Data Uncertainties in China's Population

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Abstract

China's large population and many demographic phenomena have drawn much attention, but its population data are flawed. In the paper we address uncertainties regarding China's total population size, the fertility rate, and the death rate in China's census data. The review is aimed to alert users of China's data about the uncertainties and flaws so as to avoid misleading claims or research.

Keywords: uncertainty, population size, fertility rate, mortality rate

1. Data Uncertainties in China's Population

China is the world's most populous country, and its population-related problems have been attracting global attention. However, it is surprising how much uncertainty exists about current demographic data in China (Ren et al., 2009). First, there was uncertainty regarding the total population. In the 2000 census, the published total population was 20,720,000 above the sum of the population figures reported by the respective provinces. To make the sum of the populations reported by the respective provinces consistent with the nationally published population number, the State Council Census Office "distributed" the 20,720,000 people indicated by the census across the respective provinces (Li, 2008). Second, There is controversy over the fertility rate. The estimated total fertility rate in 2000 ranges from 1.22 to 2.3 (Ren et al., 2009). Currently, to estimate China's total fertility rate, many scholars have studied China's low fertility rate and its related effects on the population (Zeng, 2007; Gu et al., 2007; Morgan et al., 2009; Zhao & Chen, 2011; Mai et al., 2013). Although all observers agrees that the fertility rate has already reached a level below the population replacement level, and there is even a broad consensus that it is approximately 1.5, no authoritative data are universally accepted. With the publication of China's 2010 census data, China's total fertility rate has again attracted attention. Third, while there is relatively less controversy over the death rate, some uncertainties regarding the death rate, life expectancy and other variables remain.

The present paper addresses uncertainties regarding total population, the fertility rate and the death rate in China's census data. We write the review to alert users of China's data about the uncertainties so as to avoid misleading claims or research.

2. Population Size

The quality of the Chinese census data has been challenged on several counts. Coale (1984) confirmed that the age and gender data collected from the third population census of 1982 were highly reliable. However, the release of the data from the fourth census revealed the underreporting or concealing of infants by families desiring to escape punishment or violating the family planning policy. Such underreporting was also found in the 1990 census data (Johannson & Arvdsson, 1994). Although the rate of underreport in the fifth census of 2000 was1.81%, which is considered a reasonable rate of underreporting according to the international standard (Walfish, 2001), the 2000 census data are still unreliable in some respects (Lavely, 2001). One leading Chinese demographer Liang (2010) disclosed some details about Chinese 2000 census: The original 2000 census data indicate that there were only 1.2 billion people in China at that time. As this number seemed low, the census office took various actions, including a national review and gap-filling efforts. Over a period of more than two weeks of double-checking for the underreporting, more than 40 million people were identified. However, the

total population figure remained 14.3 million below the figure presented in the 1999 statistics bulletin. Therefore, a 1.81% underreporting rate was assessed, and 22.27 million people were added, resulting in a total population estimate of 1.265 billion.

In China, an annual one per thousand surveys is conducted to collect annual data of population changes. The number of births, the total population, and other relevant information for that year are released based on an analysis of the sample. Many studies suggested that underreporting affected the 2000 census data, creating gaps between the announced births of the calendar year prior to the census and the census data, especially among the younger segments of the population. In 1997, 1998, and 1999, the number of published births among the sampled population was 20.38 million, 19.91 million, and 19.09 million, respectively. In the 2000 census, however, the number of 0-year-olds, 1-year-olds, and 2-year-olds was 13.79 million, 11.50 million, and 14.01 million, respectively, revealing a large discrepancy in the data. Contradictions have been found even within the survey data. For example, the published number of annual births from 2001 to 2009 was approximately 16 million, but the number of annual births before 2000 exceeded 19 million. The 2000 census therefore serves as a watershed; the numbers of annual births prior to 2000 exceed 19 million, and then sharply drop by 2-3million after 2000. Moreover, the survey data published annually by the National Bureau of Statistics (NBS) are the adjusted data, and the NBS does not explain the adjustment parameters. Therefore, the reliability of the upward adjustment cannot be determined.

Based on the 2000 data, China's Tenth Five-Year Plan (encompassing 2001-2005) predicted that the total population would reach 1.331 billion by 2005. However, the 1% population survey of China showed a total population of only 1.308 billion in 2005. The Tenth Five-Year Plan required that the population growth during the five-year planning period remain under 56 million. The population had only grown by 42 million in 2005, and at the 2000 census, the total population was 1.265 billion even after a great upward adjustment as aforementioned. The population projection of the Eleventh Five-Year Plan (2006-2010) predicted a total population of 1.36 billion by 2010, but the 2010 census returned a total population of 1.34 billion, indicating that the Eleventh Five-Year Plan had over projected the total population by 20 million (Guo, 2012).

In 2010, the population corresponding to individuals aged 0-10 in 2000 was more than the number originally registered in 2000.There were 6.6 million more males and 10.86 million more females, as shown in Table 1. Tao and Zhang (2013) points out that in the 2010 census, the size of population aged 16- 21 is abnormally greater than that counted in the 2000 census and that registered household statistics by the Ministry of Public Security, indicating an over-registration in the youth aged 16-21.

Table 1. The number of 1990-2000 cohorts in 2000 and 2010 census (millions)

Cohort	2000 census			2010 census			Survival ratio	
	Age	Male	Female	Age	Male	Female	Male	Female
2000	0	7.46	6.33	10	7.83	6.62	1.05	1.05
1999	1	6.33	5.16	11	7.52	6.41	1.19	1.24
1998	2	7.70	6.31	12	8.29	7.11	1.08	1.13
1997	3	7.90	6.56	13	8.16	7.06	1.03	1.08
1996	4	8.26	6.97	14	8.46	7.43	1.03	1.07
1995	5	9.16	7.78	15	9.52	8.50	1.04	1.09
1994	6	8.87	7.60	16	9.80	9.00	1.10	1.18
1993	7	9.59	8.32	17	10.76	10.01	1.12	1.20
1992	8	10.01	8.74	18	10.74	10.01	1.07	1.15
1991	9	10.67	9.41	19	11.08	10.46	1.04	1.11
1990	10	13.81	12.40	20	14.20	13.83	1.03	1.12

Data source: PCO (2002, 2012)

The Population Division of Department of Economic and Social Affairs of United Nations have also adjusted its estimation of Chinese population size. In the "World Population Prospects: The2008Revision", China's total population was put at 1.354 billion in 2010, later in "The 2010 Revision", the total population in 2010 was adjusted downward to 1.341 billion, and in "The 2012 Revision", the population size in 2010 was estimated at 1.359 billion.

3. Fertility Rate

Since the 1980s, the strict implementations of the family planning policy and the subsequent rapid decline in fertility have been extensively discussed by scholars. China's fertility rate is highly controversial (Cai, 2012, 2013). Based on annual sampling survey data, the data obtained from the National Population and Reproductive Health Survey conducted by the National Family Planning Commission of China, and the 2000 census data, it is estimated that the total fertility rate of China has been below1.5 since the early 1990s (Guo, 2004). Since the implementation of the family planning policy in the 1980s, the ideal number of children in a family has differed widely from the number of children allowed by the policy, making birth concealing a serious problem. China's family planning policy motivates parents and family planning cadres to conceal unplanned births, making underreporting or concealment of births a common demographic phenomenon (Bongaarts & Greenhalgh, 1985; Zhang, 2004; Scharping, 2007) and causing many to believe that China's low birth rate is the result of wide spread concealment and underreporting. For this reason, the National Bureau of Statistics has been upwards adjusted the number of births reported annually; in the 1990s and early 2000s, scholars were concerned that NBS underestimated the number of people born in the 1990s (Merli & Raftery, 2000; Attané, 2001).

Recently, however, scholars have suggested that the extent of birth underreporting in the 1990s and the seriousness of the problem has been exaggerated. The current consensus is that the NBS has over-adjusted the fertility rate (Zhang & Zhao, 2006; Zeng, 2007; Cai, 2008; Morgan et al., 2009; Goodkind, 2011). The 2000 Chinese census data returned a total fertility rate of 1.22; the rate fell to 1.18 in 2010. Although underreporting may affect the census data, especially for female infants, it is difficult to adjust these data in the absence of more reliable data to obtain an acceptably accurate fertility rate. Based on the 2010 census population data for the younger segments, Jiang et al. (2013) found that a fertility rate of 1.5 eliminates the discrepancy between the predicted births cohort and the previous birth cohort that occurs in various accounts of Chinese TFR. A TFR of 1.5 approaches the post-2010 TFR of 1.45 used in a simulation by Zhao and Chen (2011). In the 2000 adjusted internal data published by the National Bureau of Statistics, the total fertility rate was adjusted from 1.22 to 1.40 (Morgan et al., 2009).

Several other major international population agencies, including the International Population Reference Bureau and the U.S. Census Bureau International Programs, have successively adjusted China's post-2000 fertility rate. In "World Population Prospects: The 2012 Revision," published by the United Nations, China's current and future fertility rate rose from 1.55 in 2000-2005 to 1.63 in 2005-2010, then further rise 1.66 in 2010-2015, and 1.69 in 2015-2020. Yang and Zhao (2013) evaluated China's fertility rate since 2000 by assessing and comparing the latest educational enrollment statistics and household registry data in the 2000 and 2010 censuses. Based on substantial data and the use of multiple methods, the authors concluded that the total fertility rate had reached at least 1.6 since 2000. Cai (2012, 2013) believed that China's total fertility rate had been approximately 1.5 or even lower. Just after the Third Plenary Session of the 18th Central Committee of the Chinese Communist Party, held from November 9 to 12 in Beijing, the newly merged National Health and Family Planning Commission announced that based on comprehensive analysis, the total fertility rate now is between 1.5 and 1.6.

4. Mortality Rate

Life expectancy growth has also been controversial in China. Oeppen and Vaupel (2002) indicated that in the past 160 years, the observed best-performance life expectancy has increased almost linearly, with an average annual increase of 0.25 years (three months); they believe that this trend will continue. However, this opinion is not universally held. For example, Bongaarts (2006) predicted that life expectancy would increase 7.5 years in the next half-century, with an average annual increase of 0.15 years.

In the early 1950s, life expectancy in China was 50 years. By the early 1980s, life expectancy had increased to approximately 65 years. In 1990, life expectancy reached 67.9 years, only to be surpassed in 2000 by a life expectancy of 71 years (Huang et al., 2008). Banister and Hill (2004) estimated that Chinese life expectancy increased from approximately 60 years between 1964 and 1982 to nearly 70 years between 1990 and 2000, with a further improvement to more than 71 years by 2000. However, since the beginning of the 21st century, the mortality rates and life expectancy published in China began to be questioned. For example, on March 5, 2008, Premier Wen Jiabao presented the "Report on the Work of the Government" (Report on the work of the Government, Delivered at the First Session of the Eleventh National People's Congress on March 5, 2008) on behalf of the government. Wen asserted that the life expectancy of China's population had reached 73 years in 2005. This statement was questioned by the President of the Chinese Medical Association, Professor Zhong Nanshan. Zhong indicated that the majority of the monitoring sites from which the life expectancy data are gathered are located in cities. He argued that the data obtained could therefore not reflect the

situation of the whole country and that these data overestimated the life expectancy of the Chinese population. In 2010, the sixth population census provided a wealth of data about mortality rates and life expectancy. According to the census data, the calculated life expectancy was 77.9 years, 75.6 years for males and 80.4 years for females. These estimates are clearly inflated.

In the 2010 census, the infant mortality rate was calculated as 3.805 per 1000 live births (male: 3.72; female: 3.906). China's National Bureau of Statistics adjusted the infant mortality rate to 13.6 per 1,000 live births (Cai, 2013). Huang and Zeng (2013) determined the infant mortality rate to be 17.27 after amending the relevant census data, and the underreporting rate of the infant mortality rate in the census was determined to be 78%. Using Brass Logit life table techniques to measure death underreporting in 2010 census, it is found that death underreporting of youngest population is very serious, the rate exceeding 60%, the underreporting of male infant deaths is more serious. The average rate of death underreporting for the elderly population has also exceeded 5%, with the total rate reaching 20% (Wang & Ge, 2013).

Jiang et al. (2013) utilized an extension of the Lee-Carter method for limited data to forecast the mortality pattern and life expectancy for the 2000-2030 period based on China's 1982, 1990, and 2000 census data. Their study found that, between 2000 and 2030, male life expectancy rose from 69.17 years to 74.62 years, increasing by 5.45 years within a 30-year period at an average annual growth of 0.18 years. Between 2000 and 2010, the average annual growth was 0.22 years; between 2010 and 2020, it was 0.18 years; and between 2020 and 2030, the average annual growth was 0.15 years. Female life expectancy rose from 72.72 years to 78.63 years, increasing by 5.92 years within a 30-year period. The average annual growth rate was 0.20 years, with an average annual growth of 0.23 years between 2000 and 2010, 0.20 years between 2010 and 2020, and 0.17 years between 2020 and 2030.

5. Conclusion

As the world's most populous nation, China has long attracted widespread attention regarding its population problems. However, the accuracy of China's population data has been controversial, and consequently the reliability of conclusions based on these data has been called into question. In this paper we examine the problems surrounding data on China's population size, fertility rate and mortality rate. Our findings can be summarized as follows:

China's population size may be overestimated. Even though some researchers believe that the number of 1339.72 million in the 2010 census convincingly reflects the actual size of China's population (Cui et al., 2013), there is some disagreement, with other experts maintaining that China's total population is below 1300 million (Yi, 2011). Taking Fujian province as an example, in the 2010 census, based on data reported across the province, there were 33.29 million permanent residents, which was 2.98 million less than in 2009. However, the published number was 36.89 million, which was 3.6 million more than the tabulated population number, which means 10.8% over reporting. Even if half of the over reporting rate could be generalized nationwide, then this would account for an overestimate of around 60 million people, given a total population of 1300 million (Yi, 2011).

China's total fertility rate may be around 1.5, but it may be even lower. The published births that have been adjusted by the National Bureau of Statistics over the years may overestimate China's actual birth and fertility rates. The general consensus is that it is 1.5, but this lacks a solid basis for the data. This fertility rate is close to the rate associated with the low fertility trap, and in view of the results of China's 30-year family planning policy, the government should now shift toward a policy of encouraging births. Otherwise, if China's fertility rate continues to decrease, it may, as in Japan and South Korea, already be too late to adopt a policy that encourages births.

China may also exaggerate the increase in life expectancy. Even the census data indicate very low mortality rates, especially for infants and young age groups, but the mortality rates may be underreported, meaning that higher life expectancies are obtained.

With China's dramatic transition in social and economic development, and the increased population mobility, survey data and census data have become much less accurate, which has sparked much debate. Population data concerning China should therefore be employed with caution, so as to avoid making wrong interpretations and drawing inaccurate conclusions.

References

Attané, I. (2001). Chinese fertility on the eve of the 21st century: Fact and uncertainty. *Population: An English Selection, 13*(2), 71-100.

Banister, J., & Hill, K. (2004). Mortality in China 1964-2000. *Population Studies, 58*(1), 55-75. http://dx.doi.org/10.1080/0032472032000183753

Bongaarts, J. (2006). How long will we live? *Population and Development Review, 32*(4), 605-628. http://dx.doi.org/10.1111/j.1728-4457.2006.00144.x

Bongaarts, J., & Greenhalgh, S. (1985). An alternative to the one-child policy in China. *Population and Development Review, 11*(4), 585-617. http://dx.doi.org/10.2307/1973456

Cai, Y. (2008). An assessment of China's fertility level using variable-r method. *Demography, 45*(2), 271-282. http://dx.doi.org/10.1353/dem.0.0003

Cai, Y. (2012). China's demographic reality and future. *Asian Population Studies, 8*(1), 1-3. http://dx.doi.org/10.1080/17441730.2012.646803

Cai, Y. (2013). China's new demographic reality: Learning from the 2010 Census. *Population and Development Review, 39*(3), 371-396. http://dx.doi.org/10.1111/j.1728-4457.2013.00608.x

Coale, A. J. (1984). *Rapid Population Change in China, 1952-1982*. Washington D. C.: National Academy Press.

Cui, H., Xu, L., & Li, R. (2013). An evaluation of data accuracy of the 2010 population census of China. *Population Research, 37*(1), 10-21.

Goodkind, D. (2011). Child underreporting, fertility, and sex ratio imbalance in China. *Demography, 48*(1), 291-316. http://dx.doi.org/10.1007/s13524-010-0007-y

Gu, B., Wang, F., Guo, Z., & Zhang, E. (2007). China's local and national fertility policies at the end of the twentieth century. *Population and Development Review, 33*(1), 129-147. http://dx.doi.org/10.1111/j.1728-4457.2007.00161.x

Guo, Z. G. (2004). A study on China's fertility level in the 1990s. *Population Research, 28*(2), 10-19.

Guo, Z. G. (2012). Re-thinking China's demographic situation. *International Economic Review, 20*(1), 96-111.

Huang, R. Q., Yang, G., Zhuang, Y., Qi, X., Zhai, D., Qi, M., Wang, X., & Lin, X. (2008). *Report of Mortality level and life expectancy in China* (p. 510).

Huang, R., & Zeng, X. (2013). Infant mortality reported in the2010Census: Bias and adjustment. *Population Research, 37*(2), 3-16.

Jiang, Q., Feldman, M. W., & Li, S. (2013). Marriage squeeze, never-married proportion and mean age at first marriage in China. *Population Research and Policy Review*. http://dx.doi.org/10.1007/s11113-013-9283-8

Johannson, S., & Arvidsson, A. (1994). Problems in counting the youngest cohorts in China's censuses and surveys. China State Council and National Bureau of Statistics (Ed.), *1990 Population Census of China B Proceedings of International Seminar*. Beijing: China Statistics Press.

Lavely, W. (2001). First impressions from the 2000 census of China. *Population and Development Review, 27*(4), 755-769. http://dx.doi.org/10.1111/j.1728-4457.2001.00755.x

Li, J. X. (2008). Humanly shaped and misguiding data in China's population number. *Academia Bimestris, 19*(1), 5-12.

Liang, Z. (2010). Census data should not be calculated. *Outlook Weekly, 30*(29), 64.

Mai, Y., Peng, X. J., & Chen, W. (2013). How fast is the population ageing in China? *Asian Population Studies, 9*(2), 216-239. http://dx.doi.org/10.1080/17441730.2013.797295

Merli, G., & Raftery, A. E. (2000). Are births underreported in rural China? Manipulation of statistical records in response to China's population policies. *Demography, 37*(1), 109-126. http://dx.doi.org/10.2307/2648100

Morgan, P. S., Guo, Z., & Hayford, S. R. (2009). China's below-replacement fertility: Recent trends and future prospects. *Population and Development Review, 35*(3), 605-629. http://dx.doi.org/10.1111/j.1728-4457.2009.00298.x

Oeppen, J., & Vaupel, J. W. (2002). Broken limits to life expectancy. *Science, 296*(5570), 1029-1031. http://dx.doi.org/10.1126/science.1069675

Population Census Office under the State Council (PCO). (2002). *Tabulation on the 2000 Population Census of the People's Republic of China*. Beijing, China: China Statistics Press.

Population Census Office under the State Council (PCO). (2012). *Tabulation on the 2010 Population Census of the People's Republic of China*. Beijing: China Statistics Press.

Ren, Q., Zheng, X., Lutz, W., & Scherbov, S. (2009). Uncertain population dynamics and HIV/AIDS in China. In J. D. Tucker, & D. L. Poston (Eds.), *Gender Policy and HIV in China* (pp. 9-25). Springer Science + Business Media B. V. 2009. http://dx.doi.org/10.1007/978-1-4020-9900-7_2

Scharping, T. (2007). The politics of numbers: Fertility statistics in recent decades. In Z. Zhongwei, & F. Guo (Eds.), *Transition and challenge: China's population at the beginning of the 21st century* (pp. 34-52). London: Oxford University Press. http://dx.doi.org/10.1093/acprof:oso/9780199299294.003.0003

Tao, T., & Zhang, X. (2013). Underreporting and over reporting in China's sixth national population census. *Population Research, 37*(1), 42-53.

Walfish, D. (2001). China's census: National count reveals major societal changes. *Science, 292*(5523), 1823. http://dx.doi.org/10.1126/science.292.5523.1823

Wang, J., & Ge, Y. (2013). Assessment of 2010 census data quality and past population changes. *Population Research, 37*(1), 22-33.

Yang, F., & Zhao, M. (2013). China's fertility level since 2000: A reexamination. *Population Research, 37*(2), 54-65.

Yi, F. (2011). *How many people in China?* Retrieved February 15, 2015, from http://yi.fuxian.blog.163.com/blog/static/109005802201141272449812/

Zeng, Y. (2007). Options for fertility policy transition in China. *Population and Development Review, 33*(2), 215-246. http://dx.doi.org/10.1111/j.1728-4457.2007.00168.x

Zhang, G. (2004). *China's Far below Replacement Level Fertility: A Reality or Illusion Arising from Underreporting of Births?* Australian National University Ph D thesis.

Zhang, G., & Zhao, Z. (2006). Reexamining China's fertility puzzle: Data collection and quality over the last two decades. *Population and Development Review, 32*(2), 293-321. http://dx.doi.org/10.1111/j.1728-4457.2006.00119.x

Zhao, Z., & Chen, W. (2011). China's far below-replacement fertility and its long-term impact: Comments on the preliminary results of the 2010 census. *Demographic Research, 25*, 819-836. http://dx.doi.org/10.4054/DemRes.2011.25.26

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