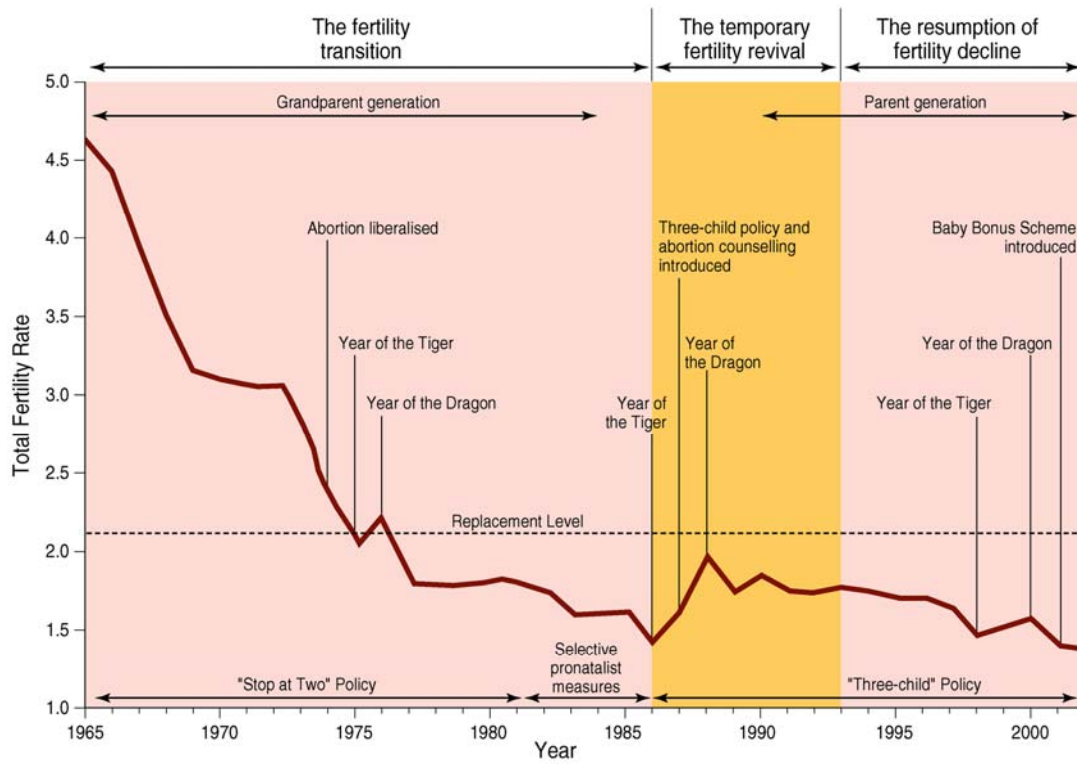
Across the whole time period of this study, a period from 1965 to 2000 when the total fertility rate more than halved, the mean sex ratio at birth in Singapore was 107.58 males per 100 females. This indicates that, in general, fertility decline was not accompanied by an abnormal increase in the proportion of males at birth. In addition, the infant mortality rate for males has improved more than that for females. Thus the sustained bias in sex ratios prevalent in other Asian countries is absent in Singapore and the city state is not currently facing the social problems thought to arise from a significant female demographic deficit and predicted for China and South Korea (Park and Cho 1995). It might be concluded that economic development and changing social attitudes have operated effectively to reduce sex-selection pressure. However, a closer examination of trends in sex ratios at birth and other demographic rates has revealed a more complex story in which short-term fluctuations in the secondary sex ratio closely follow those in fertility. A decline in fertility was associated with an increase in male excess at birth and *vice versa*. This is consistent with the alternative hypotheses that sex-selection pressure intensified as family size declined and parents responded by selectively aborting female foetuses. Yet this too is not entirely convincing since male prevalence at birth exceeded the 'normal' biological range only in selected years. The possibility that biological mechanisms, rather than individual motivation and opportunity, explain these fluctuations requires further investigation. There is no evidence in the demographic record that Singaporeans neglected daughters after birth but the question of whether or not the secular fertility decline in post-independence Singapore was accompanied by the intensification of deliberate pre-natal discrimination against daughters remains unresolved.

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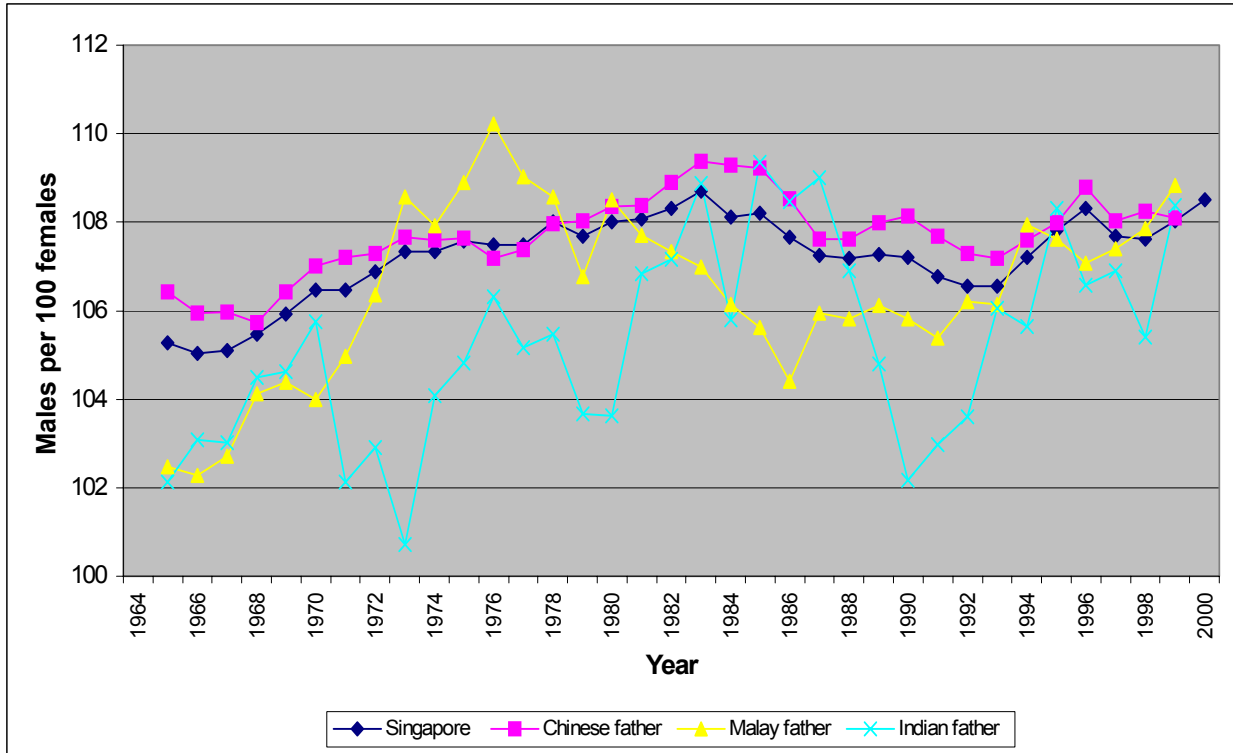
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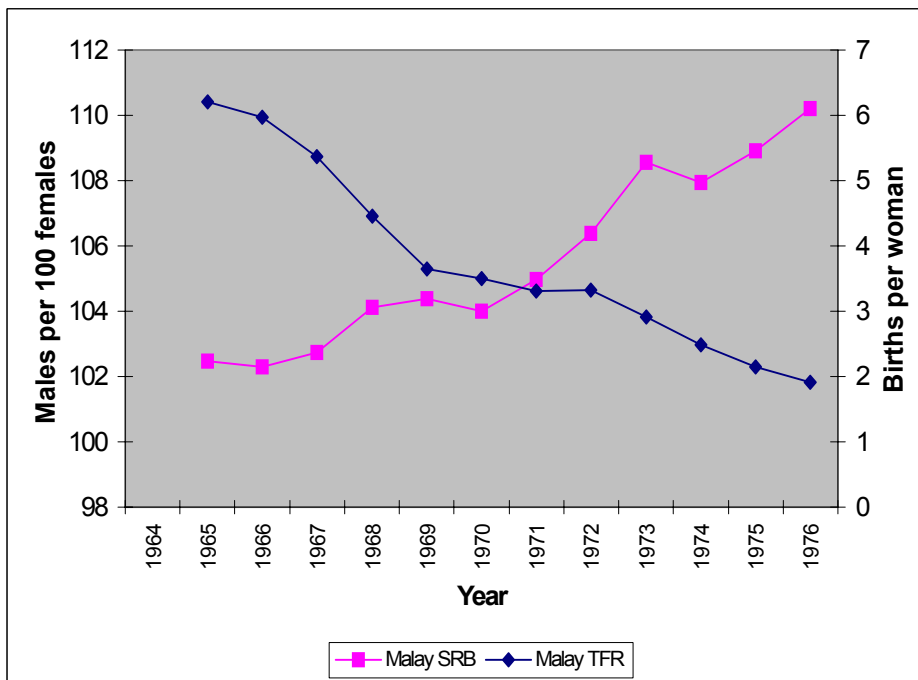
Sources: Population Report, 1992, 1998; Graham, 1995; Singapore Census of Population, 2000; Saw, 1989, 1990

Figure 1: Total fertility rates, three time periods and two generations in Singapore 1965–2002



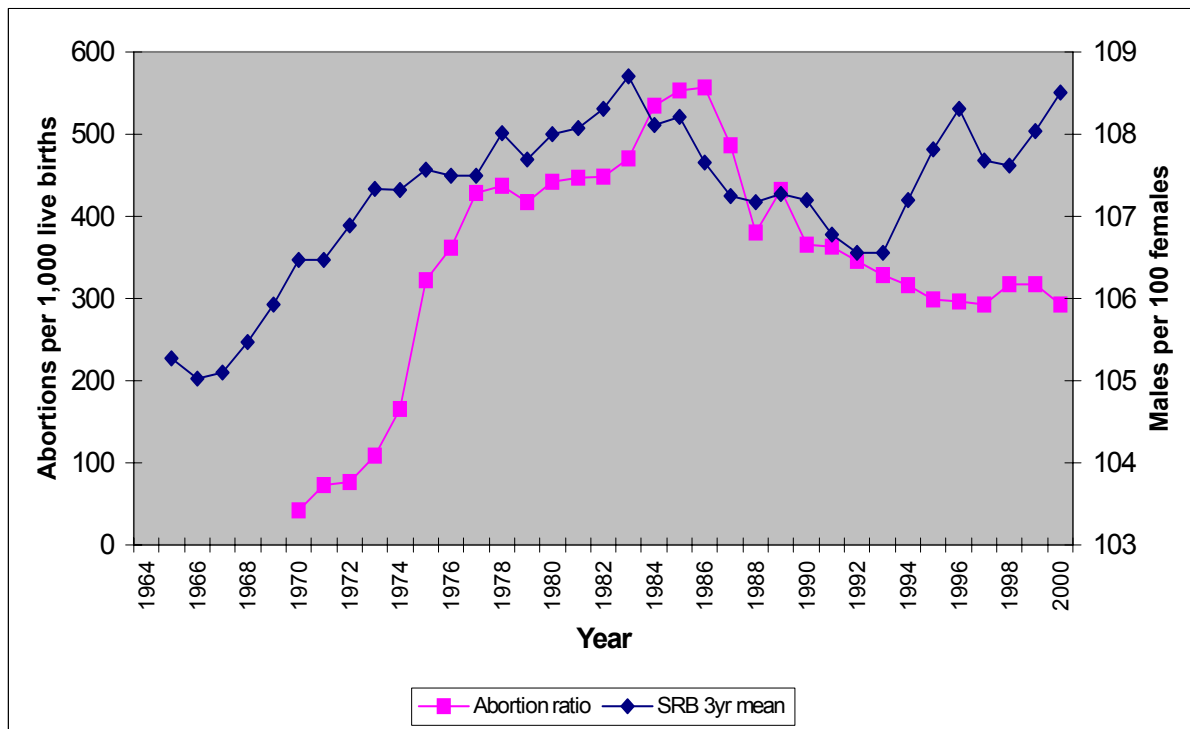
Source: Annual Reports on Registration of Births and Deaths, Singapore

Figure 2: Sex ratio at birth for total population and three ethnic groups, Singapore 1965-2000 (3 year moving mean)



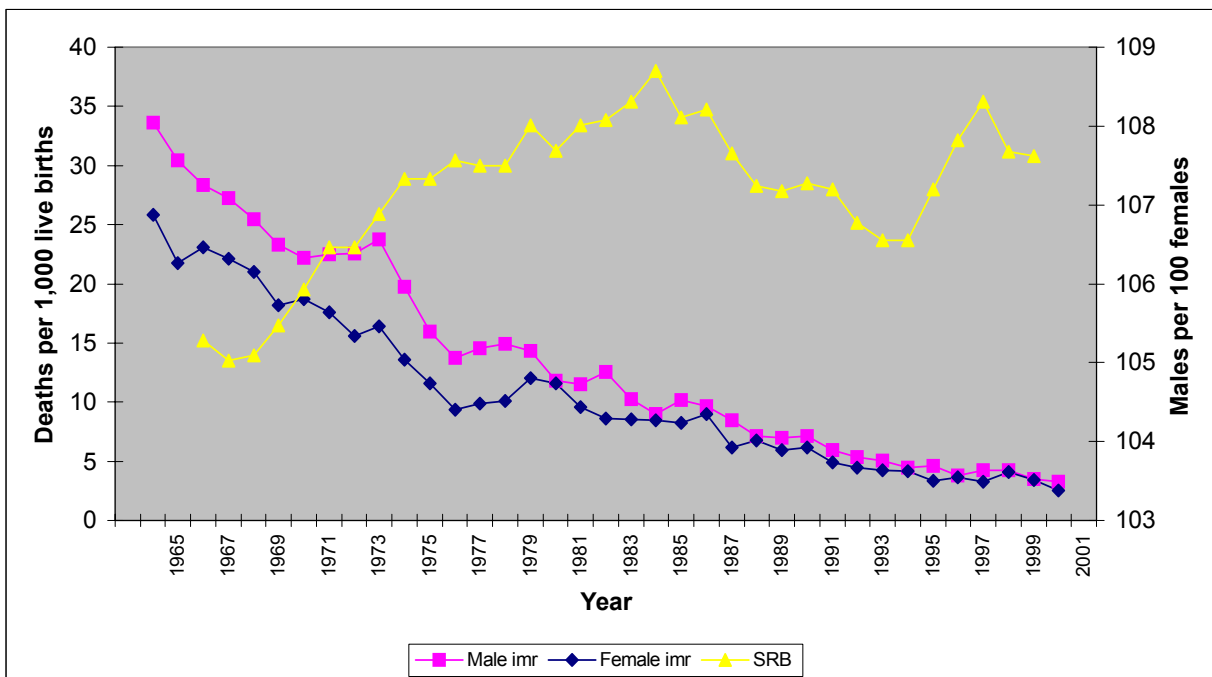
Source: Annual Reports on Registration of Births and Deaths, Singapore

Figure 3: Malay total fertility rate and sex ratio at birth, Singapore 1965-1976



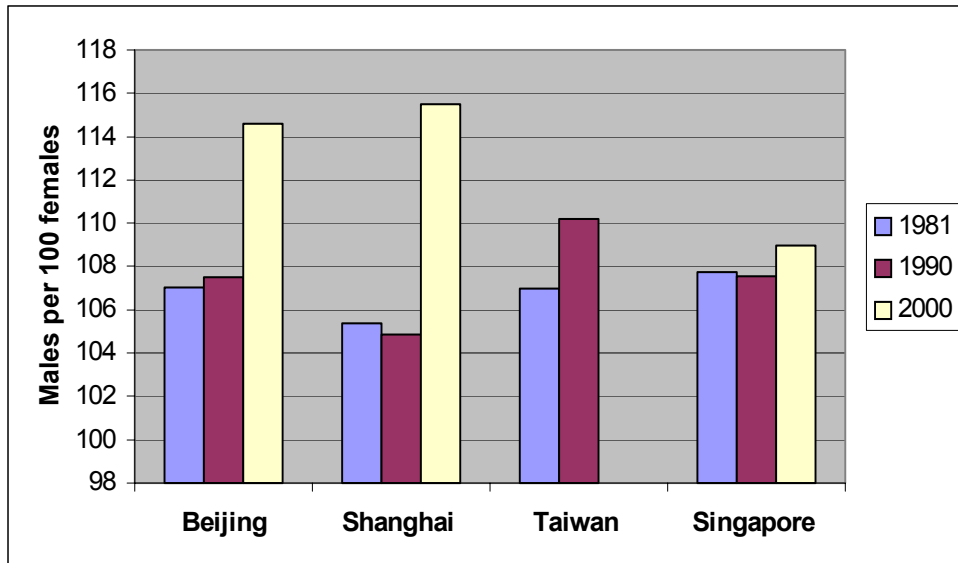
Sources: Saw (1999); Ministry of Health Annual Reports, Singapore; Annual Reports on Registration of Births and Deaths, Singapore

Figure 4: Abortion ratio and sex ratio at birth, Singapore 1965-2000



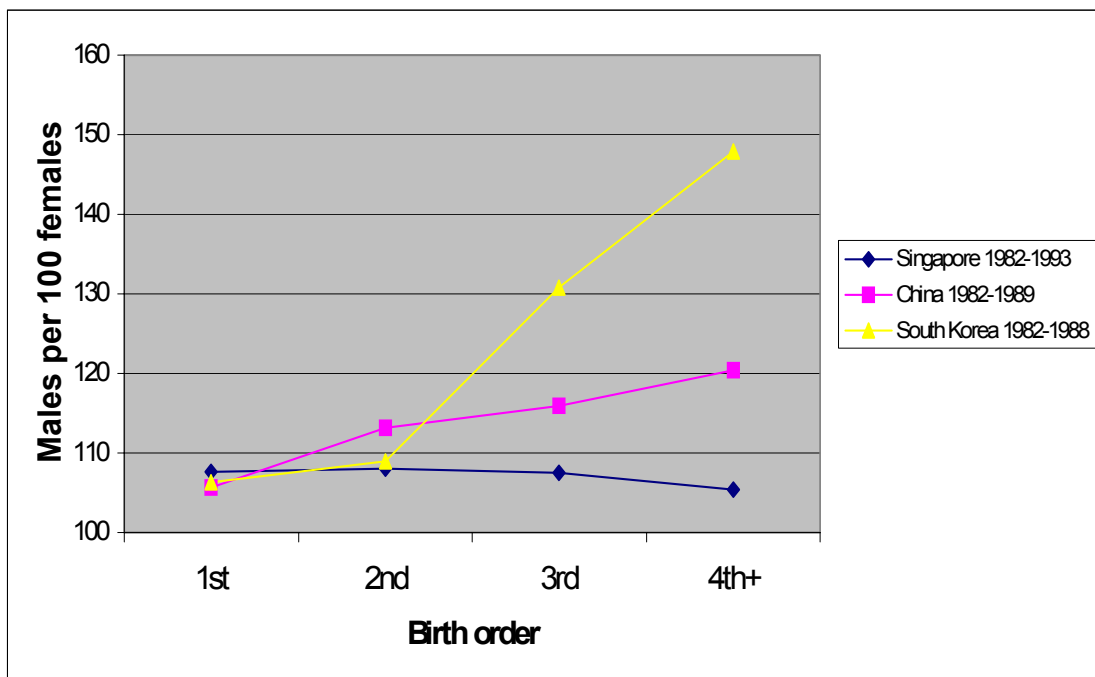
Source: Annual Reports on Registration of Births and Deaths, Singapore

Figure 5: Infant mortality rates and sex ratio at birth, Singapore 1965-2000



Sources: Lai D (2005) [Beijing, Shanghai]; Gu and Roy (1995) [Taiwan]; Annual Reports on Registration of Births and Deaths [Singapore]

Figure 6: Sex ratios at birth, Beijing, Shanghai, Taiwan and Singapore, 1981, 1990 and 2000



Source: Koh (1995)

Figure 7: Sex ratios at birth by birth order, Singapore, China and South Korea, 1982-1993