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Modeling Prenatal Son Preference: Some New Perspectives from China [1]

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Abstract

China has since the mid-1980s witnessed an increasing trend in sex ratio at birth (SRB) imbalance. While the literature agrees that SRB is caused by parents' need to have a son, it is not clear if an increase in SRB reflects an increase in son preference. This study aims at bridging this gap by developing a model to estimate prenatal son preference based on SRB and total fertility rates (TFR). Data on SRB and TFR from China are applied to the model. The results show that since the mid-1980s, prenatal son preference has fluctuated, and trends in SRB and prenatal son preference by province and by rural, township and urban areas sometimes diverge. In order to interpret these results, changing trends in prenatal son preference is discussed in relation to social change in China. The study draws conclusions at two levels. First of all, theoretically, it concludes that increased SRB does not have to signify increasing prenatal son preference when fertility rates fall. Secondly, it concludes that in China, the process of socioeconomic development has diverging impact on son preference, weakening it in some instances, while reinforcing it in others. Modeling son preference as suggested is useful for posing relevant questions with regard to how and why son preference changes. It also has important implications for where, if and how interventions that address skewed SRB should be planned.

Keywords

Prenatal son preference, sex ratio at birth, sex-selection, fertility, socioeconomic change, China

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Introduction

Over the last couple of decades, China and several other Asian countries have reported skewed sex ratios at birth (SRB), indicating that more boys than girls are born, and that there is an increasing number of "missing girls".[i] Among these countries, China is the one that has recorded the highest national level of SRB, at 120.5 in 2005 (NBS 2007). The high level of SRB in China has led to popular notions assuming that an increase in SRB imbalance reflects an intensification of son preference, a notion that can also be found in the academic literature (see e.g. Croll 2000; Li, Zhu et al. 2004). Regarding SRB as a proxy indicator for son preference is likely also to be the reason why the OECD rates China the highest[ii] when it comes to son preference (OECD 2009). However, this paper challenges the notion that increasing SRB implies an intensification of son preference. On the contrary, and as this paper will demonstrate, it is possible that son preference manifesting itself through prenatal sex-selection eases as SRB goes up provided that fertility levels fall.

The phenomenon of son preference

Son preference denotes a phenomenon, where parents due to social, cultural, economic, and political factors place sons at a higher value than daughters. Sons have in many parts of the world been desired due to virilocal marriage customs, sons' capacity for physical labor and their allotted function of taking over land, passing on the family line, and providing support for parents at old age (Brockmann 2001; Croll 2000; das Gupta and Li 1999; Hill and Upchurch 1995; Li, Zhu, and Feldman 2004; Van Balen 2006). Giving birth to at least one son has thus for many couples been important (Croll 2000; Haughton and Haughton 1998).[iii]

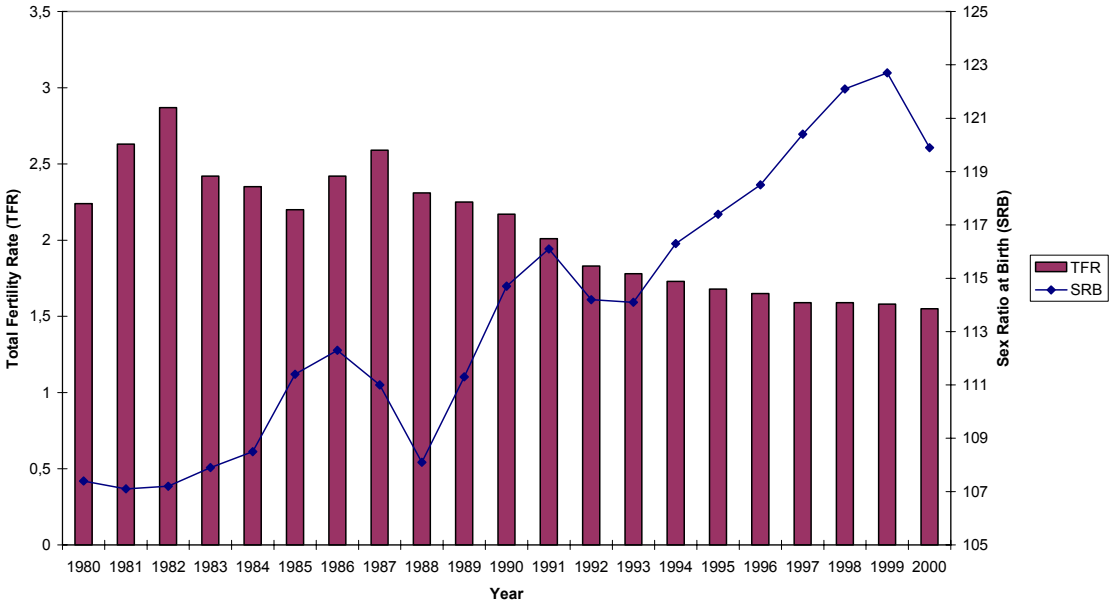
There are many expressions of son preference. Whereas son preference for many parents remains at an attitudinal level, for some it translates into behavior of sex-selection and discrimination. Such behavior can take place before conception, during pregnancy or after the child is born, and includes pre-conceptive sex-selection[iv], sex-selective abortion, and maltreatment and neglect of daughters after birth (Banister 2004a; Croll 2000; Li, Zhu, and Feldman 2004; Pande and Astone 2007). Prenatal sex-selection, if performed in favor of one particular sex, will lead to imbalance in SRB.

The literature on SRB suggests that skewed SRB occurs in populations with low fertility levels, access to sex-selective technologies and where son preference exists (see e.g. Banister and Coale 1994; Banister 2004; das Gupta and Mari Bhat 1997). The reason why son preference only gives rise to SRB imbalance in low fertility populations is explained by the fact that the probability to give birth to a male child decreases as couples get fewer children (Guilmoto 2009). In China, as is shown in Figure 1, the general trend is that SRB increased through the 1980s and 1990s, while the total fertility rate (TFR) dropped over the same period of time.

Estimating son preference

Estimating son preference is crucial in order to be able to address it effectively, which is important for mainly four reasons. First of all, son preference often implies daughter discrimination and the denial of equal opportunities for girls and women in many respects, such as access to food, nutrition, health services and education (Croll 2000; Li, Zhu et al. 2004; Purewal 2010). Secondly, as is evident from skewed SRB, son preference can trigger behavior of sex-selection, which eventually will lead to communities and regions having a shortage of women. There is growing concern that shortage of

Figure 1. Total Fertility Rate (TFR) and Sex Ratio at Birth (SRB) in China 1980-2000



Sources: Data on TFR are quoted from Greenhalgh and Winckler (2005) page 18. Data on SRB are quoted from Guilmoto and Ren (forthcoming).

women results in increased sex work, trafficking in women and children (CEDAW 1999), and that it fuels the spread of HIV/AIDS (Merli and Hertog 2010). In this way, high SRB may undermine the status of women and the value ascribed to girls, and thereby further reinforcing son preference. Thirdly, estimating son preference can be used as a "barometer" for assessing gender equality in a country. Finally, with the availability in the foreseeable future of tests that can determine the sex of the fetus early in the pregnancy through a blood test of the mother (Kaiser 2005), it becomes even more urgent to address son preference as it seems to be the only way of preventing a further rise in SRB.

There are different methods for estimating son (or daughter) preference. The most straightforward way is to ask parents and parents-to-be about the preferred sex composition of their children. However, given the fact that attitudes do not necessarily translate into fertility behavior, the predictability of such surveys has been questioned (Haughton and Haughton 1998). Such surveys may be even less reliable in settings where fertility is political, such as in China and Vietnam, and to some extent India.

Therefore, most studies on sex preference have used econometrics to look at birth history and fertility behavior, such as parity ratio, timing of subsequent parity, contraceptive use and abortion history, assuming that parents apply the "stopping rule", i.e. continue childbearing and stop only when the preferred number of sons or daughters is achieved (see e.g. Clark 2000; Larsen, Chung, and das Gupta 1998; Lofstedt, Luo, and Johansson 2004). However, since many such econometric studies look at fertility behavior of women who are in the middle of their reproductive cycle, the disadvantage is that the results may not reflect the end result of the fertility behavior and sex preference (Haughton and Haughton 1998). In addition, undertaking fertility surveys is time-consuming and costly.

Although SRB has not been used as a way of estimating the prevalence of sex preference *per se*, many studies on SRB refer to son preference as an explanatory variable for SRB imbalance, and use SRB as a proxy indicator for son preference. However, the literature on SRB does not attempt to specify how SRB and the prevalence of son preference relate. Understanding this relationship is important in order to know to what extent fluctuations in SRB signify variation in son preference.

Purpose of the study

This study suggests that any statements on the relationship between SRB and son preference must take fertility rates into account. Although it has been pointed out that increasing levels of SRB may be explained by falling fertility rates rather than increasing levels of son preference (das Gupta and Bhat 1997), a model that explains the relationship between SRB, son preference, and fertility levels is lacking.

While recognizing the complexity and difference in manifestation of son preference, this paper will focus on *prenatal* son preference, i.e. where couples want to have at least one son, and where they are prepared to resort to prenatal sex-selective behavior in order to achieve that goal. The first aim of this study is to develop a method for estimating this form of son preference. The method allows estimating how widespread prenatal son preference is and how it changes over time and differs between countries or regions within countries. The model will serve to test the following hypotheses:

1. Prenatal son preference only results in high SRB where fertility is low.
2. Increasing SRB does not have to imply increased levels of prenatal son preference, just as steady SRB may conceal an increase in prenatal son preference.
3. A relatively small proportion of a population with prenatal son preference may result in high SRB.

These hypotheses are important to test as they help illuminate the relationship between SRB and prenatal son preference. Drawing conclusions about son preference based on SRB only can be misleading.

The second aim is to discuss new perspectives regarding variations in prenatal son preference in relation to development and social change in China, as well as what programmatic implications these new perspectives have. China will be the empirical focus of the study due to its high and increasing SRB imbalance and the fact that fertility has fallen in China over the last few decades.

Material and method

Three variables were used in the analysis, all of which are defined below.

Prenatal son preference (PNSP) refers to couples wanting a son and resorting to prenatal sex-selection to make sure that they bear at least one male offspring during their lifetime. The concept as defined here does not comprise son preference that remains at the attitudinal level and son preference that manifests itself as discriminatory behavior against girls after they are born. Nor does it capture son preference that results in couples continuing childbearing until they have got at least one son, i.e., those who apply the "stopping rule".

Sex ratio at birth (SRB) refers to number of male children (N_m) born per female children (N_f) in a certain region. It is defined as:

$$SRB = {N_m}/{N_f} \times 100$$

Given no manipulation of the outcome of the pregnancy, it is expected that SRB is 105. Therefore, in this study it is assumed that SRB above 105 reflects prenatal son preference.

Number of children born per woman. Due to the lack of an alternative measurement, total fertility rate (TFR) will be used as a proxy indicator for number of children born per woman. TFR is the most

widely used measurement to estimate the number of children per women and refers to the estimated number of children a woman is expected to have during her lifetime given current age-specific birth rates.

The three variables were used to develop two equations that can be used for understanding the relationship between the said variables. The equations are explained in the data analysis section below.

Data sources

This study employs data on SRB and TFR in China based on the 1982, 1990, and 2000 censuses and the 2005 one percent sampling survey. However, census data on fertility are known for being affected by under-reporting (Scharping 2007). Therefore, rather than referring to census data as published by the National Bureau of Statistics (NBS), except for data from the 2005 survey, where no further comprehensive analysis is available, other sources are used where the data has been further analyzed. Throughout the study, data on TFR at the national level 1980-2000 are quoted from Greenhalgh and Winckler (2005), TFR at the national level and by province in 2005 are from NBS (2007), and data on TFR by province for 1990 and 2000 are from NBS and EWC (2007). TFR data by rural, township and urban areas from 1990 and 2000 are from Lee and Chang (2006). Data on SRB at the national level 1980 to 2000 are quoted from Guilmoto and Ren (forthcoming), SRB by province in 1990 are quoted from NBS (1990), SRB by province and at national level in 2000 and 2005 are quoted from UNFPA (2007), and SRB by rural, township and urban areas are quoted from Li (2007).

Method

In order to explore the relationship between prenatal son preference (x), sex ratio at birth (y) and number of children (z), different probabilities to give birth to a boy and a girl were calculated based, firstly on a "normal" SRB, (($y|x=0$) = 105), and secondly on the observed or manifest SRB when prenatal son preference exists ($y|x>0$).

The probability to give birth to a boy (a) and girl (b) given no prenatal son preference is:

$$a = \frac{(y|x=0)}{(y|x=0)+100}$$

$$b = 1 - a$$

The probability to give birth to a boy (c) and girl (d) given prenatal son preference is:

$$c = \frac{(y|x>0)}{(y|x>0)+100}$$

$$d = 1 - c$$

From this we can deduce that the probability to give birth to *only* girls given no prenatal son preference *(b)* changes with number of children *(z)* and is: b^z.

By using these probabilities, it is possible to estimate sex ratio at birth (y) when prenatal son preference (x) and number of children (z) vary. This can be done by estimating the probability that couples practice prenatal sex-selection given that a proportion of the population possesses prenatal son preference $(x \times b^z)$. A pregnancy with a female fetus would then be terminated followed by a subsequent pregnancy until a male child is born. Alternatively, couples would practice pre-conception sex-selection, having a male embryo implanted through in vitro fertilization to ensue that a male child

is born. This will add to the probability to give birth to a boy (a) and deduct from the probability to give birth to a girl (b). The estimated SRB (y) is then calculated as follows:

$$y = \frac{a+(x \times b^z)}{b-(x \times b^z)} \times 100 \quad \text{(Eq. 1)}$$

It is also possible to estimate the proportion of a population that has prenatal son preference (x) when SRB (y) and number of children (z) vary by comparing the probability to give birth to a boy where a certain proportion of the population has prenatal son preference (c) with the probability to give birth to a boy where there is no prenatal son preference (a). The difference between these two values is then put in relation to the probability of couples giving birth to only girls given number of children (b^z):

$$x = \frac{c-a}{b^z} \times 100 \quad \text{(Eq. 2)}$$

As mentioned above, TFR will be used as a proxy indicator for number of children (z). However, as I will return to later in the paper, in populations with TFR ≤1, the method I propose is not valid and gives paradoxical estimates.

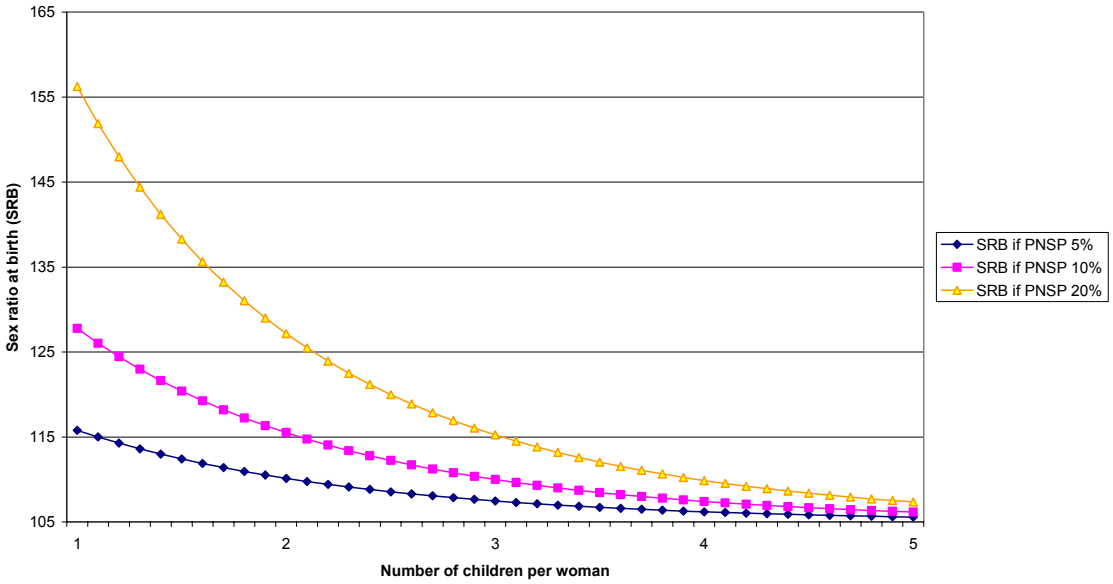
Results

In order to illustrate the correlation between SRB and prenatal son preference given different levels of TFR, Figure 2 was created based on *Equation 1*. Figure 2 is hypothetical and shows SRB for different levels of TFR and prenatal son preference.

The figure demonstrates that populations who have different TFR but the same level of prenatal son preference expose different SRB. For example, a population with a fertility level of three children per woman, and a prenatal son preference prevalence of ten percent, has an expected SRB of 110. A population with similar levels of prenatal son preference, but a TFR of two children is expected to have SRB of 117. The same is true for one and the same population over time. A population who experiences simultaneous trends of increasing SRB and decreasing fertility levels may in fact not experience an increase in the prevalence of prenatal son preference. Similarly, stagnation in SRB does not have to imply that the prevalence of prenatal son preference has remained unchanged. If fertility levels have fallen over time, a stable SRB implies that prenatal son preference has decreased. Likewise, if fertility levels have increased, a stable SRB signifies an increase in prenatal son preference. This is illustrated in Figure 2 by the fact that SRB will remain effectively the same – at 115 – for populations where the number of children per woman goes up from two to three, if son preference increases from 10 to 20 percent.

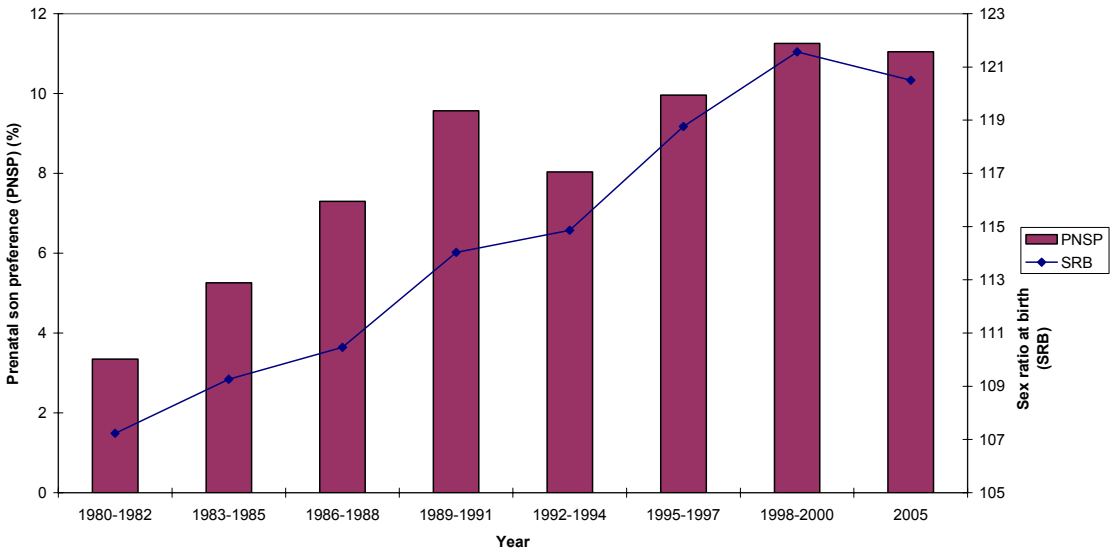
In order to illustrate the correlation between SRB and prenatal son preference and to what extent SRB reflects son preference in China, Figure 3 was created based on *Equation 2.* The figure shows that the general trend for both SRB and prenatal son preference is to increase over time. However, the results indicate that prenatal son preference increased faster than SRB in the 1980s, and that although SRB

Figure 2. Sex ratio at birth (SRB) given different levels of prenatal son preference (PNSP) and number of children per woman



continued to increase steadily for each period prenatal son preference did not increase between the late 1980s and early 1990s. Prenatal son preference again increased in the 1990s, but not as fast as SRB.

Figure 3. Sex ratio at birth (SRB) and prenatal son preference (PNSP) by three year averages, 1980-2000 and 2005



Both SRB and prenatal son preference have increased over time at an aggregate level, as indicated in Figure 3 above. However, when disaggregated by province the results suggest that the relationship between SRB and prenatal son preference is not complete.

Table 1. Sex ratio at birth (SRB) and prenatal son preference (PNSP) by province, 1990, 2000 and 2005

Province	SRB 1990	PNSP 1990	SRB 2000	Δ*	PNSP 2000	Δ	SRB 2005	Δ	PNSP 2005	Δ
*Anhui***	*109.1*	*7.04*	*130.8*	↑	*15.53*	↑	*132.2*	≈	*20.51*	↑
Beijing***	106.6	1.02	114.6	↑	4.46	↑	117.8	↑	5.88	↑
Chongqing	n/a	n/a	115.8	n/a	6.81	n/a	111.2	↓	3.38	↓
Fujian	*112.0*	*11.48*	*120.3*	↑	*8.11*	↓	*125.9*	↑	*10.66*	↑
Gansu	108.9	5.96	119.4	↑	9.30	↑	116.2	↓	7.14	↓
Guangdong	113.0	12.71	137.8	↑	18.63	↑	119.9	↓	6.82	↓
Guangxi	112.1	12.37	128.8	↑	17.82	↑	119.8	↓	11.84	↓
Guizhou****	101.3	-	105.4	≈	0.49	≈	127.7	↑	19.47	↑
Hainan	110.2	12.44	135.0	↑	23.19	↑	122.0	↓	11.85	↓
Hebei	*107.9*	*4.36*	*118.5*	↑	*8.63*	↑	*119.4*	↓	*9.92*	↑
Heilongjiang	*105.8*	-	*107.5*	≈	*1.21*	↑	*110.7*	↑	*2.70*	↑
Henan	*112.8*	*18.99*	*130.3*	↑	*16.90*	↓	*125.8*	↓	*11.32*	↓
Hubei	*109.0*	*5.93*	*128.0*	↑	*11.82*	↑	*128.0*	≈	*13.14*	↑
Hunan	107.5	3.67	126.9	↑	13.44	↑	127.8	≈	13.84	≈
Inner Mongolia	*108.6*	*3.78*	*108.5*	≈	*1.90*	↓	*117.1*	↑	*6.21*	↑
Jiangsu	111.9	7.36	120.2	↑	7.47	↑	126.5	↑	10.7	↑
Jiangxi	110.7	10.66	138.0	↑	24.28	↑	137.3	≈	22.18	≈
Jilin	*106.0*	*0.89*	*109.9*	↑	*2.32*	↑	*109.3*	≈	*2.01*	↓
Liaoning	106.1	0.77	112.2	↑	3.58	↑	109.5	↓	2.10	↓
Ningxia	*108.5*	*6.42*	*108.0*	≈	*2.52*	↓	*111.1*	↑	*4.90*	↑
Qinghai	107.1	3.51	103.5	↓	-	↓	116.9	↑	7.26	↑
Shaanxi	110.4	8.92	125.2	↑	10.94	↑	132.1	↑	13.32	↑
Shandong	*114.4*	*11.11*	*113.5*	≈	*4.83*	↓	*113.4*	≈	*5.73*	↑
Shanghai***	105.4	0.27	115.5	↑	5.06	↑	120.1	↑	6.84	↑
Shanxi	*109.3*	*6.48*	*112.8*	↑	*5.77*	↓	*116.7*	↑	*7.56*	↑
Sichuan	107.9	2.86	116.4	↑	7.21	↑	116.3	≈	7.46	≈
Tianjin***	105.6	-	113.0	↑	3.74	↑	119.8	↑	6.74	↑
Tibet	102.8	-	97.4	≈	-	≈	105.2	≈	0.12	≈
Xinjiang	*105.5*	*1.16*	*106.7*	≈	*1.36*	↑	*109.4*	↑	*3.19*	↑
Yunnan	104.4	-	110.6	↑	5.46	↑	113.2	↑	6.39	↑
Zhejiang	106.9	1.33	113.1	↑	4.79	↑	113.4	≈	4.69	≈

* Changes in SRB that represent more than two units are considered "change" and changes in PNSP that show more than 10 percent difference in value are considered "change". Change refers to comparison between 1990 and 2000 and 2000 and 2005.

** Provinces marked in italics show diverging trends in SRB and PNSP.

*** TFR in Beijing in 2000, and Beijing, Shanghai and Tianjin in 2005 was ≤1 and hence when data was applied to Equation 2, TFR was set for 1.

**** Any value below 105 is treated as 105.

As Table 1 indicates, when comparing the data on SRB and prenatal son preference by province from 1990, 2000 and 2005, 19 provinces or regions show a pattern where fluctuation in SRB and prenatal son preference follow similar patterns, i.e. when SRB goes up, prenatal son preference goes up and vice versa. However, there are three scenarios where changes in SRB and prenatal son preference show different trends. The first scenario is that SRB increases, but prenatal son preference in fact

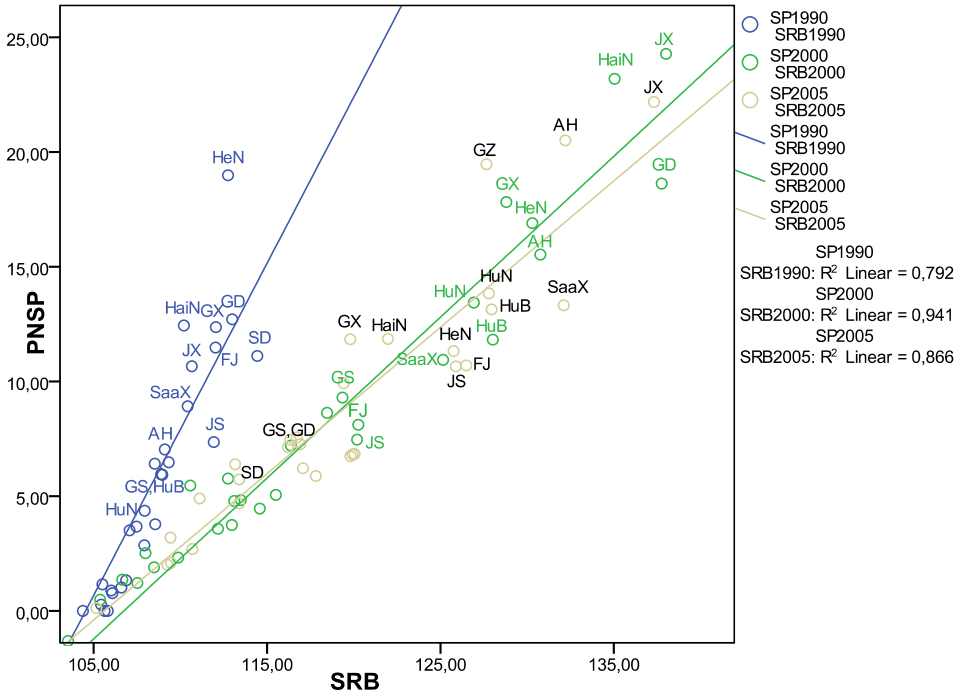
decreases. This trend took place between 1990 and 2000 in Fujian, Henan and Shanxi. The second scenario is that SRB remains stable but prenatal son preference decreases. This was the case for Inner Mongolia, Ningxia and Shandong between 1990 and 2000, and Jilin between 2000 and 2005. The results further point at a third scenario where SRB remains stable, but prenatal son preference increases. This scenario took place in for example Anhui, Hebei and Shandong between 2000 and 2005. Shandong is the only province which exposes different trends in SRB and prenatal son preference both between 1990 and 2000 and between 2000 and 2005. Although SRB in Shandong remained steady at around 114, prenatal son preference first decreased between 1990 and 2000 and then increased between 2000 and 2005.

Worth noting is that between 1990 and 2000 SRB developed more aggressively than prenatal son preference. SRB increased in 22 provinces and dropped in one province, whereas prenatal son preference increased in 21 provinces and actually dropped in seven provinces. Between 2000 and 2005, the situation was reverse; SRB increased in 14 provinces and dropped in eight, while prenatal son preference increased in 18 provinces (including six out of seven provinces which had shown a decrease in prenatal son preference between 1990 and 2000) and dropped in eight provinces.

Comparing SRB with prenatal son preference also brings new perspectives with regard to interprovincial differences and shows that the provinces most severely burdened by SRB imbalance may not be the ones with highest levels of prenatal son preference. For example, SRB data from 2005 suggest that Anhui and Shaanxi have similarly high SRB (132). However, when looking at prenatal son preference, it becomes evident that Anhui has significantly higher prenatal son preference (at 20.5 percent) than Shaanxi (at 13.3 percent).

When Table 1 is converted into a scatter diagram (Figure 4), it becomes visually clear that Henan had nearly 20 percent prenatal son preference already in 1990, even though SRB was medium high at 113.

Figure 4. Prenatal son preference (PNSP) and sex ratio at birth (SRB) by province, 1990, 2000 and 2005



*Only provinces which at some point ranked among the highest 10 provinces with son preference are indicated.
Abbreviations are as follow: AH=Anhui, BJ=Beijing, FJ=Fujian, GS=Gansu, GD=Guangdong, GX=Guangxi, HaiN=Hainan, HeN=Henan, HuB=Hubei, HuN=Hunan, JS=Jiangsu, JX=Jiangxi, SaaX=Shaanxi, SD=Shandong, TJ=Tianjin.

Moreover, despite the fact that SRB increased markedly to 130 in Henan in 2000, prenatal son preference decreased over the same period of time. As indicated in Figure 4, when the correlation between SRB and prenatal son preference was tested, the R2 test showed that the correlation was 0.792 in 1990, 0.941 in 2000 and 0.866 in 2005. These results confirm that SRB and prenatal son preference are correlated, but not on a one to one basis. Moreover, the correlation was strongest in 2000, when the TFR was particularly low, which confirms the importance of fertility rates in understanding the relationship between prenatal son preference and SRB imbalance.

When census data on SRB and TFR by rural, township and urban in 1990, 2000, and 2005 is applied to *Equation 2*, interesting patterns emerge. As illustrated in Table 2, prenatal son preference was close to ten percent in rural areas already in 1990 and although SRB increased from 111.7 to 121.7 in rural areas from 1990 to 2000, prenatal son preference remained virtually the same. The results show that the biggest increase in prenatal son preference took place in urban China, where, although still at low levels, prenatal son preference increased from 2.8 percent to 4.3 percent. Even though the increase in prenatal son preference in urban China is matched by an increase in SRB during the 1990s, the increase in prenatal son preference represents a much larger increase compared to the increase in SRB. Also worth noting is that between 2000 and 2005, prenatal son preference increased in rural and township areas, while it stagnated in urban areas, even though SRB stayed close to steady in all three areas.

Table 2. Sex ratio at birth (SRB) and prenatal son preference (PNSP) by rural/urban 1990, 2000 and 2005

		1990	2000	2005
Rural	SRB	111.7	121.7	122.9
	TFR	2.5	1.4	1.6
	PNSP	9.6	10.0	12.7
Township	SRB	n/a	119.9	119.9
	TFR	n/a	1.1	1.3
	PNSP	n/a	7.2	8.3
Urban	SRB	108.9	114.2	115.2
	TFR*	1.6	0.9	0.9
	PNSP	2.8	4.3	4.1

* Since TFR in urban areas in 2000 and 2005 was ≤1, TFR at the value of 1 was applied to Equation 2 when estimating son preference

Sources: Data on SRB in 1990 and 2000 are quoted from Li (2007), data on TFR in 1990 and 2000 are quoted from Lee and Chang (2006) and data on SRB and TFR in 2005 are quoted from NBS (2005).

Discussion

One way of estimating prenatal son preference

Prenatal son preference as modeled in this study is only one out of several methods for estimating son preference. It basically considers the proportion of son-less women who would practice prenatal sex-selection, given year-specific TFR and SRB, as an indicator of prenatal son preference. The paper does not propose that there is a one to one correlation between prenatal son preference and son preference in a broader sense, which includes neglect and maltreatment of girls. Whereas some authors have suggested that prenatal sex-selection is replacing postnatal sex-selection rather than adding a new form of discrimination against girls (Goodkind 1996), data from China show that prenatal and postnatal

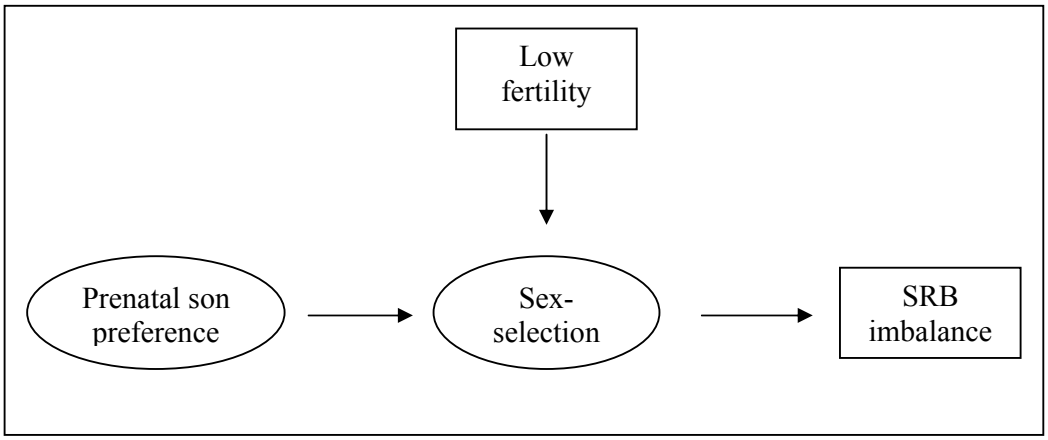
discrimination follow similar patterns. For example, excessive mortality among infant girls has increased parallel to the increase in SRB in China (for an in-depth analysis of this, see further Banister 2004). Factors that affect the reliability of the model include whether means to practice sex-selection are affordable and readily available. Another important factor is whether sex-selection is deemed ethical.

The fact that prenatal son preference is estimated based on TFR and SRB means that the model is sensitive to the availability and accuracy of such data. It should also be noted that TFR is a proxy indicator, estimating the average number of children a woman is expected to have in a lifetime given year-specific birth rates. However, in reality, some women may give birth to many children and other women to none. This may reduce the accuracy of the estimations of prenatal son preference. On the other hand, in low-fertility countries with preferences for sons and strong family values, it is likely that many women give birth to at least one child and that few women give birth to more than two. In fact, childbearing among Chinese women is near universal at 97.1 percent (Chen 2007).

On the relationship between SRB and prenatal son preference

The three hypotheses set out in the beginning of the study were partly confirmed. As hypothesized, prenatal son preference only results in skewed SRB when TFR is relatively low, provided prenatal sex-selection technologies are available and accessible. The results further suggest that populations with high TFR and normal SRB may have elements of prenatal son preference, although it does not translate into demographic rates in favor of male newborns. It is important to note that in such populations son preference may be manifested in many other ways than prenatal sex-selection. However, once the TFR starts to drop, skewed SRB may appear or increase if prenatal son preference persists. Populations where this may be relevant include Afghanistan, Nepal and Pakistan, where fertility rates are still relatively high[v] (UNDESA 2006) and son preference is documented (see e.g. Alia 1989; Hussain and Fikree 2000; Leone, Matthews, and Zuanna 2003; OECD 2010), as well as some ethnic minority populations in China (Attané 2007). In other words, low fertility in itself does not lead to sex-selective behavior unless there is the underlying cause of prenatal son preference. Low fertility thus becomes the mechanism that triggers sex-selective behavior, which leads to SRB imbalance. This is illustrated in the figure below.

Figure 5. Figure illustrating causes and consequences of sex-selection



The results also support the second hypothesis, which states that increasing SRB does not have to imply increased levels of prenatal son preference. As the results of this study show, given the drop in fertility levels in China from the late 1980s to the late 1990s, the increase in SRB over this time seems to only modestly represent an increase in prenatal son preference. Moreover, data by province illustrated that steady or decreasing SRB can conceal increased levels of prenatal son preference if

fertility levels go up. Hence, hypothesis 2 is only true provided that SRB is already imbalanced and fertility levels change. The different scenarios of changes in SRB and prenatal son preference are illustrated in Figure 6.

Figure 6. Different scenarios of changing sex ratio at birth (SRB) and prenatal son preference (PNSP)

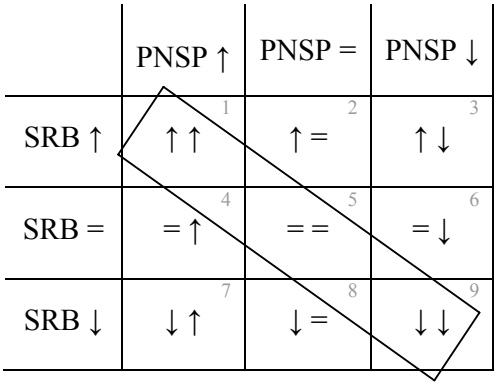


Figure 6 illustrates that there are nine possible scenarios with regard to changes in SRB and prenatal son preference. Out of these, three boxes (1, 5 and 9) show scenarios representing a situation where changes in SRB are accompanied by changes in prenatal son preference and vice versa. These three scenarios, highlighted with a diagonal rectangle, represent the conventional understanding of the relationship between SRB and prenatal son preference. One of the contributions of this study is to show that changes in SRB and prenatal son preference can diverge, as illustrated in the other six scenarios. In the results presented in this study, all scenarios have taken place in China between 1980 and 2005, except for those where SRB increased while prenatal son preference remained steady (box 2), SRB decreased and prenatal son preference increased (box 7) and SRB decreased and prenatal son preference remained steady (box 8).

The results confirm hypothesis 3. Even small proportions of around five percent of prenatal son preference in a population with low fertility levels will result in skewed SRB. For example, in the provinces of Shandong and Zhejiang, prenatal son preference of just under 5 per cent leads to SRB imbalance of 113 in 2000. Ten years earlier, in for example Hebei Province, similar rates of prenatal son preference gave rise to only a small imbalance in SRB (107.9) as fertility levels were higher.

Although not being an exhaustive measurement of son preference, this study argues that the model presented can reveal over all trends and changes in son preference as manifested in couples taking measures to secure that at least on male child is born. Effectively, this means that the proportion of couples who by all means want to have at least one son and who are prepared to practice sex-selection to achieve that goal has changed over time and between regions. As will be discussed below, those changes bring new perspectives on son preference in China.

New perspectives on son preference in China

It could be that in China, the proportion of couples who want to have at least one son has stayed constant since the 1980s and, as mentioned above, that the increase in SRB is a result of more widely available services for prenatal sex-selection. However, although the availability of such services surely has played an important role in making possible sex-selective behavior, there are several important issues related to technology and policy changes that point to the fact that variations in the availability of such services do not alone explain the increase in SRB. First of all, the technology to perform sex-identification of the fetus through ultrasound has become both better and cheaper with time. Hence, if there existed an unmet demand for fetal sex-identification among parents with prenatal son preference, that demand would have been more easily met in the 1990s than in the 1980s. This means that prenatal

son preference as modeled here should have increased more rapidly in the 1990s than, as is the case, in the 1980s. Secondly, and to support the point just made, the medical services required to perform a sex-selective abortion have become more easily accessible in the 1990s through the expansion of a private sector that offers private health care, beyond the scrutiny of the Ministry of Health (MoH) and the National Population and Family Planning Commission (NPFPC). Thirdly, the Law of the People's Republic of China on Maternal and Infant Health Care, which outlaws sex-identification for non-medical purposes, came into effect in 1994 (UNFPA 2007), and it seems fair to assume that this law would have reduced the availability of services that enable couples to undergo sex-selective abortion. However, the temporary stagnation in prenatal son preference, as the results of this study have shown, occurred before the Law came into effect. These three developments suggest that there were other issues at stake – rather than changes in the availability of technology and medical services enabling couples to select the sex of their child – that triggered couples to practice sex-selection in order to secure a male off-spring.

Prenatal son preference in rural China

Although data on SRB and TFR from the 1980s are not disaggregated by rural and urban areas, one explanation for the increase in prenatal son preference at the national level in the mid and late 1980s could be that son preference as a social institution became strengthened in rural China during the 1980s. There are several plausible explanations for this. Land was redistributed in the mid-1980s under the household responsibility system (HRS), granting land use rights to rural residents. The reform in land distribution meant that farmers were highly tuned in on the land issue and on strategies to acquire as much land as possible, which relates to maintaining and keeping the land in the family. Due to virilocal marriage customs, bearing a son was essential in conserving the land. In fact, a recent study has shown that in areas where land was periodically readjusted depending on the number of family members, SRB imbalance was higher than in areas where land distribution was kept as it was allocated in the mid-1980s, implying that son preference may have been reinforced by periodic land distribution (Bossen 2011). Moreover, between 1978 and 1985, farming had experienced a dramatic increase in productivity, and more than 150 million people had been lifted above the national poverty line (Zhang 1993). Farming, and hence safeguarding land use, was therefore seen as important livelihood strategies. The increase in prenatal son preference during and immediately after the introduction of the HRS supports other research which suggests that the HRS has contributed to reinforcing the importance of having sons (Bossen 2007; Greenhalgh and Winckler 2005). However, the results from this study also show that the effect of the HRS on prenatal son preference seems to have leveled off by the late 1980s. One possible explanation for the dip in son preference in the early 1990s is that the initial gains in productivity provoked by the introduction of the HRS had begun to level off starting in the mid-1980s. Simultaneously, there was a rapid expansion of the township and village enterprises (TVEs), which provided off-farm labor opportunities for both women and men. The boom in TVEs further reduced the importance of land, male manual farm labor, and land inheritance, and may thus also have taken away some of the rationale for son preference in the early 1990s, before many TVEs met difficulties by the mid-1990s (Park and Shen 2003).

Another reason why there was a dip in prenatal son preference in the early 1990s could be that migration as a livelihood diversification strategy became an increasingly common phenomenon in rural China. Some villagers migrated to the cities and left their land altogether, or let relatives or fellow villagers farm their land. However, if there were a phase in the early 1990s where land was considered less valuable, and son preference therefore was partly eased, land soon regained its status as a kind of social security asset for migrant workers. Through the experiences of millions of rural migrants in the cities, it had become evident that becoming permanent urban residents is granted only to few very rich and successful migrants. Most migrants return to their home villages when their competitiveness in the urban labor market ends. This means that keeping land has become an important life line for many migrants (Murphy 2009). Moreover, recent policy changes have made land more attractive, such as the abolishment of the agricultural tax in 2006, and the discussions on land property rights in rural China. Hence, the increasing importance and value attached to land may help explain why prenatal son preference increased in rural areas from 2000 to 2005.

An additional important factor to take into consideration when understanding fluctuations in prenatal son preference is the introduction of the 1.5-child policy in rural China by the mid-1980s (Greenhalgh and Winckler 2005; Zeng 2007). Although the policy was justified based on son preference of rural residents and their proneness to continue childbearing until they bore a son, its introduction did little to ease neither son preference nor SRB. Rather, on the contrary, as the results of this study show, both prenatal son preference and SRB continued to increase at the national level after it was introduced, suggesting that if anything, the 1.5-child policy has helped to reinforce prenatal son preference and exacerbate SRB imbalance.

Son preference in urban China

As is evident from the results estimating prenatal son preference by rural and urban areas, the largest increase in prenatal son preference took place in urban areas in the 1990s. There are mainly three possible factors contributing to this increase, understood as a reflection of the social institution of son preference becoming strengthened. First of all, during the 1990s, urban China went through a process of dismantling its social welfare system, which through work units (*danwei*) to a large extent had provided all the necessities in life, including employment, housing, education, health care and even basic staple foods (Lü 1997). With market reform and a deregulation of the labor and housing markets, there was a trend where the family became the main unit to provide and secure social and economic welfare (Chan, Ngok, and Phillips 2008), and this strengthened the patriarchal character of the Chinese urban family. The shift towards the family as the main provider of social and economic safety had already happened in rural China in the 1980s with the introduction of the household responsibility system and the dismantling of the communes, which had provided some basic social welfare, although modest in comparison with the *danwei* system in urban areas.

Secondly, the labor market in urban China has become more gender segregated with the introduction of economic reforms, with women experiencing various forms of discrimination in recruitments, in salary, recruitment for senior management positions and during lay-offs (Dong, Yang, Du, and Sai 2007; Fang, Granrose, and Kong 2005). For example, women have been disproportionately affected by lay-offs in the state owned enterprises (SOEs) in urban areas. Moreover, recent accounts reveal that more female than male university graduates have difficulties finding jobs after graduation (ACWF 2006).

Thirdly, another reason why prenatal son preference went up faster in urban areas than in rural areas in the 1990s can be related to rural-urban migration and the massive influx of rural residents, who in general have higher prenatal son preference than urban residents, to urban areas. This argument is often used in both academic and popular discourses. There is even research showing that in Shenzhen, individual migrants tend to have stronger son preference if they belong to a social network where other network members possess son preference, suggesting that son preference is reinforced in migrant communities through social networking (Li, Wu, and Feldman 2006). Another explanation is that urban areas attract migrants with prenatal son preference as it is easier to undergo a sex-selective abortion without being detected by local family planning officials, given the anonymity of the city and the wider provision of private health care.

Provincial differences in SRB and prenatal son preference

The results also shed light on regional differences in terms of prenatal son preference. It is beyond the scope of this study to elaborate on possible explanations for this, but some discussion points are worth raising.

The results indicate that some provinces exposed a sharp increase in SRB between 1990 and 2000 and then dropped markedly in 2005. For example, SRB in Guangdong, Guangxi and Hainan increased dramatically from 1990 to 2000, and then fell sharply in 2005, even though it stayed relatively high at around 120. This suggests that there may be a "sex ratio transition" in the making. According to

Guilmoto, a sex ratio transition refers to a process where gender biased social norms and patriarchal systems slowly become weakened and SRB returns to normal (Guilmoto 2009). A sex ratio transition would eventually lead to a decline in the number of "missing girls", which has been observed in China in the early 2000s according to analyses by das Gupta et al (das Gupta, Chung, and Li 2009). However, this study suggests that a sex ratio transition is not meaningful unless it is accompanied by a "prenatal son preference transition", and as the results have shown, theoretically, a sex ratio transition can take place without a prenatal son preference transition. Likewise, a prenatal son preference transition can take place without a sex ratio transition. If looking at the trends in prenatal son preference for the three provinces just mentioned, it seems that the prenatal son preference transition has progressed further than the sex ratio transition, particularly for Guangdong, where prenatal son preference increased from 13 percent in 1990 to 19 percent in 2000 and then dropped to seven percent in 2005, i.e. well below the 1990 level. Although prenatal son preference in Guangxi and Hainan also dropped between 2000 and 2005 – from 18 and 23 percent respectively to about 12 percent – neither of these two provinces had lower prenatal son preference in 2005 compared to 1990. As opposed to these three southern provinces, the central and landlocked provinces of Anhui, Hubei, Hunan and Jiangxi, which also recorded excessively high SRB in 2000, stayed at similarly high levels of SRB in 2005. However, whereas SRB in for example Anhui and Hubei was stabilizing between 2000 and 2005, prenatal son preference was in fact increasing, suggesting that a son preference transition is far away.

Interestingly, the provinces that have the highest estimated prenatal son preference are, by and large, migrant sending provinces, while Guangdong, which recorded the fastest drop in prenatal son preference between 2000 and 2005, is a migrant receiving province. Although hard to establish, the fact that Guangdong is a destination for many female labor migrants (Fan 1999) may play a role in bringing down prenatal son preference, as it has been shown that there is a negative correlation between son preference and cash income of women as well as exposure to the world outside the village (Li and Lavely 2003).

Programmatic implications

The model to estimate prenatal son preference put forward by this study can be a useful tool for providing general directions for planning policy and program interventions to address son preference and SRB imbalance. It can be used to calculate which areas/populations have relatively high prevalence of prenatal son preference. This may be a more strategic approach compared to focusing only on SRB imbalance, not least as it helps identifying future "hot spots" of SRB imbalance. Along the same lines, the model provides arguments for focusing not only on areas where SRB is skewed, but also on areas where SRB is skewed *and* where TFR is relatively high as these areas have higher prenatal son preference than areas with low TFR and similar levels of SRB. Since the overall global trend seems to be that fertility levels continue to drop well below the replacement level, it can be expected that fertility rates will continue to fall in areas where they are relatively high today. Addressing root causes for son preference if it exists in these areas would therefore be an efficient way of preventing future exacerbation in SRB imbalance.

Moreover, from a program monitoring point of view, it is important to be cautious when drawing conclusions about prenatal son preference based on SRB only. When monitoring impact of programs that aim at reducing SRB imbalance, it is also useful to monitor prenatal son preference as modeled in this study to get a better grasp of the sustainability of the results achieved. Likewise, stagnation in SRB does not have to imply a programmatic failure as long as prenatal son preference continues to decrease.

However, the results show that even small proportions of prenatal son preference in a population may result in high SRB if fertility levels are low. This implies that both prenatal son preference as modeled here and SRB are indicators with limitations when it comes to identifying program areas that aim at reducing SRB and son preference. The target population for addressing prenatal son preference that one can identify through these two indicators thus becomes too broad and the interventions may not be very efficient. This suggests that neither SRB nor prenatal son preference can be viewed as a regional

phenomenon. Interventions have to be targeted taking individualistic and social-specific contexts into account in order to be effective. For example, indicators such as gender disparities among girls and boys in access to health services and education may be important additional indicators to identify sub-populations with son preference. Similar observations have been made in India (Pande and Astone 2007).

Conclusions

This study bridges the literature on son preference and SRB imbalance by showing how prenatal son preference and SRB are related. It does so by providing a model to estimate prenatal son preference in a population, based on SRB and TFR in a given year. The study does not argue that prenatal son preference as modeled in this study is an exhaustive approach to son preference. On the contrary, sex-selection giving cause to skewed SRB is merely one of many articulations of son preference. However, the study suggests that the model is useful for demystifying the relationship between SRB and son preference, as well as to detect different trends in prenatal son preference.

The study makes observations and draws conclusions at both theoretical and empirical levels. Theoretically, it demonstrates not only that, but also *how*, SRB imbalance exists in populations with prenatal son preference and where fertility rates are low. The study draws several conclusions which are important for understanding the relationship between SRB and prenatal son preference. First of all, the study concludes that the conventional understanding of the link between SRB and prenatal son preference, i.e. that any changes in the former reflects similar changes in the latter, is misleading. It shows that increased SRB does not have to imply increased prenatal son preference. Rather, in populations where fertility rates drop, SRB may go up despite decreased levels of prenatal son preference. Likewise, SRB may fall even if prenatal son preference persists. Hence, it is important to be cautious about making assumptions about prenatal son preference based on variations in SRB without taking fertility rates into account. Secondly, the study concludes that SRB and prenatal son preference are more closely correlated to each other the lower fertility rates are. This means that the higher the fertility rates are, the less reliable SRB is as a proxy indicator for prenatal son preference, and the more need for alternative ways of modeling son preference. Thirdly, by lowering fertility levels to below "normal", reductionist family planning policies exacerbate SRB imbalance, but not son preference in itself, unless there is gender bias built into the policy. From this follows that, perhaps counter intuitively, it is possible that the number of "missing girls" increases, while prenatal son preference remains steady or even drops. Fourthly, provided that fertility levels will continue to fall, SRB imbalance is likely to persist in countries and regions where it is already high, and areas which do not yet have high SRB may experience increasing SRB when fertility rates start to fall, given that there is prenatal son preference. Fifthly, the study concludes that few and small pockets of prenatal son preference can give rise to high SRB in low fertility areas.

Empirically, by applying data from China to the model, the study shows how new patterns emerge with regard to the prevalence of prenatal son preference, compared to if SRB imbalance is used as a proxy indicator of son preference. These new patterns are useful for posing relevant questions with regard to how and why prenatal son preference changes and allows for several observations and conclusions to be made. First of all, the results suggest that there has been an increase in SRB, and thereby "missing girls", over the past two decades, but that trends in prenatal son preference sometimes depart from trends in SRB. In fact, in the 1990s, the increase in SRB shows a bleaker picture than the increase in prenatal son preference. Secondly, prenatal son preference is increasing in some areas while decreasing in other areas, suggesting that processes of modernization do not necessarily lead to less prenatal son preference. The study concludes that changes in prenatal son preference in rural and urban areas concur with processes of deepening the economic reforms and the dismantling of social welfare, which have reinforced the patriarchal character of the Chinese family, a gender segregated labor market and male-centered inheritance practices. More specifically, these processes pertain to the introduction of the household responsibility system in rural areas in the 1980s, and the dismantling of the work unit system in rural China in the 1990s. Thirdly, the study shows that

already in 1990, Henan province exposed levels of prenatal son preference similar to the provinces which reported excessively high SRB in 2000 and 2005. Had prenatal son preference been recognized and acted upon already in the 1990s, the excessively high SRB in some provinces in 2000 and 2005 may have been preventable. However, the strong focus on SRB imbalance by scholars and policy-makers alike both means that "early warning signs" for future SRB imbalance are ignored and that the wider issues of the denial of rights and opportunities of girls and women are paid too little attention to. The study proposes that modeling prenatal son preference as suggested can be a small step towards zooming in on the root cause of SRB imbalance – rather than SRB imbalance itself – and the larger phenomenon of discrimination against girls and women.

Lastly, the study concludes that what is needed is to look beyond numbers and to commission more research into the processes that challenge and alter values of son preference and the factors contributing to weakening son preference. Fuelling change which challenges son preference is the only effective and sustainable way to address SRB imbalance.

References

ACWF (2006). Female University Students Face Sexual Discrimination in Employment. *Women of China, All-China Women's Federation*. 21 December 2006: Accessed 31 March 2010 at http://www.womenofchina.cn/Issues/Employment/12270.jsp.

Alia, S. M. (1989). "Does son preference matter?" *Journal of Biosocial Science* 21: 399-408

Attané, I. (2007). Minorities: Cultural Integration, Family Planning, and Population Changes. In Z. Zhao and F. Guo, editors. *Transition and Challenge: China's Population at the Beginning of the 21st Century* (pp 251-270). Oxford, Oxford University Press.

Banister, J. (2004). "Shortage of Girls in China Today." *Journal of Population Research* 21(1): 19-45.

Bossen, L. (2007). Missing Girls, Land and Population Controls in Rural China. In C. Z. Guilmoto and I. Attané, editors. *Watering the Neighbour's Garden* (pp 207-228). Paris, Committee for International Cooperation in National Research in Demography.

Bossen, L. (2011). Reproduction and real property in rural China: three decades of development and discrimination. In T. Jacka and S. Sargeson, editors. *Women, Gender and Development in Rural China* (pp 97-123). London, Edward Elgar.

Brockmann, H. (2001). "Girls preferred? Changing patterns of sex preferences in the two German states." *European Sociological Review* 17(2): 189-202.

CEDAW (1999). Concluding Observations of the Committee on the Elimination of Discrimination Against Women: China. New York, CEDAW.

Chan, C. K., K. L. Ngok, et al. (2008). *Social policy in China - development and well-being*. Bristol, The Policy press.

Chen, W. (2007). Induced Abortion and its Demographic Consequences. In Z. Zhao and F. Guo, editors. *Transition and Challenge: China's Population at the Beginning of the 21st Century* (pp 87-107). Oxford, Oxford University Press.

Clark, S. (2000). "Son Preference and Sex Composition of Children: Evidence from India." *Demography* 37(1): 95-108.

Croll, E. (2000). *Endangered daughters: discrimination and development in Asia*. London, New York, Routledge.

das Gupta, M. and M. P. N. Bhat (1997). "Fertility Decline and Increased Manifestation of Sex Bias in India." *Population Studies* 51 (3): 307-315.

das Gupta, M., W. Chung, et al. (2009). "Evidence for an Incipient Decline in Numbers of Missing Girls in China and India." *Population and Development Review* 35(2): 401-416.

das Gupta, M. and S. Li (1999). "Gender Bias in China, South Korea and India 1920-1990: Effects of War, Famine and Fertility Decline." *Development and Change* 30(3): 619-652.

Dong, X.-y., J. Yang, et al. (2007). Women's employment and public sector restructuring - the case of urban China. In O. M. Lee and M. Warner, editors. *Unemployment in China: Economy, Human Resources and Labor Markets* (pp 87-107). G. London and New York, Routledge.

Fan, C. C. (1999). "Migration in a socialist transitional economy: Heterogeneity, socioeconomic and spatial characteristics of migrants in China and Guangdong Province." *International Migration Review* 33(4): 954-987.

Fang, Y.-Q., C. S. Granrose, et al. (2005). National policy influence on women's careers in the People's Republic of China. In C. S. Granrose (editor). *Employment of women in Chinese cultures: Half the sky* (pp 49-83). Edward Elgar Publishing.

Goodkind, D. (1996). "On Substituting Sex Preference Strategies in East Asia: Does Prenatal Sex Selection Reduce Postnatal Discrimination?" *Population and Development Review* 22(1): 111-125.

Greenhalgh, S. and E. A. Winckler (2005). *Governing China's Population: From Leninist to Neoliberal Biopolitics*, Stanford University Press.

Guilmoto, C. Z. (2009). "The Sex Ratio Transition in Asia." *Population and Development Review* 35(3): 519-549.

Guilmoto, C. Z. and Q. Ren (forthcoming). "Birth Masculinity in China Socioeconomic Differentials and Transition Processes."

Haughton, J. and D. Haughton (1998). "Are simple tests of son preference useful? An evaluation using data from Vietnam." *Journal of Population Economics* 11(4): 495-516.

Hill, K. and D. M. Upchurch (1995). "Gender Differences in Child Health: Evidence from the Demographic and Health Surveys." *Population and Development Review* 21(1): 127-151.
Hussain, R. and F. F. Fikree (2000). "The role of son preference in reproductive behavior in Pakistan." *Bulletin of the World Health Organization* 78(3): 379-389.
Kaiser, J. (2005). "Prenatal Diagnosis: An Earlier Look At Baby's Genes." *Science* 309 (5740): 1476 - 1478.
Kazuo, Y. (1989). "A Formal Theory for Male-Preferring Stopping Rules of Childbearing: Sex Differences in Birth Order and in the Number of Siblings." *Demography* 26(3): 451-465.
Larsen, U., W. Chung, et al. (1998). "Fertility and Son Preference in Korea." *Population Studies* 52(3): 317-325.
Lee, C.-F. and C.-F. Chang (2006). The managed fertility transition in rural China and implications for the future of China's population. In D. L. Poston, C.-F. Lee, C.-F. Chang, S. L. McKibben and C. S. Walter, editors. *Fertility, family planning, and population policy in China* (pp 159-171). New York, Routledge.
Leone, T., Z. Matthews, et al. (2003). "Impact and Determinants of Sex Preference in Nepal." *International Family Planning Perspectives* 29(2): 69–75.
Li, J. and W. Lavely (2003). "Village Context, Women's Status, and Son Preference Among Rural Chinese Women*." *Rural Sociology* 68(1): 87-107.
Li, S. (2007). Imbalanced Sex Ratio at Birth and Comprehensive Intervention in China. *4th Asia Pacific Conference on Reproductive and sexual Health and rights*. Hyderabad, India, Accessed 9 September 2009 at http://www.unfpa.org/gender/docs/studies/china.pdf.
Li, S., H. Wu, et al. (2006). "Social Network and Son Preference among Rural-Urban Migrants in China: A Study in Shenzhen [in Chinese]." *Population Research* 30(6): 5-13.
Li, S., C. Zhu, et al. (2004). "Gender differences in child survival in contemporary rural China: A county study." *Journal of Biosocial Sciences* (36): 83-109.
Lofstedt, P., S. Luo, et al. (2004). "Abortion Patterns and Reported Sex Ratios at Birth in Rural Yunnan, China." *Reproductive Health Matters* 12(24): 86-95.
Lü, X. (1997). Minor public Economy: The Revolutionary Origins of the Danwei. *Danwei - the Changing Chinese Workplace in Historical and Comparative Perspective* (pp 21-41). X. Lü and E. J. Perry. New York, M. E. Sharp.
Merli, M. G. and S. Hertog (2010). "Masculine sex ratios, population age structure and the potential spread of HIV in China." *Demographic Research* 22(3): 63-94.
Murphy, R. (2009). Migrant remittances in China - the distribution of economic benefits and social costs. In R. Murphy (ed.). *Labor Migration and Social Development in Contemporary China* (pp 46-72). Abingdon, New York, Routledge.
NBS (1990). Tabulations on the 1990 Population Census [in Chinese], China Statistical Press.
NBS (2007). Tabulations on the 2005 National 1% Population Sample Survey [in Chinese], China Statistics Press.
NBS and EWC (2007). Fertility Estimates for Provinces of China 1975-2000. China Statistics Press, Beijing, National Bureau of Statistics of China and East-West Centre. Accessed 2 February 2010 at: http://www.eastwestcenter.org/fileadmin/stored/pdfs/popfertilityestimateschina.pdf.
OECD (2009, Gender, Institutions and development Database 2009 (GID-DB). Accessed 30 March, 2010 at http://stats.oecd.org/Index.aspx?DatasetCode=GID2).
OECD (2010). Gender Equality and Social Institutions in Afghanistan. Accessed 31 May 2010 at http://genderindex.org/country/afghanistan.
Pande, R. P. and N. M. Astone (2007). "Explaining son preference in rural India: the independent role of structural versus individual factors." *Population Research and Policy Review* 26(1): 1-29.
Park, A. and M. Shen (2003). "Joint liability lending and the rise and fall of China's township and village enterprises." *Journal of Development Economics* 71(2): 497-531.
Purewal, N. K. (2010). *Son Preference - Sex Selection, Gender and Culture in South Asia*. Oxford, New York, Berg.
Scharping, T. (2007). The Politics of Numbers: Fertility Statistics in Recent Decades. In Z. Zhao and F. Guo, editors. *Transition and Challenge: China's Population at the Beginning of the 21st Century* (pp 34-53). Oxford, Oxford University Press.

UNDESA (2006). *World Population Prospects, the 2006 Revision*. New York: United Nations Department of Economic and Social Affairs.
UNFPA (2004). Sex Ratio - Facts and Figures. Beijing, UNFPA
UNFPA (2007). Sex Ratio - Facts and Figures. Beijing, UNFPA
Van Balen, F. (2006). "Attitudes towards sex selection in the Western world." *Prenatal Diagnosis* 26(7): 614-618.
Zeng, Y. (2007). "Options for Fertility Policy Transition in China." *Population and Development Review* 33(2): 215-246.
Zhang, A. (1993). "Poverty Alleviation In China: Commitment, Policies And Expenditures." Accessed 31 March 2010 at http://hdr.undp.org/docs/publications/ocational_papers/oc27.htm.

[i] Today most regions and countries that are known for having or having had skewed SRB have SRB in favour of males. These include China, India, Taiwan, Singapore, and South Korea (UNFPA 2004), and more recently Albania, Armenia, Azerbaijan, Georgia and Pakistan (Guilmoto 2009).
[ii] Afghanistan shares together with China the highest rating for son preference according to OECD. However, the reason for son preference being regarded as strong in Afghanistan is not based on SRB imbalance as such data is not readily available.
[iii] Preference for daughters has in recent times also been noted in some populations, e.g. in Germany and parts of China and Japan (Brockmann 2001), although it has not translated into demographic rates in favour of girls.
[iv] Pre-conceptive sex-selection refers to two methods: 1) sperm sorting where the X and Y chromosomes are separated and subsequently used for in-vitro fertilization (IVF) depending on sex preference of the parents, and 2) pre-implantation genetic diagnosis of embryos resulting from IVF treatment before implantation.
[v] Relatively high TFR here refers to TFR ≥ 3.