Fertility Squeeze and Gender Bias: A Quantitative and Qualitative Analysis of Birth Planning Policy and Sex Ratio at Birth in China

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Abstract

By adopting a multi-method approach, this paper examines the relationship between birth planning policy and sex ratio at birth in China. Analysis of focus group interview and in-depth interview data provides insights on how the policy restrictiveness generates fertility squeeze, and the 1.5-child policy exacerbates gender bias, both leaving people with son preference little choice but to abort female fetuses, particularly the second and higher order fetuses. Analytical results from 2000 prefecture-level and 2005 individual-level data depict an inverse U-shape relationship, while varying by parity, between policy and sex ratio at birth: it is the highest with the 1.5-child policy, followed by a strict one-child policy, and finally two-child policy. Aborting female fetuses meets both the policy demand to have few children and individual demand to have a son. A less restricitve policy without gender bias is, therefore, necessary, while insufficient, to facilitate this ratio back to normality.

Keywords: Birth planning policy; Fertility squeeze; Gender bias; Sex ratio at birth; China

Since the early 1980s, a new phenomenon has emerged in the process of demographic transition among Asian countries or regions with son preference: sex ratio at birth (SRB) were abnormal at some points of time (e.g., Singapore, Korea and Taiwan) or still has been abnormal presently (e.g., Armenia, Azerbaijan, China, Georgia, India, Vietnam) (Mesle, Vallin, and Badurashvili 2007). Among these countries or regions, China has perhaps suffered the most from the abnormal sex ratio at birth in duration, severity, and potentially negative consequences. For example, China's SRB has risen steadily since the early-1980s, from 108.5 in 1982 to 113.8 in 1989, 116.9 in 2000, 121.18 in 2004 (Yang 2009), and 118.06 in 2010 (NBSC 2011), far exceeding the normal range, which is about 102-107 male births for per 100 female births, and much higher than the values of aforementioned countries or regions.

The extremely skewed sex ratio at birth is not merely a population phenomenon, but also an economic, political, and sociocultural phenomenon, mirrioring gender discrimination towards women in the very early stage of life and relatively low socioeconomic status in later life trajectory (Yang 2010). Although the Chinese government has strongly promoted gender equality since the 1950s, a biased gender norm has been jointly maintained by various factors in the reform era.

However, an unequal gender ideology has existed in China for ages, but why did it manifest itself through a high sex ratio at birth most pronouncedly after the early 1980s, when China initiated the restrictive and gendered fertility policy, and launched socioeconomic reform? Is it a coincidence or an inevitable consequence in the new contexts? Socioeconomic transformation raises the cost of childrearing and the demand for "high quality" children; fertility policy has played an inarguably most important role (Qiao 2008) to reduce China's fertility to a very low level in a short period of time, particularly in the early stage of fertility decline. Nevertheless, both transitions did not accordingly erode son proclivity. Ideally, most Chinese prefer two children with at least one son (Mo 2005; Yang et al. 2009; Zheng 2004). This desire led to large families with sons and daughters in the past. Presentaly, birth planning policy generates conflicts between the desired sex of children and limited number of births; meanwhile, the gendered property of the 1.5-child policy (Greenhalgh 1986; Murphy 2003; Short et al. 2001) have appeased, tolerated, and even intensified son preference. Both fertility squeeze and gender bias inherent in the policy may motivate couples to practice sex selective abortion; together with readily available sex determining techniques, they generate more boys than girls, particularly in areas with a 1.5-child policy.

Drawing on multi-method approach, this paper has three purposes. First, it attempts to understand the way by which the policy contributes to the abnormality of the sex ratio at birth by our focus-group discussion and in-depth interviews. Second, it uses survey data to describes the trend, patterns, and characteristics of sex ratio at birth in relation to policy in recent China, a context where fertility decline and economic growth is much faster than the erosion of son proclivity. Third, it disentangles the independent and non-spurious relationship between fertility policy and sex ratio at birth, while taking into account other factors that may relate to the abnormal sex ratio at birth. China presents a unique setting in examining this relationship in that its rapid fertility decline and demographic transition are largely conditioned on the fertility policy. Analytical results emerging from this analysis would have implications for broad issues: How do couples respond to this policy in family building process? How do couples balance their desire between the ideal sex composition of offspring and number of births permitted by fertility policy in the context of strong son preference and socioeconomic transition? How does public policy perpetuate male supremacy in a regime that vigorously promotes gender equality?

Most existing studies tend to compare aggregate sex ratio at birth in pre- and post-policy period, and across regions. This paper highlights fertility squeeze and gender bias, the most salient features of the birth planning policy, in post-policy period to assess their potential effects on sex ratio at birth at prefecture level in 2000 and individual level in 2005. Such approach is innovative. While a high sex ratio at birth has existed in China for over two decades, studies examining closely and directly fertility policy are few (Attene 1009; Yang 2006; Yang 2009; Yang et al. 2009; Zhang 2005; Zhu et al. 2009). With these features, this policy would surely have profound yet divergent impacts on reproductive behaviours. Also, identifying the independent effect of fertility policy on sex ratio at birth is important. Demographic transition, economic development and societal changes have improved people's life opportunities, and challenged traditional reproductive norms. Experience from surrounding countries or regions suggests that as long as people's desire to have a son is retained, the sex ratio at birth could be abnormal in the absence of a restrictive fertility policy. Hence, all else equal, has the policy contributed to the high sex ratio at birth, given that policy variations are largely contingent on local socioeconomic development level and proportion of minority population?

Background

Local variations of fertility policy

An one-child policy was adopted in 1979 to replace the policy of "one is not too few, two is enough, three is too many" initiated in the 1970s. Couples, except for ethnic minorities, were encouraged to have only one child under normal circumstances.[1] However, the policy has not been uniformly implemented, but varied locally and over time since the early 1980s (Peng 1997). It was been strictly enforced in the early 1980s. Since 1982, particularly after 1984, however, it has been gradually relaxed (Greenhalgh 1986; Peng 1997). For example, about 5 percent of rural couples were allowed a second birth in 1982; 10 percent in 1984 and over 50 percent in 1986 (White 1992). On the spectrum of local variations, the state government stressed the

[1] A normal circumstance is defined as: the couples are of Han ethnicity (the majority), and not singletons; children are healthy, etc (see Peng [1997] for details). Note that, exceptions differ for rural and urban couples, and broadened over time.

importance and effectiveness of regulation adjustments at local levels to suit unique regional demands since the early 1980s (Peng 1997), leaving provincial government to administer the policy and monitor its progress. Each province designs and implements its own set of policy based on local demographic, socioeconomic, cultural, and political environments to most effectively reduce fertility (Merli and Smith, 2002), leading to substantial local policy variations (Guo et al. 2007).

Three salient characteristics of fertility policy emerge. The first pertains to the strictness of the policy, which requires Chinese citizens to have only one or two children except for some minorities. Such regulation presents strongly limits to the number of children people can have. The second relates to the three major variations of policy across provinces: strict one-child policy (1-child policy thereafter), 1.5-child policy,[2] and two- or more-child policy (2-child policy thereafter), covering 35.4 percent, 53.6 percent and 11 percent of China's total population, respectively (Zhang 2007).[3] This suggests that couples in different places are entitled to diverse policy rules. The third refers to the gendered property of the policy, which is a built-in feature of the 1.5-child policy: couples are allowed to have a second birth if the first child is a daughter in the countryside, provided a 4- or 5-year interval. Hence, while the 1-child policy and 2-child policy only prescribe the number of births, the 1.5-child policy involves in the number, spacing, and gender of the first child, and it sets the precondition to have a second birth based on the sex of the first child. The gendered property of the policy, together with its strictness, would have implications for the abnormal sex ratio at birth.

Profile of sex ratio at birth in recent China

A normal sex ratio at conception is about 120 male fetuses for every 100 female fetuses (Overfield 1995), and the normal sex ratio at birth is about 102-107 male births for every 100 female births. While more male infants were born than female infants, the slightly higher male mortality rate makes sex ratio in reproductive ages largely balanced. Conversely, once sex ratio at birth has been abnormal for a longer period of time, it may cause imbalanced sex structure in the age of marriage and thereafter, and thereby generating unwanted consequences for individuals, the family and the society (Yang et al. 2009).

The sex ratio at birth in China has exceeded 107 for nearly 30 years. Globally, China is neither the first nor the only country with an imbalanced value. In the context of son preference, a high value is almost an inevitable problem with socioeconomic

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[2] The 1.5-child policy first emerged in November, 1985, when Wei Wang, the former Deputy Minister of NPFPCC, gave a talk “On Family Planning Issues” at the the Party School of the CCCPC. He mentioned that the policy would allow peasants “whose first child is a daughter to have a second child.” No government document calls this policy as “1.5-child policy."

[3] Variations always exist within each policy rule. Sichuan and Jiangsu provinces which implement an one-child policy, for example, still allow couples to have a second birth (Zeng 1989; Zhang 2005).

transformation and demographic transition, as shown in Korea (Park and Cho 1995; Shi 2004; Yin 2007), Taiwan (Shi 2002), India (Curtis et al. 2005; Das Gupta and Bhat 1997; Sen 1990), Bangladesh (Bairagi 2001), Vietnam (Haughton and Haughton 1995; Guilmoto et al. 2009) and some west Asian countries (Mesle et al. 2007). Figure 1 describes sex ratio at birth in recent years in Korea, Taiwan, Vietnam, India and China. While they have all experienced earlier or later an abnormal value, China has suffered most judging from the duration and severity.

(Figure 1 about here)

The extremely high value in China is closely yet inversely linked to the rapid reduction of fertility rate, largely results from the effective fertility policy, which is much restrictive than fertility programs implemented in Taiwan, Korea, India and Vietnam (Seltzer 2001). The high sex ratio at birth occurs when China's economy developed, and fertility rate fell rapidly. As depicted in Figure 2, sex ratio at birth goes up while fertility goes down over the past 50 years, with a correlation of -0.756. Overall, prior to 1980, it tended to be normal; after 1980s it has steadily risen, which is in sharp contrast with the downward trend of crude birth rate; and when the policy was tightened up, sex ratio at birth surged.

(Figure 2 about here)

Literature on fertility policy and sex ratio at birth

The above patterns clearly indicate a connection between excessive boys and fertility policy. However, current studies on the relationships between fertility policy and sex ratio at birth do not reach a consensus. Some argue that the policy per se (Cai and Chen 2005; Cai 2009; Gao 1995; Yuan and Shi 2005) and its local variations (Cai 2009) were both unrelated to sex ratio at birth, because India, Korea and Taiwan without restrictive fertility policy, and some minority groups with a 2-child policy in China also had a skewed value (Cai 2009:41). Most, however, believe that the policy is related to the sex ratio at birth, either causing or worsening its abnormality (Assche 2004; Banister 2004; Chen 2008; Greenhalgh 1986; Hull 1990; Liu 2009; Zeng et al. 1993; Zhou 2005) by limiting the number of births (Chen 2008; Gu and Roy 1996; Li 2005; Mu 1995, 2008; Tang 2006; Yang 2009; Yang et al. 2009) or intensifying gendered bias (Qian 2005; Yang 2006, 2009; Yang et al. 2009; Zhang 2005; Zhu et al. 2009), particularly for the second birth (Li 2008; Yang 2006; Zhang 2005). When the first child was a son, the sex ratio of the second birth was 101.1, while it was 126.4 if the first child was a daughter (Qiao 2008).

While existing studies have acknowledged the importance of fertility policy for sex ratio at birth, many issues remain unaddressed. First, most examine their linkage based on reasoning, rather than on empirical analysis. Is fertility policy linked to sex ratio at birth, all else equal? Gu (2007) has rightfully argued that excessive boys results from the interplay of multiple forces: a cultural setting of strong son preference, low socioeconomic development, rapid fertility decline, and fertility policy focusing on reducing fertility. This suggests that it is difficult to assert the net contribution of the policy to the abnormal sex ratio at birth without considering other factors. Second, some study only differentiates the 1-child policy from other policy rules without identifying the 1.5-child policy (Guo 2007). Given what has been depicted above and the gender bias of the policy, it would miss one of the essential points without singling out the 1.5-child policy in explore the association of fertility policy with excessive boys in China. It is neither the strictest policy nor the most relaxed policy, but the 1.5-child policy that is linked to most boys. Third, some studies analyze their linkage only using aggregate (i.e., prefecture or province) data (Attane 2009; Guo 2007; Zhang 2005; Zhu et al. 2009). Such approach is necessary but insufficient; it is individual who selects boy, as a coping strategy in family building process, given that it is more difficult to have out-of plan births than to select a son under current policy environment. It is thus necessary to look more closely on individual reproductive behavior.

Data and Method

We integrate quanlitiative data, and data from focus group interview and in-depth interview to formulate analytical framework and improve model specifications. The quantitative data come from China's 2000 census and 2005 National One Percent Population Survey (also known as mini-census). With large sample size and being nationally representative, they meets the requirement to calculate reliable sex ratio at birth. The 2000 census data are used at the aggregate level to describe the average characteristics of sex ratio at birth at prefectures[4] in relation to fertility policy. About 338 prefectures entered the analysis after eliminating cases with missing values. The 2005 data are based on the 25,300 respondent women who reported a birth one year prior to November 1, 2005, the survey date. This individual-level analysis aims to explore the associates of women's reproductive behavior that may mirror their responses to the policy, net of other factors, which enables us to better assess strategies that women adopted to cope with the policy in family building process.

These two datasets are complemented by data of policy fertility or authorized fertility (Attane 2009) at prefecture-level unit (prefecture thereafter). Policy fertility is the direct indicator of fertility policy: if couples in a given prefecture followed the applicable policy and have corresponding number of births, the fertility in that prefecture would be policy fertility (Zhang 2005). The policy fertility data, collected by the NPFPCC for each of the 343 prefectures in 2000, is merged with the 2000 data of prefecture sex ratio at birth and 2005 individual data.

Data from six focus group discussions (with a total participants of 36) and 60 in-depth

[4] A prefecture is an administrative unit under the jurisdiction of the province that are heterogeneous geographically, socially, economically, and demographically. There were 345 prefectures in 2000.

interviews, colleccted in towns and villages in two provinces in 2008 and 2010 were desinged to suppliment quantitative data and explore decisionmaking related to response to the policy in reproduction in greater depth. These sites, Ezhou city in Hubei province, and Wenzhou City in Zhejiang province, are both prefecture-level cities implementing a 1.5-child policy. Ezhou is an agriculturally-based city with a medium-level development, and a sex ratio at birth value of 178 in 2000 (the highest across prefectures). Wenzhou has been one of most developed areas in China, but its SRB was also high, 128 in 2000, and 127 in 2009.

In each site, there were 3 focus groups and 30 in-depth interviews. All of the interviews featured similar questions on four aspects: desired number and sex of children, interpretation and response (e.g., sex selective abortion) to the policy, concerns in the absence of a son, and awareness of the consequences of abnormal sex ratio at birth. Particular emphasis of focus group and in-depth interviews varied. Focus groups had township family planning cadres and village family planning liaison, and more questions related to fertility policy were asked. Participants of in-depth interview were women, husbands, and grandmothers; questions on fertility desire, sonless concerns, and behavioral responses to the policy were the focus. Taken together, these interviews contrasted people in different positions or roles, generations, and rural and town context. While we have found unique cases, the findings were more common than difference, and our analysis below will highlight commonalities. The consistent responses to our questions in different sites enhanced our confidence in drawing conclusion from this analysis.

A multi-method analysis is adopted in this study. Interview data are first analyzed to explore the decisionmaking related to fertility policy and reproductive behavior. Then, we use the 2000 census data to plot prefecture-level sex ratio at birth against policy fertility, and model the linkage between policy and the likelihood of having a boy with the 2005 individual women data. The combination of multiple types of data strenghtens our ability to develop appropriate analytical framework, causality and measurements in this work. We analyze the in-depth interview data to determine the interpretations of the policy and decisionmaking of women and their families in family building. We use focus group interviews to understand whether family planning cadres and liaisons share similar view on fertility policy and their interpretation of women's responses to the policy. The use of these data improves our ability to attend to the causal concerns between fertility policy and sex ratio at birth, and address the potential endogenous problems (i.e., both policy variations and the high ratio are caused by son preference and economic development). We confirm that son prefernce is further reinforced by 1.5-child policy, which is interpreted as a policy encouraging couples to produce a son, and that the fertility squeeze and reduced fertility desire are driving forces to use sex selecctive abortion. Sex selective abortion is a common practice for the second or higher order birth, particularly when the first child is a daughter. This is the key finding for modeling the relationship between fertility policy and the likelihood of having a boy, suggesting that the effect of fertility policy on sex ratio at birth will be more appropriately measured with an interaction of fertility policy and birth order.

Fertility squeeze and gendered bias: A qualitative approach

China's distorted ratio has a lot to do with the rapidity of fertility decline and the downward change in desired family size along with persisted son preference. Studies have suggested that couples prefer a son for family line continuation, economic support, property inheritance and mother's status, among other utilities, but their capacity to do so is constrained by the policy.

If we want to understand how fertility squeeze may affect individual fertility behaviors, we need to know their desired family size. Like in many other places, the answers were almost unanimous in these two sites. While young people do not want many children due to the high cost of childrearing, it does not mean they want only one child. A common expression is that single children is too lonely; two children are the best. Further, people do not simply want two children, but want them with certain sex composition. The best sex composition of children is unanimously a boy and a girl. Responses to "two boys" were diverse, but no people said that they prefer to have "two girls". Since the two sites implement a 1.5-child policy, many people are entitled to a second birth, and hence, for the sex of the first child, either sex is acceptable. For the sex of the second child, it depends on the sex of the first child. If the first child is a daughter, having a son for the second child is a must:

> *My first grandchildren is a girl. My daughter-in-law plans to have another child. I want them to have a grandson; … I have a son, my door has been opened. When my husband passed away with regret because he did not see a grandson, my son promised him that he would definitely have a son to keep his door open* (a 57-year-old grandmother).

> *If the first child is a daughter, people will try all means to have a son; if the first two children are daughters, they will try a third time.* (Then the woman pointed to a house three doors away) *See that house? Its door was forever closed. The owners of the house passed away; they did not have a son, and their daughters were married out. In their funeral, only their nephew carried their deedees. How sad it was! We all feel sorry for them. And their housing land will be given away in land redistribution. Now technology are so advanced, we can make choices. … One son and one daughter is the best, two sons are acceptable, but two daughters are absolutely not* (a 32-year-old woman with two children).

Evidently, local people are very aware of the birth planning policy, and know how to cope with it. In response to our qustions about the policy, cadres, liaisons, women and husbands openly expressed their interpretations, and all believed the policy unfair to female fetuses, and sets conditions for people to select the sex of children:

Either all couples are allowed to have only one child, or all are allowed to have two children. The precondition for the second birth is unfair. If it is not a discrimination towards girls, then what it is? (we asked here if his village or surrounding villages had more boys than girls) *Is this obvious? If the first child was a daughter, they would select the sex of the second child; but if the first child was a son, they could not legally have another birth. It would be surprising if no more boys than girls* (a 35-year-old husband with a daughter and a son).

Having boys satisfies the desire and expectations of family members, but having a daughter does not. Then, what to do with this? The solution is to allow you to have another child. Clearly, the government policy is of gender inequality, discriminating daughters (a 28-year-old woman with a son).

The policy itself is unfair. Without the policy, most people just want two children. But why should couples are allowed to have a second birth if the first one is a daughter, while those whose first child is a son are not? (a 36-year-old township family planning cadre, male).

There is no doubt that the overall increase of the sex ratio at birth is driven by an increase in the prevalence of sex selective abortion among births, particularly the second one. Aborting female fetuses is highly acceptable with low costs economically, morally and emotionally compared to female infanticide and abuse, and therefore has become the best way to realize fertility desire. In the past, people practiced female infanticide or abuse, or gave daughters away, in order to have a son. Presently, these post-natal methods were replaced by pre-natal sex selective abortion. Since a fetus is not regarded as a human being in China, aborting it is not considered as immorality. However, China has explicitly banned prenatal sex examination and sex selective abortion for non-medical needs, and set it illegal for health practitioners to do so. Nevertheless, this does not stop these behaviors, and people find ways to beat the system.Additionally, the advancements and covertness of the techniques for sex check have facilitated the realization of having a son. We got the following answers to our question of "How can people know the sex of fetuses and then abort female ones since they have been strictly prohibited":

In pregnancy checks, health practitioners need not to directly tell women the sex of the fetus, but do so in a way without violating the regulations. They uses jargons, default words or gestures by which the sex of the fetus is told. For example, if doctor says, "the fetus is malpositioned, maldeveloped, or has inadequate amniotic fluid, " the woman knows it is a girl. If doctor says, "the fetus is all normal," and tells the women to be well prepared for delivering the baby, then she knows it is a boy. What can you do? The doctor does not violate policy regulations (a 32-year-old local family planning cadre, male).

Now, it is much easier to manage woman whose first child is a daughter than those *whose first child is a son. Why should the sex of the first child make a difference? This makes our family planning work much harder. Women take advantages of it, saying that "if it was not let me have a son, why was there this policy?" Particularly, the requirement of a 4-5 year interval between the two births provides people with opportunities to select the sex of the second birth. Women get pregnant earlier in the interval. A son will be kept, but a daughter will be reported to me as a failure of contraception and aborted without penalty* (a 30-year-old village family planning liaison, female).

In addition to ultra-sound check, there are other ways to determine the sex of fetus, including amniocentesis, folk prescription, and taking medicines to change the pH values of the body in order to create a favorable biological environment to conceive a son. Methods diffuse fast among reproductive women and their families. To ensure a boy, some women use various methods:

I should not let my daughter-in-law to get pregnant blindly without knowing its sex of the fetus. In two-months of pregnancy, she tried amniocentesis. This is to change the pH values of her body to create a favorable condition for male fetus. After she was pregnant, she did ultra-sound check. The sex of the first birth is less important, but the second birth has to be a son. These two methods provide double guaranttes to have a son. We did not take medicine; it is harmful for fetus's brain. Amniocentesis has 90% accuracy and is harmless (a 49-year-old grandmother).

Clearly, findings from interviews indicate that in these two places, like in other places, son preference remains strong, and serves as the fundamental force driving sex ratio at birth abnormal; and readily available sex check technologies make this preference possible. Fertility policy comes between the two such that it generates fertility squeeze by limiting the number of births and intensifies gender bias by setting the condition for having a second birth.

China's restrictive fertility policy makes fertility decline too fast and fertility level too low in a short period of time, which leaves people little choice in number of children. This leads to conflicts of fertility desire and permitted number of births, generating fertility squeeze. In other settings marked by son preference and a recent transition to lower fertility or where demand for children drops faster than the demand for a son, most couples are able to balance their desires for preferred sex of offspring. By contrast, fertility policy makes China's context of reproduction somewhat unusual. Its present low fertility is partially state-enforced; couples' ability to control their own family building is limited (Short et al. 2001). When people with son proclivity are allowed to have only one or two children, having a son accommodates both parents' sex preference for sons and the small family regulations. That is, fertility squeeze motivate couples to select the sex of children, yielding high sex ratio at birth.

The gendered property of the policy may intensify people's desire to have a son, and thereby making gender bias more pronounced, although the policy has attempted to improve gender equality. The 1.5-child policy has legitimated and perpetuated son preference by officially and legally allowing couples with a daughter to have a second birth, while couples with a son as the first child are required to stop childbearing. Although “it is not to discriminate girls, but to better attend to the need and hardships of rural households with only daughters in farmland” (Wang, cited in Peng 1997:322), setting such condition for a second birth declares to the public that a daughter and a boy are unequal or a daughter equalizes to half a son. Evidently, it has misguided people's reproductive desires, and been interpreted as an unfair policy that encourages those without a son to have a son. The interplay and intersections of fertility squeeze and gender bias of the policy motivate people to take advantage of the policy by selecting the sex of children, particularly the second or higher order births.

Sex ratio at birth and fertility policy: A quantitative approach

In this section, we present descriptive statistics and a series of models to explore statistically how sex ratio at birth might be linked to fertility squeeze and gender bias. Our variable selection and definitions are guided by above findings. If we find more boys in places with a strict policy or with 1.5-child policy, we may consider it as an squeeze effect and gender bias effecct, respectively. The absence of direct meausres of son preference and sex selective abortion in the data presents caveates to our assertion, although the latter will not pose problems to our assumption.

Variables

Dependent variables: The dependent variable of this paper is sex ratio at birth. For 2000, it reflects prefecture average values from the tabulations of each prefecture, while in the 2005, it refers to the sex of the births born one year prior to the survey, gauged as the likelihood of having a boy for respondent women.

Key predictors: This work features fertility policy; the key is to identify appropriate indicators to measure fertility squeeze and gender bias of the policy. Several variable are used.

Policy fertility: It refers to the fertility permitted by the policy, which is a quantitative summary of China’s current fertility policy on the basis of diverse prefecture-level fertility policies, and serves as a reference for evaluating China’s policy implementation (Gu et al. 2007). Using policy fertility to proximate fertility policy is appropriate: the policy fertility data was collected in July 2000, while the sex ratio at birth was based on births between October 31, 1999 and November 1, 2000, and the sex of the latest births born between October 31, 2004 and November 1, 2005. There is a clear temporal order between the two factors. Policy fertility was calculated by using fertility policy information from local areas. There are two types of classifications on fertility policy, one is by Guo et al. (2003),[5] and the other by Zhang

[5] Guo et al.’s (2003) classification slightly differs: they classify policy fertility as 1.0-1.3, 1.3-1.5, 1.5-2.0, and greater 2.0, which refer to 1-child policy, the mixture of 1-child policy and 1.5-child

(2005). Following Zhang (2005), this paper measures policy fertility as three categories: <1.3, 1.3-1.59, and >1.6, to proximate fertility policy. When policy fertility is lower than 1.3 child per women, about 90 percent of the population in corresponding areas are subject to 1-child policy; when policy fertility falls between 1.3 and 1.6, approximately three-fourth of couples with a daughter are allowed to have a second birth, and when the policy fertility is over 1.6, two-thirds of the population are allowed to have two or more children.

Parity of the new baby: Policy fertility is directly linked to parity progression. On the one hand, a strict policy implies fewer higher order births; on the other hand, higher parity might be associated with a higher sex ratio at birth, particularly in 1.5-child and 1-child policy areas. To test this, parity of the new births is included in analysis.

Composite measure of policy fertility and parity: In addition to the single measures of policy fertility and parity, a composite variable combining the two is created to gauge simultaneously their effect on the dependent variable. For simplicity, parity is collapsed into parity 1 and parity 2 (including higher parity) in the composite measure. It contains six categories. This choice mirrors my thought that substantive understanding of the relationship between fertility policy and sex ratio at birth is contingent on partiy.

Presence of an older daughter: The sex of later births is largely conditional on the sex of previous births (Gu and Roy 1995; Liu 2008; Yang 2009; Yang et al. 2009; Yang and Wang 2006). That is, the presence of an older daughter might be an important determinant of the sex of the new birth. Hence, to predict the sex of the second births, the presence of an older daughter is used. To some extent, the sex of the new births reflects women's attitudes toward sons and daughters, their selection of the sex of children and coping strategy to the policy.

Control variables: Sex ratio at birth is determined by a wide variety of factors, as existing studies and our in-depth interviews suggest. Investigating its net relationship to fertility policy requires controlling for relevant factors. Given data availability, this paper holds constant mothers' demographic characteristics (e.g., age, ethnicity and rural residence), socioeconomic background (i.e., education and social securities), as well as family structure and household economic status. Different ethnic groups have divergent fertility policy, and the policy regulations take into account minority composition in each province. A rural residence tends to be associated with lower opportunity costs of childbearing and childrearing, and peasants adhere to stronger son preference (Xie 2002; Yang 1994). Conversely, education increases job options and earnings for women, raises opportunity costs of childrearing, and challenges traditional sexist notions of male supremacy and son preferences (Clark 2000). Thus, education is found to be inversely related to sex ratio at birth (Lavely and Freeman

policy, the mixture of 1.5-child policy and 2-child policy, and 2-child policy, respectively. Sensitivity test indicates that the results of these two codings are very similar.

1990). However, better-educated mothers might be more informed on and have easier access to sex-selective abortion, generating more sons than daughters in China (Yang 2006), India (Arokiasamy 2007; Bhat and Zavier 2007), Vietnam (UNFPA 2009), and Korea (Chung and Das Gupta 2007). To explore the effect of education on sex ratio at birth in 2005, mother's education is included in analysis.

Son preference is not merely an issue of culture, but also a practical consideration. Our interviews, and studies inside and outside of China, have found that people want to have sons largely because, in addition to keeping family line continued, a son has been securities in old ages and disasters (Yang 2008). Having medical insurance and old age pension might alleviate peoples' concern for old ages and risk times, and thereby weakening their desire for sons. Conversely, a higher percent of elderly relying on family members for support is associated with a higher sex ratio at birth (Attane 2009). This paper controls the two social securities.

With regard to household context, two variables, extended family and household economic status, are included in analysis. The former, together with education, is used as a proxy of culture, while the latter, together with social security, is utilized as a proxy of development. Whether a household is a nuclear or extended one affects women reproductive behavior (Yang and Short 2007). In traditional households where women co-resided with parents, pressures to have a son largely came from the older generation, particularly in rural China. Presently, family comprising of three or four generations is also linked to a higher sex ratio at birth (Attane 2009). In our interviews, younger women expressed strong pressure to have a son, while older generation women expressed the inflexible demand to have a grandson. With regard to household economic status, the 2005 data contain information on women's income and occupation, but for respondents in the countryside, occupation tends to be missing and income tends to be 0, render them unusable given that 80 percent of respondents locate in rural areas in the sample. Rather, I use the index of household economic status created by factor analysis, consisting of unweighted sum of 7 items, including building materials of the house, rooms per capita, size of per capita, access to tap-water, types of kitchen, toilet and shower. Studies on India and Vietnam find no effect of household wealth on sex ratio (Das Gupta 1987; Haughton and Haughton 1999). In our interviews, we found that wealthier households, notably in Wenzhou City, are able to afford fines for extra births, particularly for a son, and have strong incentives to have a son for managing household business and property inheritance.

Definitions and univariate statistics of all variables used in this analysis are presented in Table 1. As it shows, prefecture sex ratio at birth was 116.81 in the sample in 2000, and the proportion of boys was 54.59 in 2005, corresponding to a sex ratio at birth of 120.2. Among the sampled women, about 27.59, 56.46, and 15.96 percent resided in 1-child policy, 1.5-child policy and 2-child policy areas, respectively. Among the 25000 births, about two-thirds were the first birth, and the proportion of parity 3 was rather low, accounting for less than 5 percent (n=1172). About 18.6 percent of women had an older daughter (10 percent with an older son -- results not shown here). There were also substantial variations among mothers in demographic and socioeconomic background, as well as household context.

(Table 1 about here)

Analytical approach

In the following section, I first analyze the prefecture data and then the individual data. In the individual-level analysis, policy fertility is measured at prefecture level, suggesting a hierarchical data structure where individual women are nested within prefectures. Consequently, two-level, random-intercept models are applied in modeling the relationship between the likelihood of having a boy and policy fertility, treating prefectures as level 2 and individuals as level 1. This approach can effectively handle the potential violation of independence among observations due to clustering in the same prefecture, one of the most important assumptions underlying traditional regression models, and corrrect possibly downward bias in standard errors and overstatement of the significance of independent variables. It also takes into account unobserved or unobservable heterogeneity across prefectures, and generates unbiased parameter estimates (Singer 1998).

Prefecture-level sex ratio at birth in relation to policy fertility in 2000

Figure 3 depicts sex ratio at birth by fertility policy and parity in 2000. Several salient findings are summarized as follows. First, when all births were considered, the ratio was abnormal, regardless of policy fertility, but prefectures with a 1.5-child policy had the highest sex ratio at birth (119.2), exhibiting an inverse-U shape of sex ratio at birth and policy. Second, when parity was accounted for, the value of the first birth was inversely related to the strictness of the policy: normal in 2-child policy areas (103.2), close to normal (108.4) in 1.5-child policy areas, and abnormal in 1-child policy ares, 111.0. This implies that the abnormality of the first birth is largely contributed by the high sex ratio at birth in 1-child policy area. Such findings seem intuitive. The sex of the first child is more important in 1-child policy areas than for 1.5-child and 2-child policy areas for those with a son preference since it is both the first and the last birth. Third, the value of the second birth in 1.5-child policy prefectures was the highest, 166.2. These patterns suggest that both fertility squeeze and gender bias are related to this ratio.

(Figure 3 about here)

The national average may disguise regional heterogeneities. Looking closely at the ratio, we found substantial variations across prefectures, as Figures 4 illustrates. Several features deserve mentioning. For example, many prefectures had a high value in 2000, and the highest value occurred in prefectures with a policy fertility around 1.5. Also, while about half prefectures had a normal value for the first birth, regardless of policy fertility, the value of the second birth rose dramatically. These further quantitatively confirm that an abnormal sex ratio at birth is mostly seen with the second birth, and that fertility squeeze and gender bias of the policy are closely linked to the distorted ratio.

(Figure 4 about here)

Models linking fertility policy and the likelihood of having a boy in 2005

While the above analysis support the fertility squeeze-gender bias model from macro perspective, a high sex ratio at birth is driven, at the bottom line, by individual choice. Painting a broad picture, while necessary, is insufficient to understand, quantitatively, individual responses to fertility policy. Next, we turn to micro-level analysis, the risk of having a boy in 2005. First, a bivariate analysis of the proportion of boys in relation to policy fertility, parity and the combination of the two, as well as the sex of the first child is conducted. The patterns illustrated in Figure 5 are similar to that of the macro data -- that is, the proportion of boys was curvelinearly linked to policy fertility where 1.5-child policy areas had more boys than 1-child policy and 2-child policy prefectures. The proportion of boys for parity 3 was 10-percentage-points higher than that of parity 1. With regard to the composite variable of parity and fertility policy, we found that the proportion of boys for parities 1, 2 and 3 in 1.5-child policy prefectures were all higher than corresponding values in other policy areas, although the difference of parities 2 and 3 between the 1.5-child policy and 1-child policy areas is very small. The percent of boys for those with an older sister was 65.3 percent (equal to a ratio of 188.2). Such findings further corroborates a close linkage between fertility policy and reproductive behaviours. When other factors are controlled, will these patterns hold? We Now turn to multivariate and multilevel analysis.

(Figure 5 about here)

Table 2 presents results from five hierarchical models for the full sample and by parity. The full sample and parity 2 each has two models, one with single measures of policy fertility and parity, one with composite variables of the two. When all samples are considered, policy fertility is linked to the response variable in an inverse U shape -- compared with women in prefectures with a strict policy, those residing in places with a 1.5-child policy had a significantly higher, while their peers in 2-child policy areas a significantly lower probability to have a boy. What this suggests is that a 2-child policy is associated with the lowest sex ratio at birth, while a 1.5-child policy is linked to the highest sex ratio at birth. As expected, the risk of having a boy went up with parity: the probability of having a boy for the second and third births was 48 percent ($\exp^{(0.39)}$) and 86 percent ($\exp^{(0.62)}$) higher than that of the first birth, respectively, and the parity effect on the response variable is much large than policy effect, judging from the size of coefficients. The interactions of policy fertility and parity illustrated a clearer picture that policy had a stronger impact on the second and higher order births. Compared with parity 1 in 1-child policy areas, only parity 1 in 2-child policy areas had a lower likelihood of boy (not significantly), and rest categories all had a higher risk of having a boy, particularly for parity 2 or higher parity. Such finding implies that part of the policy effect on the outcome variable is taken away by parity, and that the policy affects the outcome variable partly through affecting parity.

(Table 2 about here)

When the samples were decomposed by parity, policy fertility affected the risk of having a boy for parity 1 the same way as it did for the full sample, but the magnitude changed -- the effect of 1.5-child policy was strengthened and maintained significant, but that of 2-child policy was attenuated and no longer significant. This implies that people even select the sex of the first child in such policy areas. For parity 2 or higher parity, when policy was jointly considered with parity, we found that higher parity in both 1-child policy and 1.5-child policy areas was associated with a significantly higher risk of being boys than those in 2-child policy areas. Similarly, compared with parity 1, higher parity had extremely higher risk of being boys, as the coefficient of Parity 2 in Model 3a indicates. Moreover, having an older daughter yielded a much higher probability to have boys for the second birth. In model 3b, the effect of interactions of policy and parity on the outcome variable is as expectation: as of parity 2, there are significantly more boys in 1-child and 1.5-child policy prefectures than in 2-child policy prefectures.

Among control variables, age is a significant predictor of the outcome variable: an older age is related to a lower risk of having a boy. This may imply that selection of the sex of children occurred in the early stage of reproductive years. This is consistent to our in-depth interview in Hubei and Zhejiang, where many people tended to have a boy as early as possible in order to finish the obligation to continue family line and feel secured. No ethnic differnce in this regard is found, all else equal. The impact of education on the outcome variable was positive: as levels of education went up, the likelihood of having a boy also rose. Such finding may be counterintuitive, but it confirms finding using other data sources. For example, Yang (2006) used multiple waves of China Health and Nutrition Survey data and found that a higher education was associated with a higher percent of boys at the community level. Such finding is also consistent with studies in Bangladesh (Alam and Bairagi 1994), India (Arokiasamy 2007; Bhat and Zavier 2007) and Korea (Chung and Das Gupta 2007) and Vietnam (UNFPA 2009). The positive linkage relates to the prior knowledge of the sex of the child, confirming that sex determination technology as a tool to decide about the fate of a pregnancy is similarly prevalent among better educated women, not just among those less educated who are supposedly hold unequal gender norms. This challenges the viewpoint that improvements in education along would necessarily help this value return to the normalcy.

Conversely, if the mother had old-age insurance, her risk of having a boy significantly reduced for parity 2. This is consistent with findings from Ebenstein and Leung (2009). Another variable that deserves mentioning is family structure: extended household co-residence is associated with more boys. While household economic status is not significant related to the outcome variable, they are positively linked, suggesting that the relationship between development and sex ratio at birth might be non-linear, and development does not necessarily guarantee a balanced sex ratio (Gu and Roy 1995; Yuan and Shi 2005).

Summary and policy implication

In settings without son preference, the sex ratio at birth is largely determined by physical and biological factors, while in context with strong son preference, many female fetuses have been aborted, generating excessive boys. The extremely high sex ratio at birth in China in recent decades vividly illustrates that the two sexes do not enjoy equal rights to be born in transitional china, and that gender inequality occurs at the very beginning of individual's life course. Since this ratio has escalated after the onset of the birth planning policy, the policy has been suggested as an ignorable driving force. Utilizing multiple methods, this study evaluates the potential effect of fertility squeeze and the gender bias inherient in the policy on sex ratio at birth. Our in-depth interviews and focus-group interviews set the basis for formulating analytical framework and improving model specification. Women and their families expressed the desire to have a son by all means for the second child if the first child is a daughter in the context with low fertility. Interviewees also explicitly commented that the 1.5-child policy treats girls as half of boys, and is a policy that encourages women without a son to produce a son. They take advantage of this policy and use it as a strategies to realize their fertility desire by selecting the sex of offspring, which meets both the policy regulations on the number of births and their demand for a son.

Evidently, the difference in sex ratio at birth across diverse policy regions and parities is quantitative, rather than qualitative. Prefecture-level analysis of sex ratio at birth and individual-level analysis of the likelihood of having a boy both indicate that fertility squeeze and gender bias of the policy generate more boys than girls: an abnormal value is observed with all parities in all policy territories in 2000 and 2005. However, the extent of abnormality differs: a more balanced value is achieved in places where the policy is less strict (i.e., 2-child policy), while a more skewed value is detected in places where the policy is biased (i.e., 1.5-child policy), suggesting an inverse U-shape relationship of the policy to sex ratio at birth. Also, policy effect on sex ratio at birth is largely contingent on parities: while it is related to all births, it affects the second or higher order births more than the first one. When parity and policy are jointly considered, the varying effect of policy by parity becomes clearly. All else equal, the 1.5-child policy is associated with more boys than other policy areas for all parities. Since regardless of the sex of the second child, couples are required to stop reproduction, those who are determined to have a son would try all means to reach this goal, generating more boys among the second children in prefectures of 1.5-child policy. Similarly, if the women had a daughter as the first child, her risk of having a son as the second child doubles.

Son preference perpetuated by this public policy renders the strenuous efforts minimal taken by the Chinese government to curb the sex ratio at birth from further escalating in recent years (Tan 2008). One policy implication to reduce the sex ratio at birth is, therefore, to reformulate the policy to be less strict without gender bias. Such policy would not only contribute to a lower sex ratio at birth, but more imporantly, it will no longer be a legitimate source of gender bias. As we have seen, the 1.5-child policy has confused the public about gender ideology: on the one hand, it vigirously promotes "Boys and Girls Are the Same," while on the other hand, it allows people with a daughter to have another birth. By doing so, it confered people reasons to practice sex selection. However, relaxing the policy per se cannot bring the ratio back to normal, since the 2-child policy areas have also had an imbalanced value. Similarly, greater affluence and better education are not effective solutions, as the findings suggest. In fact, wealthy households may determine to have a son for property inheritance. Better educated women may hold a more equal gender norm, but it is not sufficiently strong enough to combat son proclivity. Rather, increasing access to old-age pension makes people less dependent on sons to provide security in old ages (Winkler 2002),alleviate son preference, and thus reduce sex ratio at birth, as indicated by this study and other studies (Ebenstein and Leung 2009; Yang 2008). Additionally, advocates and campaigns of promoting gender equality remain important (Ma 2011, cited in NSBC [2011]), a factor not examined here.

While our interest is in the relationship between fertility policy and sex ratio at birth in China, findings emerging from this analysis have implications for broad issues of gender equality in China, as well as in other settings. Gender inequality rooted in patriarchic, patrilineal, patrimonial, and patrilocal system, has been the fundamental driving force for high sex ratio at birth, which is hard to be eradicated. When intersecting the birth planning policy, it has been again legitimated in the reform era, and made the struggle between individual families and the state institution more intense. As a rational response to maximize children's utility, the policy has been widely utilized as a strategy to compensate for the reduced number of children and achieve the ideal sex composition of children (Yang, Chenggang 2009). When people are allowed to have or prefer fewer children but do not treat boys and girls similarly, and when couple's ability to control the sex composition of offspring is greater than their ability to control the ideal number of children, policy squeeze and gender bias intensify sex ratio at birth. All of these point to the decisive importance of gender ideology in sex ratio. Without ameliorating such gender norms, striving for lowering sex ratio at birth in China would require allowing couples to have as many tries as needed to have a son. But gender ideology is slow to change, which requires efforts not merely targeting sex selections, but also targeting inequalities throughout the entire life course of women. Only when people voluntarily possess an equal gender ideology, can sex ratio at birth gradually return back to normalcy. Patience is needed to witness such transition.

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Table 1. Variable Definitions and Univariate Statitics [1]

	Variable Definitions	Prop/Mean	Freq.
Dependent variables			
Sex ratio at birth in 2000	Prefecture sex ratio at birth	116.81	343
Likelihood of having a boy in 2005	1=The newborn child is a boy; 0=otherwise	54.59	13812
Key predictors			
Prefecture policy fertility in 2000			
<1.3 (1-child policy)	1= The prefecture has an authorized fertility less or equal to 1.3 child; 0=otherwise	27.59	6905
1.3-1.6 (1.5-child policy)	1= The prefecture has an authorized fertility of 1.3-1.6 child; 0=otherwise	56.46	14132
>1.6 (2-child policy)	1= The prefecture has an authorized fertility greater than 1.6 child; 0=otherwise	15.96	3994
Parity of the newborn child			
Parity 1	1=The newborn is the first child; 0=otherwise	65.89	16671
Parity 2	1=The newborn is the second child; 1=otherwise	29.47	7457
Parity 3	1=The newborn is the third child; 2=otherwise	4.63	1172
Composite variable of parity and policy			
Parity 1 in 1-child policy	1=Parity 1 in 1-child policy area; 0=otherwise	20.31	5,084
Parity 2 in 1-child policy	1=Parity 2 in 1-child policy area; 0=otherwise	7.27	1,821
Parity 1 in 1.5-child	1=Parity 1 in 1.5-child policy area; 0=otherwise	36.22	9,067
Parity 2 in 1.6-child	1=Parity 2 in 1.5-child policy area; 0=otherwise	20.23	5,065
Parity 1 in 2-child policy	1=Parity 1 in 2-child policy area; 0=otherwise	9.66	2,419
Parity 2 in 2-child policy	1=Parity 2 in 2-child policy area; 0=otherwise	6.29	1,575
Presence of an older daughter	1=The mother has an older daughter; 0=otherwise	18.62	4711
Mother's characteristics			
Age	Age of the mother	26.95 (4.83)	25300
Han Ethnicity	1=The mother is of Han Ethnicity; 0=otherwise	84.70	21428
Rural residence	1=The mother has a rural hukou; 0=otherwise	80.23	20258
Education			
<=primary school	1=The mother has a primary or lower education; 0=otherwise	27.95	7072
Middle school	1=The mother has a middle-school education; 0=otherwise	54.08	13682
High school or above	1=The mother has a high-school or higher education; 0=otherwise	17.97	4546
Have medical insurance	1=The mother has public medical insurance; 0=otherwise	26.23	6634
Have old-age insurance	1=The mother has public old-age pension security; 0=otherwise	9.43	2386
Household characteristics			
Extended household	1=The household is an extended one with three generations; 0=otherwise	30.00	7500
Household utility index	Household socioeconomic index	-0.02 (0.12)	25276

Souce: 2000 Census data, policy fertility data and 2005 National One Percent Population Survey data.

Note 1: All variables, except for policy fertility and sex ratio at birth, are characteristics of 2005.

Note 2: Values in parenthesis are standard deviations.

Table 2. Multilevel Logit Model Results of Probability of Having a Son

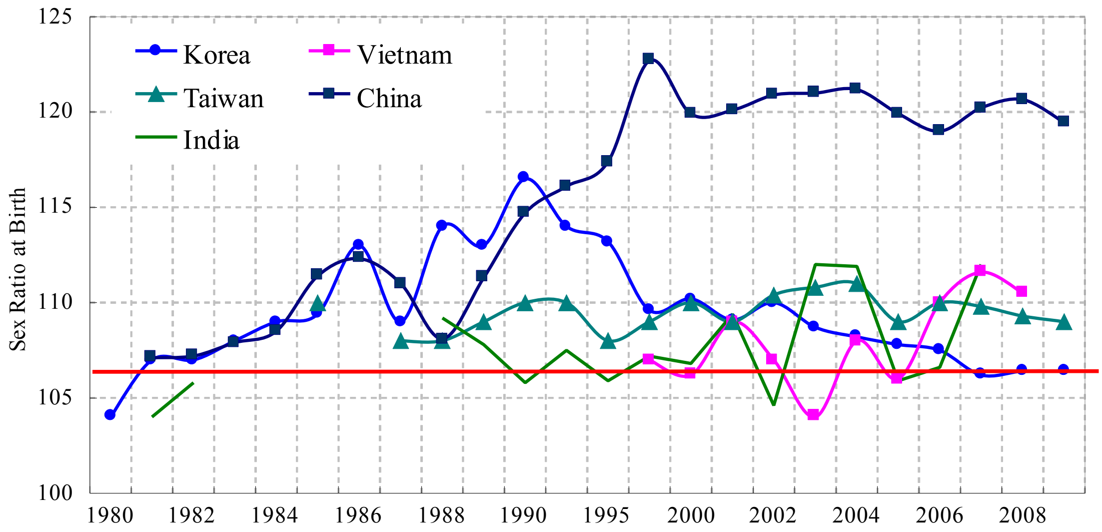
	All parity						Parity 1			Parity 2 or high parities					
	Model 1a			**Model 1b**			**Model 2**			**Model 3a**			**Model 3b**		
	Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE	
Policy fertility															
<1.3(=ref)															
1.3-1.6	0.06	0.03	*	-	-		0.09	0.04	*	0.02	0.07		-	-	
>1.6	-0.09	0.05	*	-	-		-0.04	0.06		-0.14	0.09		-	-	
Parity of the new baby															
Parity 1(=ref)															
Parity 2	0.39	0.04	***	-	-		-	-		-1.27	0.13	***	-	-	
Parity 3	0.62	0.07	***	-	-		-	-		-	-		-	-	
Composite measure of policy fertility and parity															
Parity 1 in 1-child policy area (=ref)															
Parity 1 in 1.5-child policy	-	-		0.08	0.04	*	-	-		-	-		-	-	
Parity 1 in 2-child policy area	-	-		-0.05	0.05		-	-		-	-		-		
Parity 2+ in 1-child policy	-	-		0.47	0.06	***	-	-		-	-		0.18	0.09	*
Parity 2+ in 1.5-child policy	-	-		0.49	0.05	***	-	-		-	-		0.21	0.07	**
Parity 2+ in 2-child policy	-	-		0.28	0.07	***	-	-		-	-		(reference)		
Presence of an older daughter	-	-		-	-		-	-		0.72	0.05	***	0.54	0.05	***
Mother's characteristics															
Age	-0.01	0.00	***	-0.01	0.00	***	-0.01	0.00	*	-0.02	0.01	***	-0.01	0.01	*
(Table 2 continues at the next page)															

(Table 2 continued)																
	All parity						**Parity 1**			**Parity 2 or high parities**						
	Model 1a			**Model 1b**			**Model 2**			**Model 3a**			**Model 3b**			
	Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE		
Han Ethnicity	0.05	0.04		0.05	0.04		0.01	0.05		0.09	0.07		0.05	0.07		
Education																
<=primary school(=ref)																
Middle school	0.08	0.03	**	0.08	0.03	*	0.07	0.04	^	0.09	0.05	^	0.06	0.05		
High school or above	0.13	0.05	*	0.13	0.05	*	0.11	0.06	^	0.15	0.12		0.12	0.12		
Have medical insurance	-0.02	0.03		-0.02	0.03		-0.05	0.04		0.02	0.06		0.02	0.06		
Have older age insurance	-0.06	0.06		-0.05	0.06		-0.01	0.06		-0.27	0.15	^	-0.28	0.14	*	
Rural *hukou*	-0.001	0.04		-0.01	0.04		0.01	0.05		-0.04	0.10		-0.03	0.10		
Household characteristics																
The household is extended	0.04	0.03		0.04	0.03		0.01	0.03		0.11	0.05	^	0.10	0.05	*	
Household utility index	0.11	0.13		0.09	0.13		0.19	0.16		-0.03	0.25		-0.26	0.25		
Constant	0.35	0.13	**	0.32	0.13	*	0.29	0.16	^	1.57	0.30	***	0.02	0.27		
Model fit statistics																
Random effect	0.001	0.096		0.00	0.07		0.05	0.07		0.18	0.04		0.15	0.05		
N of observations	24949						16511			8438						
N of prefecture	338						338			337						
LR	-17087.8			-17092.0			-11415.5			-5538.6			-5598.9			
Wald chi2	191.42			183.38			26.39			290.93			179.46			

Source: 2005 National 1% Population Survey data.

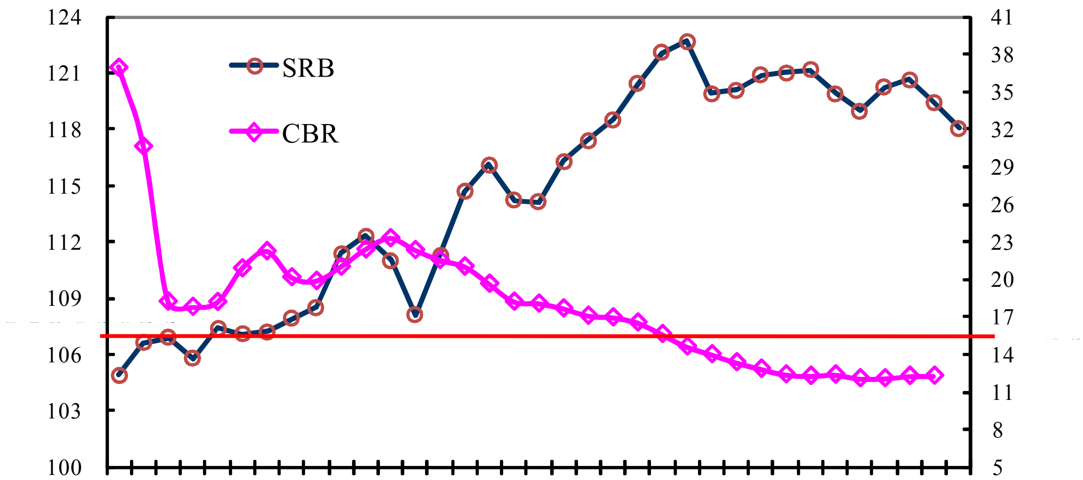
****p<0.001; **p<0.01; *p=0.05; ^p=0.10.*

Figure 1. Sex Ratio at Birth in Some Asian Countries or Regions



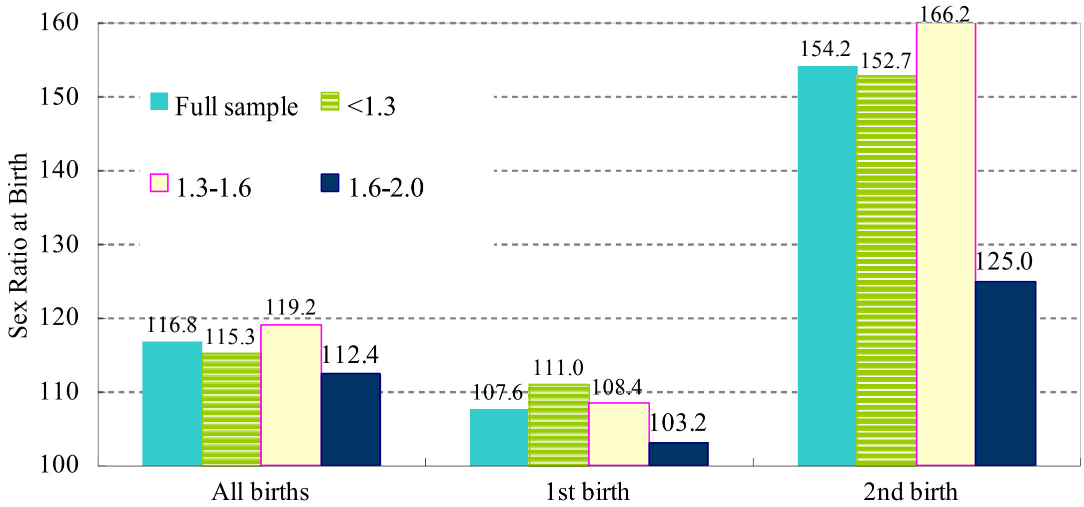
Source: For Korean,the 1985-1995 data are from Chunjing Shi (2004); data since 1999 are from http://kostat.go.kr/eboard_faq/BoardAction.do?method=view&catgrp=eng2009&catid1=g01&catid2=g01b&catid3=g01ba&catid=g01ba&board_id=106&seq=328&num=328. For Vietnam, the 1999-2006 data come from UNFPA (2009); the 2008 data come from Vietname 2009 Census (http://www.thanhniennews.com/2010/Pages/20100808154954.aspx),and the 2009 data come from CIA World Factbook. For Taiwan,data prior to 1992 are from Gu and Roy (2006); data of 1995-2006 are from MIRC (2007,Taiwan-Fuchien Demographic Fact Book. 1985 - 2006. Ministry of the Interior. Republic of China); the 2009 data are from CIA World Factbook. For India, data are from Seth (2009). For China, data are from Yang (2009).

Figure 2. Sex Ratio at Birth and Crude Birth Rate in China: 1953—2010



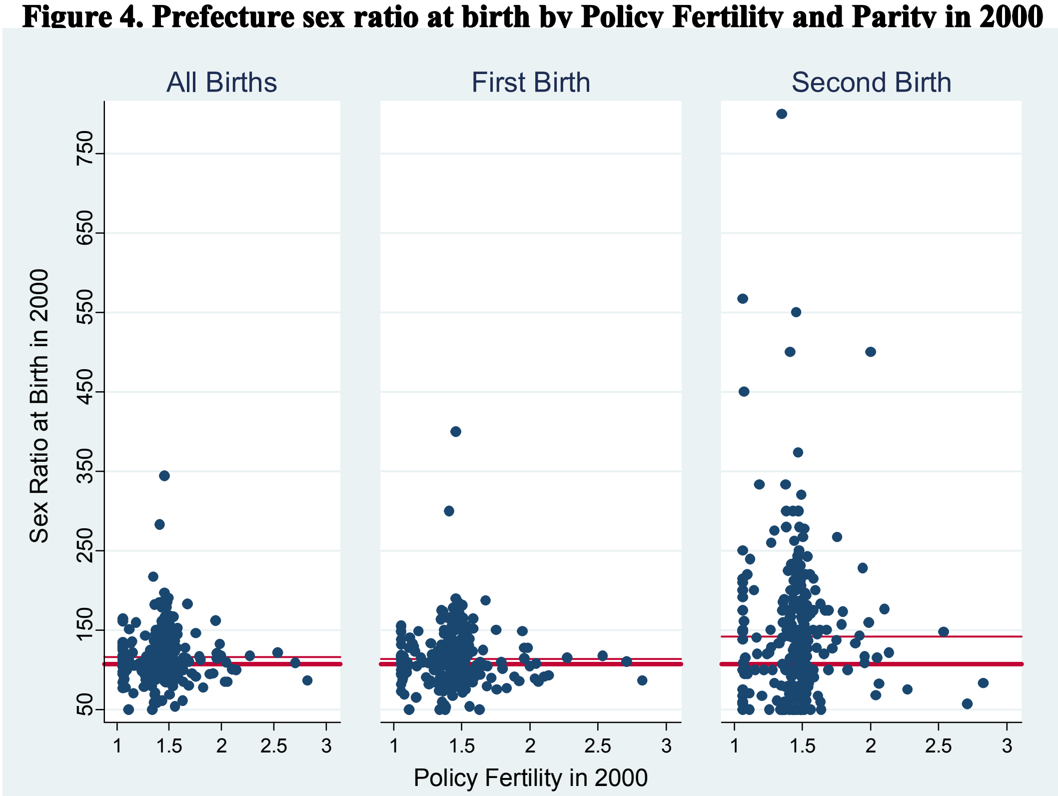
Source: Compiles by Yang (2009) from multiple sources. The 2009 and 2010 sex ratio at birth come from NSBC (2011).
Note: The horizontal line refers to the upper limit of the normal sex ratio at birth; correlation=-0.756.

Figure 3. Sex Ratio at Birth by Policy Fertility and Parity, China 2000



Source: 2000 Census data and policy fertility data.

Figure 4. Prefecture sex ratio at birth by Policy Fertility and Parity in 2000



Source: 2000 Census data and policy fertility data.

Note: The thick horizontal line is the upper limit of normal sex ratio at birth, and the thin line is the mean of sex ratio at birth.

Figure 5. Proportion of Boys by Policy Fertility, Parity and Presence of Older Son/Daughter, China 2005