The Unexpected Rapid Normalization of the Sex Ratios at Birth in China

Tomáš Sobotka[1] and **Cuiling Zhang**[2]

1 Wittgenstein Centre for Demography and Global Human Capital (IIASA, VID/ÖAW, WU), Vienna Institute of Demography/Austrian Academy of Sciences. Email: tomas.sobotka@oeaw.ac.at

2 China Population and Development Research Centre. Email:zcl_cpdrc@hotmail.com

**Paper submitted for the 2019 meetings of the Population Association of America.*

Abstract

At the turn of the century China had become a country with the most distorted sex ratio at birth (SRB) globally, with a pronounced deficit of girls reported every year. The phenomenon of "missing girls" – or "gendercide" (Economist, March 4, 2010) raised alarm among experts, policymakers and general public. Initial responses in the form of laws and regulations prohibiting sex-selective abortion and the campaigns to promote the value of girls seemed to have very little effect. However, our exploration of recent trends reveals a sharp and lasting fall in the SRBs in China during the past 15 years. This trend, if sustained, marks an end of an era of unprecedented demographic gender discrimination that will have negative consequences on the lives, partnerships and marriage prospects of men and women born in the past three decades. We document and discuss the welcome "normalization" of the SRBs in China using previously untapped birth registration data.

Introduction and background

In the 1980s and 1990s China experienced a rapid rise in the sex ratios at birth (SRB) (Johansson and Nygren 1991; Zeng et al. 1993; Goodkind 2011), well above the normal levels at 105-107 boys per 100 girls that characterize all human populations in the absence of prenatal sex selection (Hesketh and Xing 2006; Guilmoto and Tove 2015;). The rise in the SRB in China was an extreme manifestation of gender inequality and patriarchal culture (Banister 2004; Das Gupta et al. 2009; Jayachandran 2015). It coincided with the rapid adoption of diagnostic ultrasound technology across the country that allowed pregnant women to identify sex of the fetus (Chen and Meng 2013; Zeng et al. 1993). As abortion is widely available in the country, women who were pregnant with a girl could terminate their pregnancy. The practice of sex-selected abortion was fueled by a strong preference for sons coupled with fertility decline to very low levels, which was in part driven by restrictive antinatalist policies—at least in its initial stage (Cai 2010).

The available data vary widely, with most estimates putting the SRB in China in 2000 at 112-124 (Guilmoto and Tove 2015; Das Gupta et al. 2009; Goodkind 2011; Zhu and Hesketh 2009; UNFPA 2018). The rise in distorted SRBs was most pronounced in the regions of southeastern and central China that historically displayed strong clan culture and patrilineal descent (Banister 2004; Huang et al. 2016). The SRBs were also highly distorted in regions applying a "1.5-child policy" that allowed couples with a girl to have another child and thus reinforced cultural preference for sons (Zeng 2007; Zeng and Hesketh 2016); this practice also contributed to the underreporting of female girls (Goodkind 2011).

Despite uncertainty about exact SRB levels, partly caused by the fact that some of the births were not registered and remained hidden from the official statistics for many years (Goodkind 2011; Shi and Kennedy 2016; Cai 2013), distorted SRBs clearly became one of the key demographic challenges in China (Peng 2011). High SRBs will affect the lives of the younger generations of Chinese women and men for many decades to come. Altogether, millions of girls in China are "missing" due to sex-selective abortion. Estimate by Bongaarts and Guilmoto (2015, Appendix 2) puts the number of girls "missing" due to sex-selective abortion in China in 1980-2009 at 18 million, more than a half of the estimated global number of missing female births in that period.

The distorted population age structure due to missing girls will negatively affect the chances of Chinese men to marry (Tuljapurkar et al. 1995; Poston and Glover 2005; Guilmoto 2012; Tucker and Vvan Hook 2013; Zeng and Hesketh 2016); some research suggests that the excess of males has additional wide-reaching consequences such as increasing violent and property crime (Edlund et al. 2013) or the rise in sexual violence (Diamond and Rudolph 2018), rising use of commercial sex, and more sexually transmitted infections. However, most of the envisioned effects, such as rise in sex trafficking, aggression or the breakdown of social order, remain speculative and have not been sufficiently researched (Hesketh et al. 2011; Dyson 2012; Greenhalgh 2012). For instance, South and Trent (2010) reported that men in Chinese regions with lower SRBs are actually engaging in earlier and more frequent sex with more partners due to higher opportunities and thus also face higher risk of sexually transmitted infection.

Lower-educated and lower-income males will be affected most and will often spend their lives as involuntary bachelors (Dyson 2012; Attané 2012), which is highly problematic in a society where men's social status is closely tied to marriage, reproduction and a continuation of family lineage. The excess of male births also implies a lower rate of society's reproduction (as measured by the number of girls born and surviving to reproductive age) and a more rapidly declining population size in the future.

Chinese government has responded to the rise in SRB distortions by issuing a series of laws and regulations prohibiting sex identification of the fetus and sex-selective abortion since 1986 (Greenhalgh 2012). In addition, 14 provinces issued special rules and regulations to tackle the issue (Zijuan et al. 2012). Public education campaigns and a national campaign, "Care for Girls," rolled out nationally since 2006, aimed to improve perceptions of the value of girls (UNFPA China 2018) and to curb the use of prenatal sex determination and sex-selected abortion (Zijuan et al. 2012). In November 2011, the Chinese State Council issued the *National Twelfth Five-Year Plan for Population Development*, which aimed to achieve the SRB at 115 in 2015. It is the first time that China has incorporated balancing sex ratio at birth into national planning. More recently, China has eased its restrictive "one-child policy", which varied by region and depended on the place of birth registration (*hukou*), with rural residents more often allowed to have a second child (Gu et al. 2007; Qin et al. 2018). In 2014-2015 all couples where at least one partner was the only child were allowed to have a second child (Attané 2016). Since 2016 China has implemented a universal two-child policy, with all couples allowed to have a second child.

The tightening legal regulation against sex-selective abortion, the campaigns highlighting the value of girls, and the easing of the family planning policies should be expected to lead to a reduction in SRB. Different researchers have expressed an expectation that especially the launching of the universal two-child policy will lead to a lowering use of sex-selected abortion (Das Gupta et al. 2009; Zhu et al. 2009; Zeng and Hesketh 2016). Especially the option for all parents with one boy to have a second child should ease the structural pressure towards skewed SRBs. However, SRB was not expected to fall to a normal level for many years to come (Zeng and Hesketh 2016), with a recent report by the State Council envisioning a return to normal SRB at 107 only by 2030 (Wang 2017). Basten and Jiang (2015) argued

that the problem of skewed SRBs will be alleviated only with a "profound national shift in attitudes towards females."

An analysis of maternal surveillance data for 2012-15 suggested substantially lower SRB (at around 110) than the research focused on earlier data (Huang et al. 2016). Yet, due to the shortage of reliable data and the problem of underreporting of children in Chinese population censuses and surveys recent trends in SRB have not been systematically assessed. We fill this gap by reconstructing changes in SRB in China in 1990-2017. Our analysis reveals a sharp and lasting fall in the SRB in China during the past 15 years, which heralds an end to an era when China had the highest SRB globally.

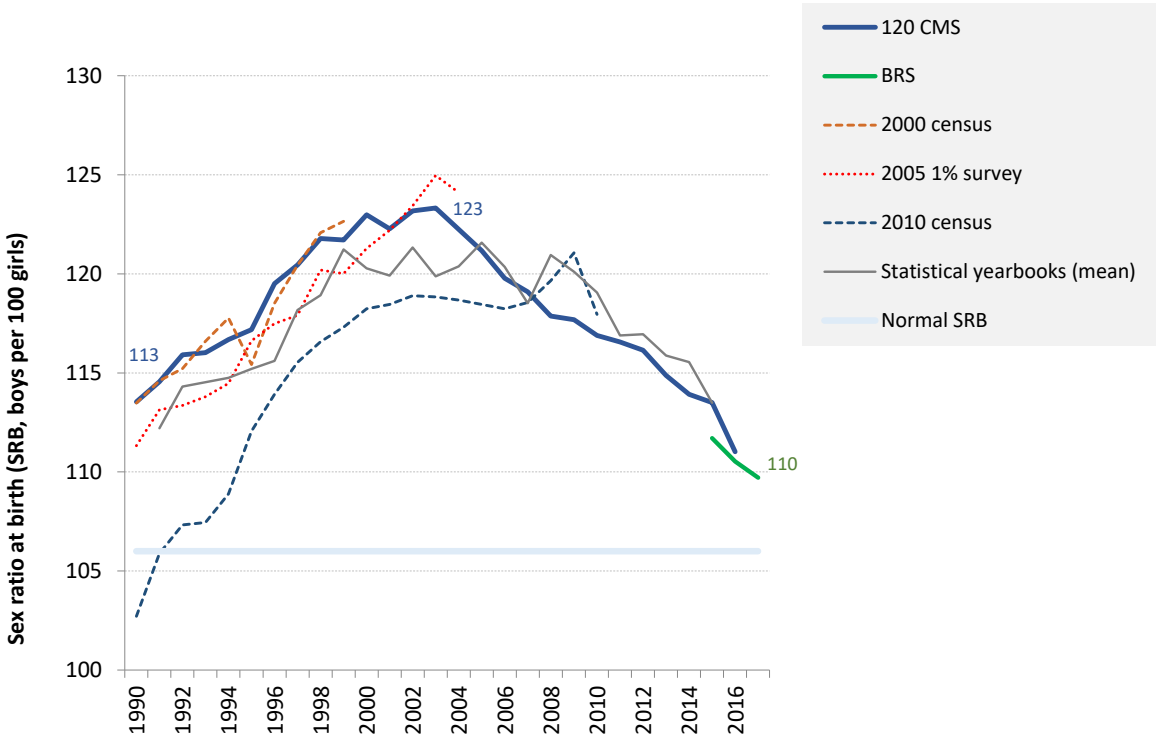
Data

We explore two previously untapped data sources—1) the *120 Counties Monitoring System* (120 CMS) and 2) the *Birth Registration System* (BRS). The 120 CMS data are used to reconstruct SRB in 1990-2014, while the BRS data is used for the most recent period, 2015-17. As of 2016 the 120 CMS data provided a complete coverage of births in 117 sites in 28 provinces with a total population of 128.4 million (9.4% of total China population), with only three provinces, Zhejiang, Yunnan and Tibet, not represented. The sites were selected to cover both urban and rural as well as more and less economically developed areas across China. The BRS covers total China population using the National Family planning data-sharing platform established in 2014. Although the 120 CMS data were not representative of the whole country, the reconstructed changes in SRBs are close to several other sources and, more important, they closely overlap with the BRS for the period 2015-2016, also with respect to the SRB by birth order.

Results

Our analysis shows surprisingly fast and sustained fall in SRBs across all provinces of China since the early 2000s, which has exceeded earlier expectation. Since peaking in 2000-2003 at the level of 123, the SRBs fell without interruption by about 1 per year, dropping below the 110 threshold in 2017 (Figure 1). If continued, China might achieve a normal SRB at around 105-106 within a few years.

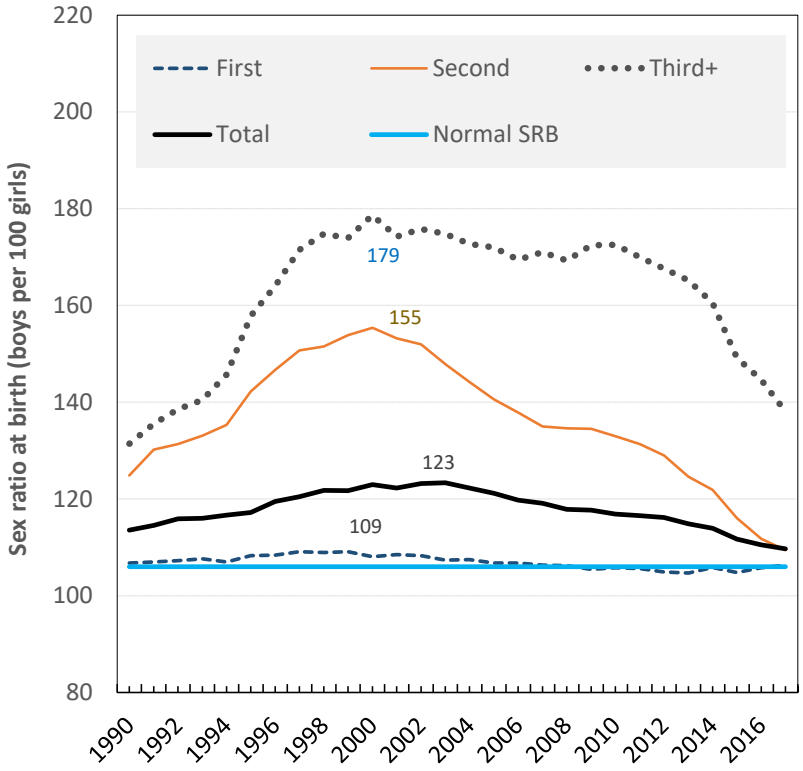
Figure 1: Sex ratio at birth (SRB) in China estimated from different sources, 1990-2017



Sources: 120 CMS: 120 Counties Monitoring System (1990-2016); BRS: Birth Registration System (2015-2017); Population by age and sex born in 1990-2010, as reported in the population census in 2000 and 2010 and 1% population sample survey in 2005; Population by age and sex born in 1991-2015 reported in the official China Statistical Yearbook for 1992-2010 and 2012-2016 published by National Bureau of Statistics in China (http://www.stats.gov.cn; data show average across all available years).

As in other countries, SRBs in China are unusually high for second and higher-order births (Guilmoto and Tove 2015), whereas they have mostly displayed normal levels at around 105-107 for the first births (Figure 2). In China, where some couples were allowed to have a second child and third children were rarely permitted (except in selected ethnic minority regions), the SRB distortion was exceptionally high for the second births and the fall in observed total SRBs was largely attributable to the falling SRB for second births. It peaked at 155 in 2000 and subsequently plummeted, reaching an almost normal level of 109 by 2017. The SRB for third and later births peaked at yet higher level (179) and started falling by about a decade later, after 2010. Between 2010 and 2017 it showed an impressive fall from 173 to 138, reducing the gap between normal and distorted SRB by over a half. However, third and later births have only a minor share (around 6%) on total births in China, possibly the lowest level globally. The pace of the SRB decline was sustained in 2013-17 despite a sharp increase in second births after the easing of the fertility restrictions since 2014, which should have otherwise pushed the SRBs up. If SRBs by birth order remained fixed at the 2013 level, the overall SRB would go up from 114.9 to 118.7 between 2013 and 2017; instead, it actually fell to 109.7.

Figure 2: Sex ratio at birth (SRB) in China by birth order, 1990-2017

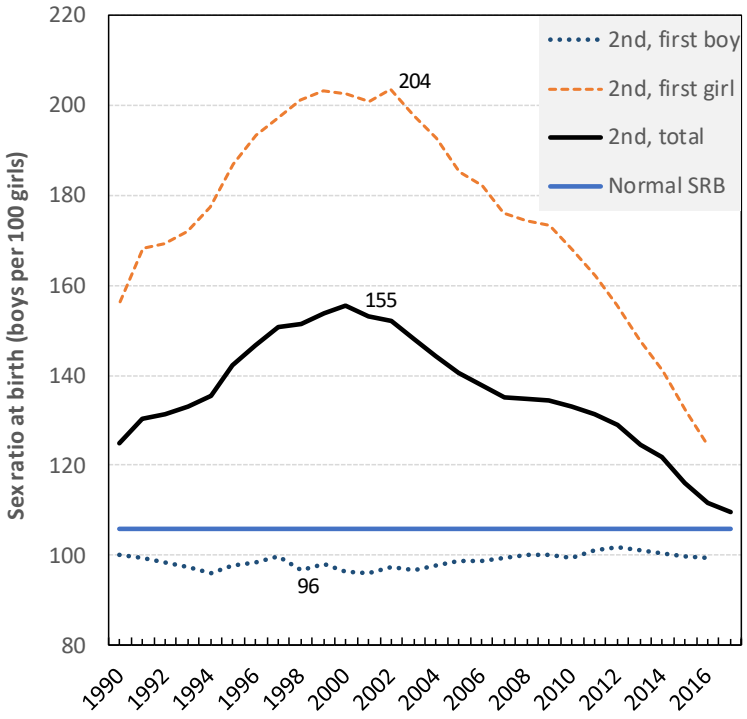


Sources: 120 Counties Monitoring System (120 CMS) for 1990-2014 and the Birth Registration System (BRS) for 2015-2017

SRB for the second births differed by sex of the first child. Not surprisingly, they were extremely high for the second births following the birth of a girl, suggesting how determined many parents were to have a boy. For the parents with a girl, the second-birth SRBs peaked at 204 in 2002 before plummeting to 125 in 2016. In other words, in the early 21st century these parents were twice more likely to have a boy than a girl as their second child.

Remarkably, our data also reveal an inverse distortion of the sex ratio at second birth for the parents with one boy (Figure 3). This distortion is much smaller than for the parents with a first-born girl, but at the same time it has remained stable in the last decade, with a second-birth SRB at around 100. This inverse sex selection in favor of girls is surprising and reveals that some parents use sex selection in order to have one child of each sex rather than to discriminate against girls. The pattern of prenatal sex selection against boys has been previously noted for third births among the parents with two boys (Zeng et al. 1993; Goodkind 2011).

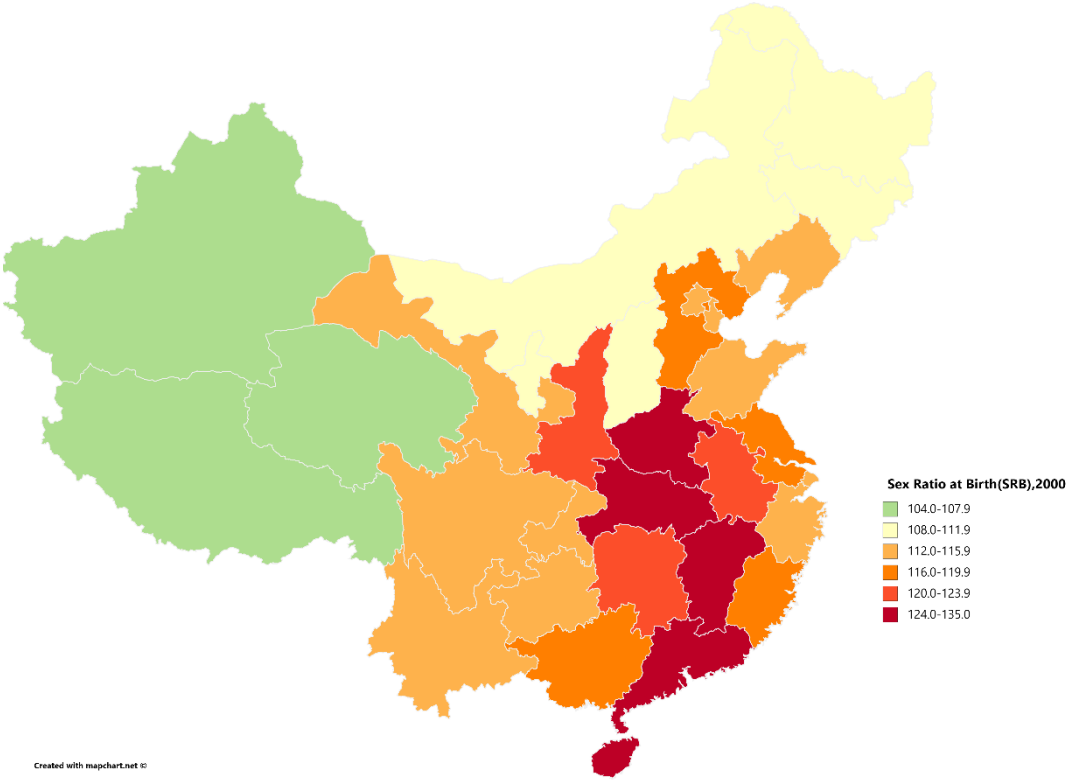
Figure 3: Sex ratio at birth (SRB) in China for second births by sex of the first child, 1990-2017

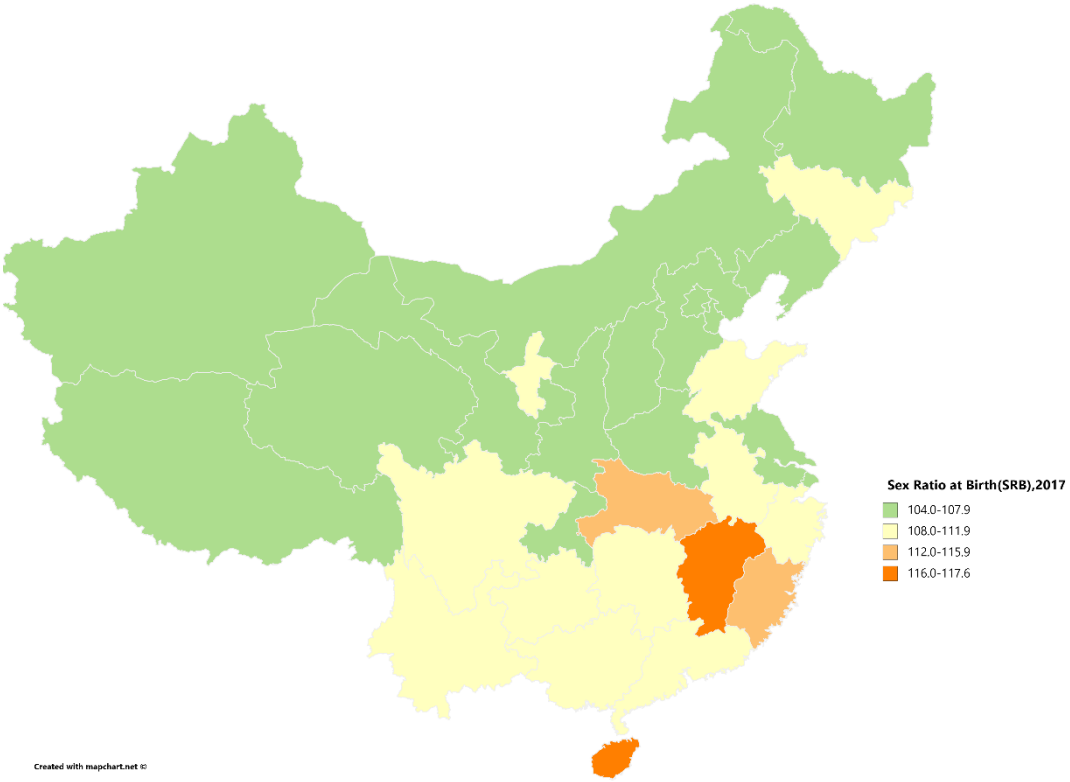


Sources: 120 Counties Monitoring System (120 CMS) for 1990-2014 and the Birth Registration System (BRS) for 2015-2017

The fall in SRBs after 2000 has taken place in all provinces in China which recorded skewed SRB in the last three decades. In 2000, only three sparsely populated provinces in western China, Tibet, Xinjiang, and Qinghai, had SRB around normal level below 108. Very high SRB was recorded in eastern, central and southern China, with a string of five provinces in eastern and southern China (Henan, Hubei, Jiangxi, Guangdong, and Hainan) reporting extreme high SRB over 125 (Figure 4). By 2017, SRB dropped markedly in all provinces where its levels were skewed in the past. Most provinces in western, central and northern China achieved SRB around normal level (below 108), with 15 out of 31 Chinese provinces falling within this range. SRB remained elevated in many provinces in the south and in the east, but only four provinces, Hubei, Jiangxi, Fujian and Hainan, still recorded very high SRB above 112. Hainan had the highest SRB in China in both 2000 and 2017, but its level fell from 135 to 118.

Figure 4: Sex ratio at birth (SRB) in mainland China by province, 2000 and 2017





Sources: Sex ratio at age 10 in the 2010 population census for 2000 and the Birth Registration System (BRS) for 2017

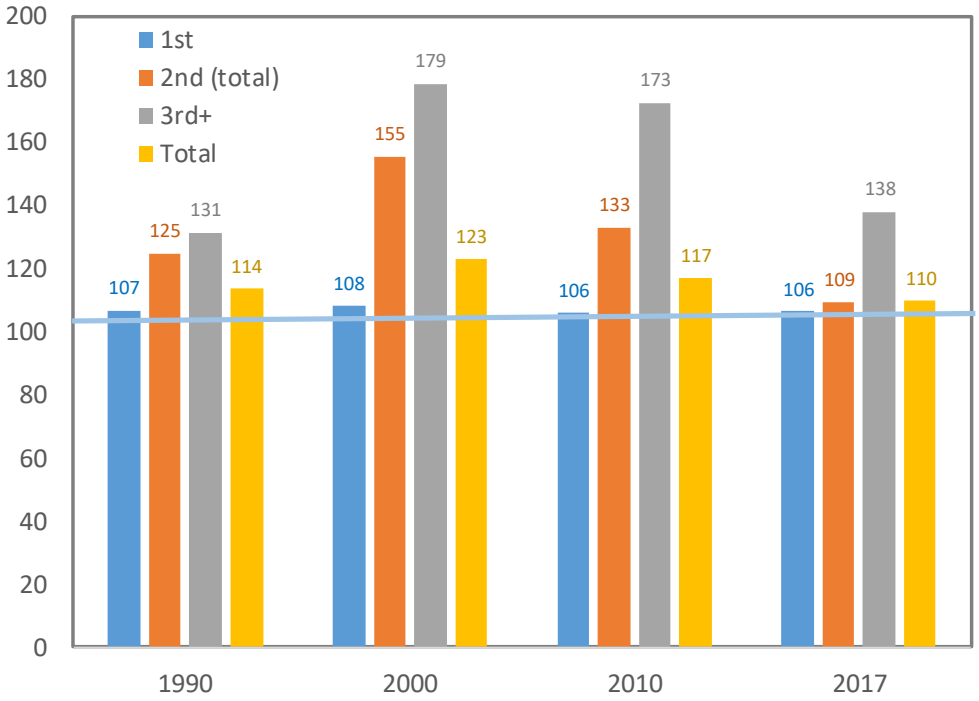
Discussion

Our analysis reveals a surprisingly rapid "normalization" of the sex ratio at birth in China during the last 15 years, which took place in all provinces where SRB was distorted in the past. By 2017 SRB in China was at a normal level for first births and at a slightly distorted level (109-110) for second births and for all births (see also Appendix Figure). Only the third and later births showed strongly distorted SRB of 138, but even this was far below the levels reached in the late 1990s and 2000s.

Why did the SRBs in China start declining in the early 2000s and why has this decline been sustained ever since? The prolonged nature in SRB decline suggest that this welcome shift was not due to one single factor. Das Gupta et al (2009: 413) and Chung and das Gupta (2007) argued that urbanization and industrialization are two key forces bringing skewed SRB down. Our analysis (data not shown here) shows a similar fall in SRB in urban and rural areas. Thus, the role of urbanization does not appear prominent. Rather, it was the combination of different factors—first, the laws prohibiting sex-selected abortion (although widely violated), then the campaigns aiming to raise the status of girls and curb the use of sex-selective abortion, and, more recently, the relaxation of the strict anti-natalist policies and the launching of a universal two-child policy since 2015. Women's rising education also played a role, as distorted SRB is typical of lower-educated mothers (Huang et al. 2016).

The sustained fall in SRB in China has brought to an end the era of an extreme gender imbalance, when China had the highest SRB globally during the 1990s and 2000s. The relatively steep drop in SRB was surprising also in the light of the size and diversity of Chinese population and the historically entrenched preference for sons in the country. China has thus followed in the footsteps of South Korea, where the SRB fell fast in the 1990s, dropping from 112-115 in the early- and mid-1990s to 109-110 around 2000 and later to a normal level around 106 in the late 2000s (Chung and Das Gupta 2007). The drop in the SRB in China is a key milestone which will lead to a significant reduction in the number of "missing girls" globally. It now leaves India as a country with the largest number of newly missing girls due to sex-selective abortion (Bongaarts and Guilmoto 2015) and the countries in the Caucasus (especially Azerbaijan and Armenia) having the most distorted SRB globally (Guilmoto and Tove 2015;Duthé et al. 2012). Eventually, a combination of laws, policies, campaigns, and the rising status of women should bring the "gendercide" to an end.

Appendix figure: Sex ratio at birth in China by birth order, selected years 1990-2017



Note: Blue line shows normal SRB level (106 boys per 100 girls).

Sources: 120 Counties Monitoring System (120 CMS) for 1990-2014 and the Birth Registration System (BRS) for 2015-2017

References

Attané, I. 2012. “Being a woman in China today: A demography of gender.” *China Perspectives*, 2012(4): 5-15.

Attané, I. 2016. “Second child decisions in China.” *Population and Development Review* 42(3): 519-536.

Banister, J. 2004. “Shortage of girls in China today.” *Journal of Population Research* 21(1): 19-45.

Basten, S. and Jiang, Q. 2015. “Fertility in China: An uncertain future.” *Population Studies* 69(S1): S97-S105.

Bongaarts, J. and Guilmoto, C.Z. 2015. “How many more missing women? Excess female mortality and prenatal sex selection, 1970–2050.” *Population and Development Review* 41(2): 241-269.

Cai, Y. 2013. “China's new demographic reality: Learning from the 2010 census.” *Population and Development Review* 39(3): 371-396.

Cai, Y. 2010. “China's below-replacement fertility: government policy or socioeconomic development?” *Population and Development Review* 36(3): 419-440.

Chen, Y., Li, H. and Meng, L. 2013. “Prenatal sex selection and missing girls in China: Evidence from the diffusion of diagnostic ultrasound.” *Journal of Human Resources*, *48*(1): 36-70.

Chung, W. and Gupta, M.D. 2007. “The decline of son preference in South Korea: The roles of development and public policy.” *Population and Development Review* 33(4): 757-783.

Das Gupta, M.D., Chung, W., and Shuzhuo, L. 2009. “Evidence for an incipient decline in numbers of missing girls in China and India.” *Population and Development Review 35*(2): 401-416.

Diamond-Smith, N. and Rudolph, K. 2018. “The association between uneven sex ratios and violence: Evidence from 6 Asian countries.” *PLOS one*, 13(6): e0197516.

Duthé, G., Meslé, F., Vallin, J., Badurashvili, I. and Kuyumjyan, K. 2012. “High sex ratios at birth in the Caucasus: Modern technology to satisfy old desires.” *Population and Development Review* 38(3): 487-501.

Dyson, T. 2012. “Causes and consequences of skewed sex ratios.” *Annual Review of Sociology* 38: 443-461.

Edlund, L., Li, H., Yi, J. and Zhang, J. 2013. “Sex ratios and crime: Evidence from China.” *Review of Economics and Statistics* 95(5): 1520-1534.

Goodkind, D. 2011. “Child underreporting, fertility, and sex ratio imbalance in China.” *Demography* 48(1): 291-316.

Greenhalgh, S., 2012. “Patriarchal demographics? China's sex ratio reconsidered.” *Population and Development Review* 38: 130-149.

Gu, B., Feng, W., Zhigang, G. and Erli, Z. 2007. “China's local and national fertility policies at the end of the twentieth century.” *Population and Development Review* 33(1): 129-148.

Guilmoto, C.Z. 2012. “Skewed sex ratios at birth and future marriage squeeze in China and India, 2005–2100.” *Demography* 49(1): 77-100.

Guilmoto, C.Z. and Tove, J. 2015. “The masculinization of births. Overview and current knowledge.” *Population 70*(2): 185-243.

Hesketh, T. and Xing, Z.W. 2006. “Abnormal sex ratios in human populations: causes and consequences.” *Proceedings of the National Academy of Sciences*, *103*(36): 13271-13275.

Hesketh, T., Lu, L. and Xing, Z.W. 2011. “The consequences of son preference and sex-selective abortion in China and other Asian countries.” *Canadian Medical Association Journal* 183(12): 1374-1377.

Huang, Y., Tang, W., Mu, Y., Li, X., Liu, Z., Wang, Y., Li, M., Li, Q., Dai, L., Liang, J. and Zhu, J., 2016. “The sex ratio at birth for 5,338,853 deliveries in China from 2012 to 2015: a facility-based study.” *PLOS one*, 11(12): e0167575.

Jayachandran, S. 2015. “The roots of gender inequality in developing countries.” *Annual Review of Economics* 2015, *7*(1): 63-88.

Peng, X. 2011. “China’s demographic history and future challenges.” *Science* 333(6042): 581-587.

Poston, D.L. and Glover, K.S. 2005. “Too many males: Marriage market implications of gender imbalances in China.” *Genus* 61(2): 119-140.

Qin, M., Falkingham, J. and Padmadas, S.S. 2018. “Unpacking the differential impact of family planning policies in china: Analysis of parity progression ratios from retrospective birth history data, 1971–2005.” *Journal of Biosocial Science* (online): 1-23.

Shi, Y. and Kennedy, J.J., 2016. “Delayed registration and identifying the “missing girls” in China.” *The China Quarterly* 228: 1018-1038.

South, S.J. and Trent, K. 2010. “Imbalanced sex ratios, men’s sexual behavior, and risk of sexually transmitted infection in China.” *Journal of Health and Social Behavior* 51(4): 376-390.

Trent, K. and South, S.J. 2011. “Too many men? Sex ratios and women's partnering behavior in China.” *Social Forces* 90(1): 247-267.

Tucker, C. and Van Hook, J. 2013. “Surplus Chinese men: Demographic determinants of the sex ratio at marriageable ages in China.” *Population and Development Review* 39(2): 209-229.

Tuljapurkar, S., Li, N. and Feldman, M.W. 1995. “High sex ratios in China's future.” *Science 267*(5199): 874-876.

UNFPA China. 2018. “Towards a normal sex ratio at birth in China.” *UNFPA China Policy Brief*, January 2018; https://china.unfpa.org/en/publications/unfpa-china-policy-brief-towards-normal-sex-ratio-birth-china

Wang, X. 2017.” Report: Sex ratio to balance out by 2030.” *China Daily*, Updated 27 January 2017; http://www.chinadaily.com.cn/china/2017-01/27/content_28064356.htm

Wei, C. 2005. “Sex ratios at birth in China.” Paper presented *at International Conference on Female Deficit in Asia: Trends and Perspectives*, Singapore.

Zeng, Y. 2007. “Options for fertility policy transition in China.” *Population and Development Review*, 33(2): 215-246.

Zeng, Y. and Hesketh, T. 2016. “The effects of China's universal two-child policy.” *The Lancet* 388(10054): 1930-1938.

Zeng, Y., Ping, T., Gu, B., Yi, X., Bohua, L. and Yongpiing, L. 1993. “Causes and implications of the recent increase in the reported sex ratio at birth in China.” *Population and Development Review* 19(2): 283-302.

Zhu, W.X., Lu, L. and Hesketh, T. 2009. “China’s excess males, sex selective abortion, and one child policy: analysis of data from 2005 national intercensus survey.” *BMJ* 338: b1211.

Zijuan, S., Shuzhuo, L. and Feldman, M.W. 2012. “Policy responses of gender imbalance in China: The" Care for Girls" campaign” Morrison Institute for Population and Resource Studies.