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China's Below Replacement Fertility: A Further Exploration

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Abstract

China has experienced an unprecedented fertility decline since the early 1970s. Available data show that the total fertility rate has fallen from about 6 children per woman to approximately 1.5 children in the past four decades. This change has not only greatly altered China's demographic map, but also incited considerable discussion on the quality of China's recent fertility data and the impact of China's traditional culture on people's fertility behaviour in the past and present. This paper further examines China's recent fertility changes with a particular attention being directed to the following questions: China's below and far below replacement fertility since the early 1990s; the reliability of China's recent fertility data; and some historical and cultural factors that contribute to China's rapid fertility decline.

Key Words: *Fertility decline, China, data and methods of fertility analysis*

Résumé

Depuis le début des années 1970, la Chine subit un déclin de fécondité sans précédent. Les données disponibles démontrent qu'au cours des dernières quatre décades, l'indice synthétique de fécondité a chuté d'à peu près six enfants par femme à environ 1.5 enfants. Ce changement a non seulement grandement altéré la carte démographique du la Chine, mais a aussi suscité beaucoup de discussion au sujet de la qualité des données récentes en matière de fécondité en Chine et l'impact de la culture traditionnelle chinoise sur les comportements de fécondité passés et présents. Cet article continu à examiner les changements récents en matière de fécondité en Chine tout en portant une attention particulière aux questions suivantes: Le taux de fécondité sous ou très en dessous le seuil de remplacement depuis le début des années 1990, la fiabilité des données récentes en matière de fécondité en Chine, et quelques facteurs historiques et culturels qui contribue au déclin rapide du taux de fécondité en Chine.

Mots-clés*: Déclin du taux de fécondité, Chine, données en matière de fécondité*

Introduction

China has experienced an unprecedented fertility decline since the early 1970s, with its total fertility rate (TFR) falling from about 6 children per woman to approximately 1.5 children in the past four decades. This paper further examines China's recent fertility changes. It starts with the discussion of China's below and far below replacement fertility since the early 1990s, which is followed by the investigation into the reliability of China's recent fertility data. Then the paper considers a number of historical and cultural factors that contribute to China's rapid fertility decline, and it ends with some concluding remarks.

China's Below and Far Below Replacement Fertility since the Early 1990s

There is a general consensus about China's early fertility decline, which can be summarized as the following. Although noticeable fertility changes were already observed in some cities in the 1950s and 1960s, China's national fertility level remained high in most years of these decades (Lavely and Freedman 1990). Facing the fast population growth, Chinese government launched a radical family planning campaign in the early 1970s, which played a significant part in China's great fertility reduction. By 1980, the TFR had already fallen to around 2.5, and it fluctuated in the decade that followed, varying between 2.3 and 2.9 (Yao 1995). These fluctuations were largely observed in period fertility however, and cohort fertility showed a general decline in the decade. By 1990, China's TFR was already close to replacement level. While these recorded fertility statistics have been influenced slightly by under-registration of births, they could represent China's fertility trends over the period from 1950 to 1990.

Since the early 1990s, the consensus about China's fertility similar to that existing in previous two decades has largely disappeared. Although recorded fertility statistics suggest a marked fall in fertility in 1991 and 1992, and a further reduction thereafter, remarkably different opinions on China's fertility levels and the quality of its recent fertility data have widely existed. This section examines China's recent fertility trends on the basis of recorded fertility, the reliability of fertility levels reported by 2006 fertility survey and the tempo effect on China's recent TFRs.

Observed Fertility Trends

China's 1990 population census recorded that the TFR reached 2.3 that year (Yao 1995). After two years, the 1992 fertility survey by the State Family Planning Commission reported a further fertility reduction. According to the survey, TFRs were 2.05, 1.64, and 1.57 in 1990, 1991 and 1992, respectively (Hao and Gao 1996). These results were rejected immediately because of a widely held belief that the survey was affected by severe under-registration (Zeng 1996). In 1995, the Chinese government conducted a nationwide one-percent population sample

survey, also known as 1995 mini-census. This survey reported an even lower fertility for the year, only 1.43. This was too widely seen as the result of under-reporting. Since then, one national census was conducted in 2000, another one-percent population sample survey was conducted in 2005, and three national fertility surveys were conducted in 1997, 2001 and 2006. In addition, the annual population change survey conducted by the National Bureau of Statistics each year also collected and reported fertility data. Although many researchers had hoped that these later undertakings could overcome the suspected under-registration problem and report higher fertility, all of them recorded consistently low or lower fertility except that the 2006 fertility survey recorded high fertility in the two or three years before the time of enumeration. These results are presented in Figure 1, from which the following observations can be made.

According to most of the censuses, population sample survey, fertility surveys and annual population change surveys, China's TFR was within the range of 2.2 and 2.4 in the year 1990, although the 1992 fertility survey reported a slightly lower TFR which was 2.05. A marked fertility reduction took place in the next two to three years. By 1991, the recorded TFR was around 1.8, and this was likely the first time that China's national fertility fell to below replacement. By 1992, the recorded TFRs were between 1.5 and 1.7. In the next 15 years, China's recorded TFRs declined further, although there were some fluctuations. For most of the years, observed TFRs centered around 1.4, which was fairly close to the level of policy fertility of 1.47, estimated on the basis of government fertility regulations across China (Gu, Wang, Guo and Zhang 2007). Given the fact that these data were obtained through different undertakings and the sample size of some surveys is relatively small, these results are rather consistent. Since 1993, all recorded TFRs have been lower than 1.6 except those for 2005 and 2006, which were reported by the 2006 fertility survey. The high fertility for the two years was closely related to some sampling problems that were observed in the survey. After this has been taken into account, the adjusted fertility rates for these years are notably lower, and this will be detailed in the next sub-section. Accordingly, all collected data suggest that China's fertility has been far below replacement for more than a decade. China has become one of the countries with very low fertility in the world.

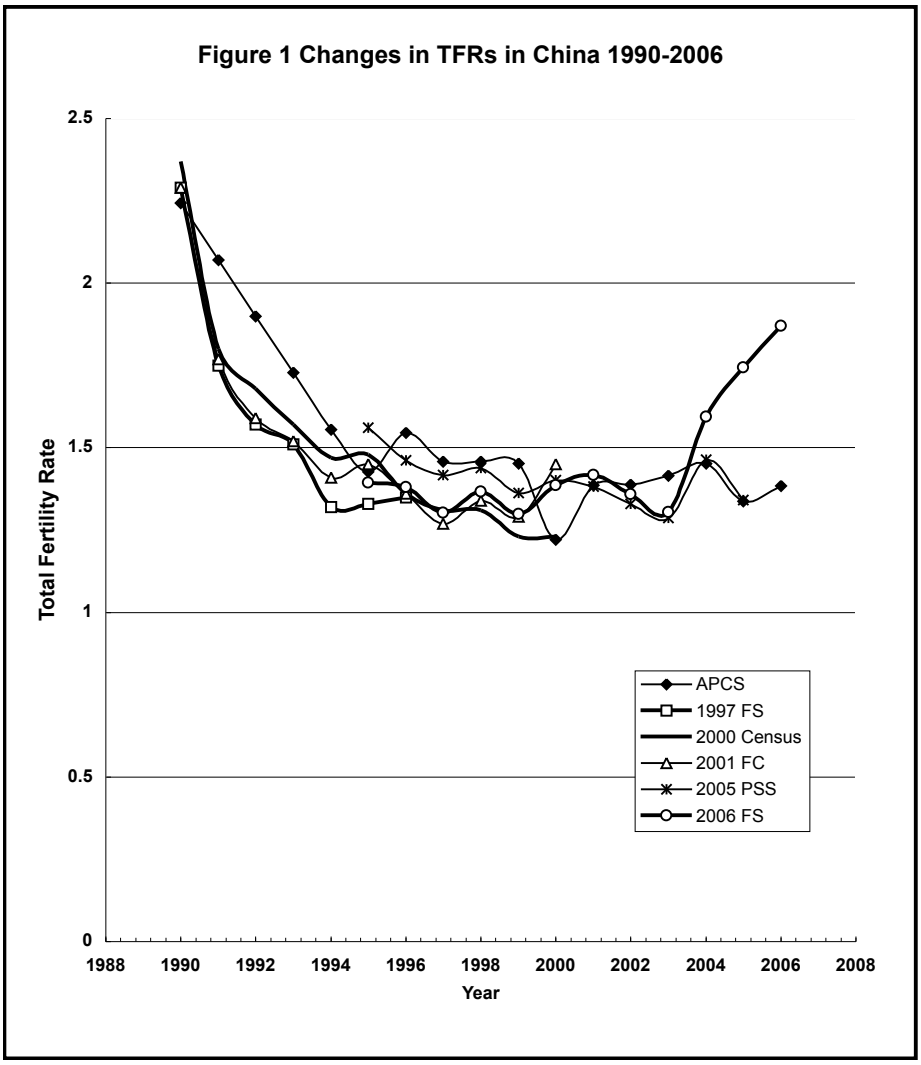
China's recent fertility changes can be further examined by parity. The TFR can be computed by parity which is denoted by TFR_1, TFR_2 and TFR_{3+} in the following discussion. Similarly, we can calculate Mean Age at Childbearing (MAC) for women by parity that is denoted by MAC_1, MAC_2 and MAC_{3+}. Here the parity is indicated by the subscript 1, 2 and 3+. These statistics are computed for years from 1994 to 2007

using data collected by China's recent annual population change surveys, censuses, and one-percent population sample surveys. The same could not be done for 1991, 1992 and 1993, because of the restriction of data availability.[1] These results, presented in Table 1, shed further lights on fertility patterns in recent years.

According to Table 1, TFRs were relatively low in 1995, 2000 and 2005 when the results were computed using data collected by population censuses or one-percent population sample surveys rather than annual population change surveys. The low TFRs observed in 2000 and 2005 were largely a result of the relatively low TFR_1 recorded in the same years. While the TFR_1 was also relatively low in 1995 in comparison with those in consecutive years, its impact on the TFR was comparatively small.

In 7 out of the 11 years when listed fertility statistics were computed using data collected by annual population change surveys, the recorded TFR_1 was greater than 1.0, while in other 4 years it was very close to that value. Under normal conditions when there is no heaping in first birth, the TFR_1 is expected to be lower than 1.0 because there are always some women who do not marry or do not have any children. A TFR_1 with a value of 1.0 or greater is an indication of a concentration of first births. This could happen under the following circumstances: some women start lowering their childbearing ages or stopped postponing their childbearing ages. Both of them alter existing fertility schedules and cause fertility heaping. Of course, heaping in reported first births can also occur when collected data were biased by problems in sampling or reporting as will be shown later.

One way of investigating the cause of fertility heaping is to examine changes in mean age at birth. Table 1 also presents parity-specific MAC for years from 1994 to 2007, which are computed using the method proposed by Bongaarts and Feeney (1998). These results show that the MAC computed from data collected by the census or one-percent population sample surveys tends to be lower than that obtained from annual population change surveys. The relatively low TFR_1 corresponded to the relatively low MAC_1 in 1995, 2000 and to some extent 2005. This seems to have suggested that the relatively low TFRs for these years were not a result of women postponing their childbearing. In other years when they were calculated using data gathered by annual population change surveys, both TFR_1 and MAC_1 tended to be higher. It is particularly noteworthy that the heaping in TFR_1 corresponded to the increasing MAC_1 in years 1996 to 1999, and 2001.



Notes: 1) TFRs are computed from the data collected by Annual Population Change Surveys (APCS), 1997, 2001 and 2006 Fertility Surveys (FS), 2000 Census, and 2005 One-Percent Population Sample Survey (PSS). 2) Annual population change survey data are not available for 1991, 1992 and 1993. The TFRs for these years are interpolated from data of other years. 3) The National Bureau of Statistics uses TFRs computed from census or one-percent population sample survey data for 1995, 2000 and 2005, because no annual population change survey was conducted in these years.

Source: 1) NBS (1990-2007); 2) Guo (2000); 3) Ding (2003); 4) Guo (2004); 5) Guo (forthcoming); and 6) Guo (unpublished paper).

Table 1. Changes in Total Fertility Rates and Mean Age at Birth, China: 1994-2007

Year	TFR	TFR_1	TFR_2	TFR_{3+}	MAC_1	MAC_2	MAC_{3+}
1994	1.56	0.95	0.44	0.17	24.21	27.46	30.96
1995	1.43	0.96	0.36	0.11	23.33	26.95	30.09
1996	1.55	1.06	0.38	0.10	24.35	27.96	30.94
1997	1.45	1.04	0.34	0.08	24.55	28.51	31.18
1998	1.46	1.04	0.35	0.07	24.63	28.85	31.43
1999	1.45	1.03	0.36	0.06	24.69	29.06	31.22
2000	1.22	0.87	0.29	0.07	24.02	28.36	30.85
2001	1.39	1.01	0.32	0.05	24.9	29.50	31.67
2002	1.39	0.94	0.32	0.13	24.86	29.57	28.07
2003	1.41	1.03	0.33	0.06	24.42	29.18	30.34
2004	1.45	1.06	0.35	0.04	24.56	29.44	30.92
2005	1.34	0.89	0.38	0.06	24.11	29.33	31.36
2006	1.38	0.95	0.39	0.05	25.25	30.19	31.80
2007	1.45	0.99	0.41	0.05	26.11	30.66	32.39

Source: NBS (1995-2008).

These contradicting results may be explained by the following reasons. First, it may be related to misreporting. As suggested by Zhang (2004) that many women could not have a second child according to China's family planning regulations. Some of them, after having had the second child, might have misreported the birth as the first one. This was more likely to have taken place in the annual population change survey, because the survey is more concerned with the number of children born in the year before the enumeration. In contrast, in the census and one-percent population sample survey, which recorded all children in the family, misreporting second birth as first one was less likely to happen. Second, the heaping in TFR_1 could have resulted from biases in sample selection, under-recording the floating population for example. While data restriction preventing us from an in-depth investigation into such a possibility in the annul population change survey, sample selection biases have been found in other operations such as the 2006 fertility survey, which will be discussed in the following sub-section. The relatively low TFR or TFR_1 in the census and one-percent population sample survey data may also arise from the fact that these data tend to be affected more by under-registration of birth than those collected by the annual population survey.

The 2006 Fertility Survey Results

As noted in the previous sub-section, all recent censuses, one-percent population sample surveys, national fertility surveys and annual population change surveys found consistently low fertility except that 2006 national population and family planning survey recorded a much higher fertility in the two or three years before the time of enumeration. According to the survey report published by the government, 'a low fertility has been stably maintained, but it has shown an increase in recent years. TFRs for Chinese women were 1.59, 1.74 and 1.87 for 2004, 2005 and the year before the survey (September 2005 to August 2006). For the three years, total first marriage rates were 1.23, 1.16 and 1.11, and total fertility rates for parity one were 1.07, 1.23, and 1.32, respectively, indicating some heaping in first marriage and first birth' (NPFPC 2007). Examining fertility patterns recorded by the 2006 fertility survey and identifying their underlying reasons are crucial for resolving the controversy caused by these results and for understanding China's current fertility situation.

The comparison of fertility patterns reported by the 2006 fertility survey with those observed from other fertility data shows a consistent fertility trend for years from 1995 to 2003, as indicated by Figure 1

presented earlier. So far as the completeness of registering births born in these years is concerned, the 2006 fertility survey is rather similar to other demographic surveys.

The 2006 fertility survey recorded markedly high fertility for 2004, 2005 and 2006, which was to a large extent caused by the heaping in first birth, as implied by the officially released survey report. If there were no heaping in childbearing, the TFR_1 should be less than or equal to 1. Assuming that the TFR_1 were 1 rather than the observed values for 2004, 2005 and 2006, the TFRs would reduce to 1.52, 1.51 and 1.55 for these years, respectively. If the influence of other factors that contributed to the relatively high fertility were also removed, the fertility level could be lower.

If it indeed existed, the heaping in first birth and first marriage as mentioned above would be found by other demographic surveys. However, when fertility patterns reported by the 2006 fertility survey are compared with those recorded by 2005 one-percent population sample survey, the following discrepancy emerges. For year 2005, the TFR reported by the 2006 fertility survey was 1.74, but according to the one-percent population sample survey, it was only 1.33. The latter, which is significantly lower than that recorded by the 2006 survey, shows no sign of being affected by heaping in first birth. Similarly, the TFR registered by the annual population change survey for 2006 was only 1.38, much lower than the 1.87 reported by the fertility survey carried out that year. The inconsistency of this magnitude calls for a further investigation into the cause of the heaping in first marriage and first birth shown in the 2006 fertility survey data.

The comparison of the population sampled by the 2006 fertility survey with those enumerated by the 2005 one-percent population sample survey and the 2006 annual population change survey reveals notable differences in their composition. In comparison with the other two surveys, the 2006 fertility survey seems to have under-sampled young (aged 15-24) and never married women, and over-sampled women who live in rural areas and have low or no education, as shown in Table 2. Because most young and single women would not start their childbearing and women living in rural areas and with low or no education tended to have children at younger ages and with higher fertility, it is not a surprise that 'heaping' in first marriage and first birth has been observed in the population enumerated by the 2006 fertility survey. We have also examined the female population sampled by 2007 population change survey. Its age structure and proportion of married in each age group are largely consistent with those sampled by the 2006 population change survey and the 2005 population sample survey, and differ considerably from those enumerated by the 2006 fertility survey.

Table 2
Women of Reproductive Ages
Sampled by 2006 Fertility Survey, 2006 Annual Population Change Survey and 2005 One-percent Population Sample Survey, China

Variable	2006 Fertility Survey	2006 Annual Survey	2005 Mini-census
Age Distribution			
15-19	7.47	15.06	14.81
20-24	9.89	11.82	11.45
25-29	12.36	11.63	12.18
30-34	17.88	14.47	15.67
35-39	20.91	17.61	17.87
40-44	19.16	17.79	15.84
45-49	12.32	11.63	12.19
Total	100.00	100.00	100.00
Proportion Never Marrying			
15-19	97.17	97.77	98.65
20-24	42.05	59.17	57.36
25-29	7.31	14.08	12.71
30-34	1.06	2.49	2.13
35-39	0.27	0.77	0.65
40-44	0.22	0.35	0.35
45-49	0.11	0.26	0.25
Total	12.31	23.95	23.25
Educational Level			
Illiteracy	7.69	3.91	5.22
Primary	26.02	23.26	24.05
Junior middle	41.57	48.02	47.37
Senior middle	16.14	16.63	16.15
College or higher	8.57	8.17	7.21
Total	100.00	100.00	100.00
Regional Distribution			
Urban	34.31	49.79	48.43
Rural	65.69	53.21	51.57
Total	100.00	100.00	100.00

Sources: NPFPC 2008, NBS 2007a and NBS 2007b.

The following example illustrates the magnitude of the influence arising from under-sampling never married women. Since the proportion of married women in each five year age group has been provided by the 2005 one-percent population sample survey, the information can be used to standardize the proportion of married women in the same age group in the population recorded by the 2006 fertility survey. This adjustment adds a large number of never married women in some age groups as shown in Table 3, which lowers age-specific fertility rates and TFRs.[2] As a result, the TFR_1 computed for 2005 falls from 1.23 to 0.86 and the TFR decreases from 1.74 to 1.31. This standardization alone has removed the heaping in first birth and made the TFR very close to that reported by the 2005 one-percent population sample survey, which is 1.33.

The above analysis suggests that the relative high fertility observed in the 2006 fertility survey data is very likely a result that arises from the problems in sample selection. After these problems have been corrected, what the survey results show is not an increase in fertility in recent years, but a low fertility that is largely consistent with that recorded by other surveys.

Low Fertility and Tempo Effect

China's observed TFRs were considerably lower than the replacement fertility and MACs increased in general over the period between 1994 and 2007. This suggests that the TFR, an indicator of period fertility reflecting both quantum and tempo effects, may not accurately represent actual changes in lifetime fertility. To disentangle these effects, this sub-section examines the tempo-adjusted TFR, which is denoted by $\mathbf{TFR_1}$, for the study period.

Using the method proposed by Bongaarts and Feeney (1998), Bongaarts (2001, 2002) and the data collected by 1997 and 2001 fertility surveys, one of the authors found in a previous study that low TFRs in the 1990s were affected significantly by the tempo effect, which made period fertility lower than lifetime fertility (measured by $\mathbf{TFR_1}$ as a proxy of completed fertility) by an average of 0.11 in years 1990 to 1995, and 0.23 in years 1996 to 1999 (Guo 2008). The magnitude of the influence is smaller than that observed in EU countries in recent years, which is 0.3 (Lutz et al. 2003).

This study uses census, one-percent population sample survey and annual population change survey data to calculate the $\mathbf{TFR_1}$. As shown earlier, there are some noticeable differences in TFR_n and MAC_n computed from these data sources. According to Bongaarts and Feeney (1998), tempo-adjusted method is sensitive to variations in the MAC or

Table 3. Adjusted Fertility for 2005 made on the basis of 2006 Fertility Survey Results, China

Age Group	Ratio of Married to Single Women		Number of Married Women	Number of Women after Adjustment		Adjusted Fertility	
	2005 PPS	2006 FS		Single	Total	TFR	TFR_1
15−19	0.01	0.1	227	16,544	16,771	0.002	0.002
20−24	0.74	2.08	2,264	3,045	5,309	0.107	0.097
25−29	6.87	21.33	3,968	578	4,546	0.097	0.063
30−34	46.04	133.07	5,988	130	6,118	0.044	0.008
35−39	151.76	403.12	6,853	45	6,898	0.010	0.002
40−44	285.06	502.75	6,033	21	6,054	0.001	0.000
45−49	398.8	765.8	3,829	10	3,839	0.000	0.000
Total	3.3	8.14	29,162	20,373	49,535	1.306	0.858

Note: Ratios of married to single women have been computed using 2005 one-percent population sample survey data and data presented in (NFPPC 2008).
Number of adjusted single women = Number of married women ratio of married to single women obtained from 2005 one-percent population sample survey.
Adjusted total number of women = Number of married women + Number of adjusted single women.

Sources: NPFPC (2007), 2005 one-percent population sample survey data.

MAC_n, which is also noted by Zeng and Land (2001). Because of that, notable fluctuations in MAC or MAC_n shown in our results could lead to a less reliable TFR_1, if the statistics calculated for every single year were used in the estimation. One way to avoid such influence is to compute TFRs for a period of five years as suggested by Bongaarts and Feeney (1998). In this study, we have applied a similar approach and used the whole study period for tempo adjustment. The procedures are summarized as follow.

First, the arithmetic mean of TFR and of each TFR_n are computed for the period 1994-2007; Second, on the base of the total change in each MAC_n over the study period, the average annual change is calculated, which is the r_n suggested by Bongaarts and Feeney (1998); Third, the average tempo-adjusted TFR_1 is computed using $TFR'_n = TFR \div (1-r_n)$; and Finally, the tempo effects for the study period are estimated on the basis of discrepancies between the average TFR_n and average TFR'_n, which can also be used to calculate the composition of tempo effects by parity. This method requires fertility statistics for start and end years of the study period.[3]

Table 4 provides three sets of mean TFR, TFR_n, MAC_n and estimated r_n, the average annual increase rate of MAC_n. The first set of results are computed from the data collected by 2000 census and 1995 and 2005 one-percent population sample surveys, which show relatively low TFR, TFR_n and MAC_n in comparison with others in the table. The second set of results is calculated using all data collected from 1994 and 2007, with higher TFR, TFR_n and MAC_n. There is a notable gap between these two sets of estimated r_1, the average annual change rate in average MAC_1. The third set of results is computed in the same way as in the second, except that it uses 2006 rather than 2007 as the end year. This difference results in little change in average TFR, TFR_n and MAC_n, but a notable change in r_1, making its level closer to the first set of results. This, which is closely related to the marked increase in MAC_1 in 2007, indicates that the estimated tempo effect is sensitive to the selection of start or end year. Further examining whether increasing MAC_1 indeed took place in 2007 will help to consolidate our conclusions, but this has to be conducted in the future when the required data become available.

The average TFR_1 and TFR'_n are calculated using the formula described above and the statistics in Table 4. These results, together with Δ – the difference between the average TFR and average TFR_1, and its decomposition by parity which is denoted as Δ_n, are shown in Table 5. According to the first set of results, which were obtained from only data collected by censuses and one-percent population sample surveys, the

Table 4
Average TFRs, MACs and r Values by Parity, China

Period	TFR	TFR_1	TFR_2	TFR_{3+}	MAC_1
Census Data					
1995-2005	1.329	0.906	0.343	0.08	23.82
All Data					
1994-2007	1.423	0.987	0.359	0.078	24.57
1994-2006	1.421	0.986	0.355	0.081	24.45

Period	MAC_2	MAC_{3+}	r_1	r_2	r_{3+}
Census Data					
1995-2005	28.21	30.77	0.08	0.24	0.13
All Data					
1994-2007	28.93	30.94	0.15	0.25	0.11
1994-2006	28.80	30.83	0.09	0.23	0.07

Sources: See Figure 1.

average TFR_1, TFR_2 and TFR_{3+} for the period 1995-2005 are 0.983, 0.451 and 0.091, respectively. The difference between the average TFR (1.329) and average TFR_1 (1.525) is -0.196, or the average TFR is lower than the expected average complete fertility by 0.196 of a birth. This can be decomposed into tempo-effect of parity one (0.077), parity two (0.108) and parity three and plus (0.012).

From the statistics of $\mathbf{\Delta}$ and $\mathbf{\Delta}_n$, the percentage distribution of tempo-effects contributed by different parity can be calculated. For example, results obtained from the census and one-percent population sample survey data suggest that over the period 1994 to 2005, the largest parity-specific tempo-effect was due to women's postponement of their second birth, which accounts for 54.9 percent of the total tempo-effect. The contribution made by postponing first, and third and later births consists of 39.2 percent and 5.9 percent respectively. These results are quite similar to those obtained from the 1997 and 2001 fertility surveys (Guo 2008).[4]

In comparison with the first set of results, the second set of results show a larger tempo-effect, about 0.3 of a birth, with 57 percent of it contributable to the tempo-effect of first birth. The size of tempo-effect and its distribution computed using data for years 1994-2006 are fairly close to those shown in the first set of results.

Based on these observations, we tentatively suggest that the tempo-effect arising from postponing births makes the average TFR lower than the expected average complete fertility by about 0.2 of a birth over recent years. A major contributing factor for this difference is the tempo-effect of the second birth, which accounts for some 50 percent of the total.

Reliability of China's recent Recorded and Adjusted Fertility Statistics

The previous section shows that China's recorded fertility fell below replacement in 1991 and is now far below this level. However, in the early 1990s, it was overwhelmingly believed that the observed low fertility was a result of severe under-registration. This view dominated Table 4. Average TFRs, MACs and r values by parity the entire decade,

Table 5
Average Total Fertility Rates and
Differences Comparing with Total Fertility Rates, China

Period	TFR	TFR_1	TFR_2	TFR_{3+}
Census Data				
1995-2005	1.525	0.983	0.451	0.096
All Data				
1994-2007	1.72	1.156	0.476	0.088
1994-2006	1.626	1.08	0.459	0.087

Period	Δ	Δ_1	Δ_2	Δ_{3+}
Census Data				
1995-2005	-0.196	-0.077	-0.108	-0.012
All Data				
1994-2007	-0.297	0.169	-0.117	-0.010
1994-2006	-0.205	-0.094	-0.104	-0.006

Sources: See Figure 1.

although has increasingly been challenged from the beginning of the twenty-first century. Even today, different opinions on China's fertility level still exist. Some researchers (National Strategy on Population Development Research Group 2007; CPIRC Research Group 2003; Zhang and Cui 2003) claim that China's TFR was above 2 before the year 2000 and has been around 1.8 since, while others suggest that the fertility was already close to 1.6 in the second half of the 1990s and has stayed at this or a lower level thereafter (Cai 2008; Retherford et al. 2005; Zhang 2004).

This rather confused situation is attributable to the following facts. The quality of some of China's demographic data, those collected by recent censuses or one-percent population sample surveys for example, has deteriorated in comparison with those gathered in the 1980s. Furthermore, while Chinese government has undertaken many demographic surveys, information about under-registration, post-enumeration quality assessment, estimation results and procedures used in obtaining them, and sometimes detailed survey data have not always been made available. In this section, we first review recorded under-registration rates of some censuses and demographic surveys. Following that fertility estimates made by various researchers and officially reported fertility rates in recent years are examined.

Observed Under-registration in China's recent Fertility Data

China has conducted three population censuses since 1982. According to official sources, net underreporting rates in enumerating population are 0.04 percent and 0.06 percent for the 1982 and 1990 censuses respectively (under-registration of birth is about 0.1 percent for the 1990 census), which are very low by international standards. The reported under-registration rate for 2000 census is 1.81 percent, but this may still be regarded as moderate (Coale 1984; NBS 1993a, 2002a; Sun 2001). Under-registration does not distribute randomly across all age groups and is more likely to have taken place among children aged 0 to 4. This has been noted in by a number of scholars who suggested that the 1982 and 1990 censuses might have under-recorded those aged 0 to 4 years by 3 percent and 6 percent, respectively (Zha, Zeng, and Guo 1996; Zhang and Cui 2003). A simple comparison with data collected by 2005 one-percent population sample survey suggests that comparing with previous censuses, under-registration of children aged 0 to 4 was more serious in the 2000 census.[5]

Another major demographic data source is China's nationwide fertility sample survey. Since 1990, four such fertility surveys were conducted by the government. The data collected by 1992 and 1997

surveys were used by many demographers. According to Wang, a government official involved in organizing these fertility surveys, the 1992 fertility survey under-recorded 3 percent or more births, while other studies suggested that the under-registration problem was more serious (Wang 1996; Zeng 1996). As for the 1997 fertility survey, the post-enumeration check found that under-recording of births was 6.47 percent (Wang 2000). The 2001 fertility survey data were also examined by some researchers. They reported that the error in recording births in this survey was less than 5 percent (Wang and Huang 2002). The latest fertility survey was conducted in 2006 and its tabulated results have been published recently. The under-registration rate of this survey has not been released by the authorities. But for the first time since the mid-1990s the China government used the unadjusted TFRs obtained directly from a survey of this kind as the officially endorsed TFRs (for years 2004, 2005 and 2006). This suggests that the government was rather confident about the completeness of registration in the 2006 fertility survey, despite the bias in sample selection, which was detailed in the previous section.

The third data source for fertility studies is China's annual population change survey, which is conducted in approximately one per thousand national population each year. In comparison with censuses and one-percent population sample surveys, these annual surveys are conducted by more experienced enumerators in general. Hence, they are expected to have a better quality. After the 1993 and 1994 annual population change surveys, post-enumeration checks were conducted. It was reported that these annual surveys under-recorded crude birth rates by 6.9 percent and 6.4 percent in the two years respectively (Jia and Sai 1995). Similarly, after 1995 one-percent population sample survey, the rate of adjustment was also discussed and released. Since then, however, China's statistical authorities have changed their practices and no longer published under-registration rates of annual population change surveys and methodological details used in obtaining officially reported TFRs. Information on related issues is also difficult to find. For example, Hu, who has long been involved in organizing China's annual population change surveys, published a major paper systematically reviewing the annual survey. The paper briefly mentioned the issue of under-registration, but failed to offer any insight about it (Hu 2005).

The following conclusions can be drawn from the above discussion. Under-registration of births has indeed existed in China's recent censuses, one-percent population sample surveys, fertility surveys and annual population change surveys. There is evidence that the quality of recent census data has deteriorated in comparison with those collected two decades ago. The under-registration rates of the 1993 and 1994 annual population surveys and recent fertility surveys, either recorded by post-enumeration surveys or suggested by researchers who were heavily

involved in these operations, are all lower than 7 percent. Even after taking under-registration of this magnitude into consideration, China's recent TFRs are still considerably lower than 1.8. Finally, under-registration in recent censuses, one-percent population sample surveys and fertility surveys may have not distributed evenly across children of all ages. Severe under-registration is often found among children who were born closer to the time of enumeration.

Estimated China's Fertility Levels

Because of the under-registration in China's recent fertility data and the inaccessibility to detailed information about such under-registration and procedures used in adjusting it and calculating officially reported fertility rates, many scholars have used different data, assumptions and methods to estimate fertility levels in the past 15 years. These studies can be broadly divided into three groups.

The first group of studies estimates China's fertility levels based largely on the assumption that officially reported numbers of births and fertility rates in the last two decades were generally accurate. They usually used these statistics as important evidence or benchmark and compare them with data collected by censuses or fertility surveys of various kinds. The major conclusions of these studies are as follow. China's recent censuses and fertility surveys have considerably under-recorded actual numbers of births and fertility. For example, the 2000 census might have under-recorded 30 to 37 millions children who were under age 10 at the time of enumeration. These studies suggested that China's TFRs have been higher or around 1.8 since the mid-1990s. Because of the assumptions used, it is not a surprise that these estimation results are highly consistent with officially reported fertility rates (Zhang and Cui 2003; Goodkind 2004; Yu and Wang 2004, CPIRC Research Group 2003).

Studies included in the second group use different assumptions and approaches to estimate China's fertility level. For example, Cai used the Variable-r method developed by Preston and Coale to assess fertility levels in the 1990s. The results showed that in the 1990s, China's total fertility 'indeed reached a level far below the replacement' and was 'lower than the official adjustment' (Cai 2008). Retherford and his collaborators applied own-children method and birth history reconstruction method to China's 1990 and 2000 census data. Their results suggested that China's TFR was probably around 1.6 in the mid-1990s and even lower at the end of the decade (Retherford et al. 2005). In his PhD dissertation, Zhang systematically examined the impact of under-registration problems on China's major fertility statistics. On the

basis of this investigation and estimation results, it was determined that China's TFR was likely to have been between 1.59 and 1.63 in the years 1997 and 1998 (Zhang 2004). One of the most significant conclusions drawn from these studies is that since mid-1990s, China's fertility level has been notably lower than the officially reported fertility, and this is supported by the studies conducted independently by other scholars including the authors of this paper.

In addition to the studies clustered into the above two groups, several studies used school enrollment data to estimate China's recent fertility level, but they have reached different conclusions. Some of the early studies suggested that in comparison with school enrollment data, the 2000 census considerably under-recorded children of young ages, which was more than 30 million (Cui and Zhang 2002; Zhang and Cui 2004; Liang 2003). Under-registration of this magnitude is consistent with those previously estimated by the statistical authorities and offered support for the high fertility claim. After a reconstruction of TFRs from available education statistics gathered at both national and provincial levels, Scharping found that China's TFR already fell to 1.60–1.65 in 1997 (Scharping 2005). A further study was conducted by Zhai and Chen. They collected more detailed data and their fertility estimates were higher than those reported by Scharping and fairly close to officially reported fertility rates (Zhai and Chen 2007). The relatively high fertility estimates published in their paper, however, are related to the fact that a relatively low school enrollment rate (95 percent) was used in their estimation. In a paper published recently, Chen has reported the latest results estimated on the basis of two different school enrollment levels. The results estimated using a school enrollment rate of 98 percent are very close to those suggested by Scharping (Chen 2009). Some other scholars, however, have questioned the suitability of using recent school enrollment data to estimate fertility. They have shown that school enrollment data have also been affected by registration problems. Using them to estimate fertility changes has some limitations, which could lead to an over-estimation of fertility under China's recent particular circumstances (Cai 2009; Chen 2009).

China's Officially reported Fertility Levels

The evidence presented up to this point overwhelmingly suggests that China's TFR fell to around 1.6 or lower in the second half of the 1990s. But it is also well known that officially adjusted or endorsed TFRs have been consistently higher than this level for some 15 years, which makes a further examination of numbers of births and fertility rates from various official data sources necessary.

Numbers of births and crude birth rates (CBRs) obtained from different sources are listed in Table 6. Columns 2 and 3 present numbers of births and CBRs calculated directly from census, one-percent population sample survey and annual population change survey data.[6] The sample size of the annual survey has been approximately one per thousand of China's national population since 1994. As expected, numbers of births recorded by annual population change surveys conducted between 1996 and 1999, which are listed in column 2, are about 0.1 percent of those shown in column 4. The latter are numbers of births in the national population, which were reported by China Population Information and Research Centre but not adjusted for under-registration. Non-adjusted CBRs for the national population are listed in column 5. They are very close to those listed in column 3 except for 1995 and 2000. Figures shown in columns 6 and 7 are officially adjusted numbers of births and CBRs. The comparison between figures in columns 3, 5 and 7 suggests that the officially adjusted CBRs on average are 1.16 times of the CBRs computed directly from the annual population change survey listed in columns 5 and 3 in the 1990s (see the ratios in columns 8 and 9). For years 2001 to 2007, the differences between them increased, and the figures shown in column 7 (excluding that for year 2005 which was collected by the one-percent population sample survey) on average are 1.19 times of those listed in column 3. In 2000 and 2005 when censuses or one-percent population surveys were conducted, the gap between these figures was greater. For 2005, the CBR in column 7 was 1.31 times of that in column 3. The two sets of unadjusted CBRs (shown in columns 3 and 5) differ notably for 2000 (also for 1995), and both of them were considerably lower than the officially adjusted figures in column 7.[7] A comparison of TFRs shows similar results. For example, for periods 1994-1999 and 2001-2004, the officially adjusted TFRs were on average 1.21 times of the unadjusted TFRs calculated directly from annual population change survey or one-percent population sample survey results.[8] In contrast, the difference between officially adjusted TFRs and recorded TFRs were also larger for 2000 and 2005. Because China's statistical authorities have hardly made any public comment on the magnitude of their adjustment of CBRs and TFRs (except for the adjustment result made for 1995) and details about the procedures used in making such adjustments are not available, inconsistencies in fertility rates found from various sources still confuse many people.

The results presented above suggest that China's officially adjusted numbers of births, CBRs and TFRs are markedly higher than those computed directly from or indicated by census, one-percent population sample survey and annual population change survey data. The difference is notably greater than that indicated by the under-registration

Table 6. Comparison of Adjusted and Non-adjusted Numbers of Births and CBRs, China: 1990-2005

Year	Number of Births in the Sampled Population	CBR in the Sampled Population (‰)	Total Number of Observed Births	Unadjusted CBR (‰)	Officially Adjusted Total Number of Births	Officially Adjusted CBR (‰)	Ratio of CBRs (7)/(3)	Ratio of CBRs (7)/(5)	Size of the Sample in the Population (%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1990					23,910,000	21.06			
1991			21,210,000	18.32	22,580,000	19.68		1.07	
1992			19,160,000	16.35	21,190,000	18.24		1.12	
1993			18,460,000	15.58	21,260,000	18.09		1.16	
1994	11,603	15.42	18,350,000	15.32	21,040,000	17.70	1.15	1.16	0.063
1995	166,772	13.49	17,460,000	14.42	20,630,000	17.12	1.27	1.19	1.040
1996	17,771	14.26	17,520,000	14.32	20,670,000	16.98	1.19	1.19	0.103
1997	17,007	13.68	16,640,000	13.47	20,380,000	16.57	1.21	1.23	0.102
1998	16,452	13.23	16,570,000	13.28	19,420,000	15.64	1.18	1.18	0.101
1999	15,336	12.65	15,980,000	12.70	18,340,000	14.64	1.16	1.15	0.098
2000	1,181,952	10.01	12,180,000	11.40	17,710,000	14.03	1.4	1.23	9.510
2001	13,853	11.35			17,020,000	13.38	1.18		0.096
2002	13,668	10.86			16,470,000	12.86	1.18		0.099
2003	13,328	10.57			15,990,000	12.41	1.17		0.098
2004	13,450	10.73			15,930,000	12.29	1.15		0.097
2005	161,042	9.48			16,170,000	12.40	1.31		1.325

Notes: 1. Figures that are listed in columns 2 and 3 and for the years 1995, 2000 and 2005 are from 1995 and 2005 mini-censuses and 2000 census (data from the long-form). Other figures are from annual population change surveys. The proportion of the sampled population is given in column 10. The CBR listed in column 3 is computed directly from the sampled population. 2. Figures in columns 4 and 5 are officially reported non-adjusted figures. 3. Figures shown in columns 6 and 7 are officially reported adjusted numbers of births and CBRs.

Sources: Figures in columns 2, 3 and 10 are obtained or derived from (NBS 1996) for 1995, (NBS 2002a) for 2000, (NBS 2007a) for 2005, and (NBS 1991-2005) for other years. Figures in columns 4 and 5 are from CPIRC (2003). Figures in columns 6 are from (NBS 2002 and 2003) for 1990-2001, and (NBS 2003-2006) for 2002-2005. Figures in column 7 are from (NBS 2006a).

rate found by some post-enumeration checks and other evidence. Without sufficient justification, this may be reasonably seen as an over-adjustment. This has also been pointed out by Qiao, who claimed that China's National Bureau of Statistics 'artificially added almost 3 million births each year' to the total population over the period 1990–1999 (Qiao 2005: 12). The statistical authorities might have their own reasons for inflating numbers of births, CBRs and TFRs at a level higher than that suggested by the under-registration rates obtained from some post-enumeration surveys, practices of this kind inevitably create confusion, especially when no adequate justification was given.[9] Indeed, these officially adjusted, and most likely over-inflated, fertility rates have contributed directly to the perplexity surrounding China's recent fertility level.

China's Fertility Transition: Some Lessons

China's fertility, after its unprecedented reduction in the 1970s and some fluctuations in the 1980s, experienced another major change in the 1990s. The TFR fell first to below replacement in 1991 and then to far below this level in the second half of the decade. Although it had been expected that this was largely a result of under-registration of births, all recent censuses and surveys have failed to uncover these 'missing' children. Instead, they have shown consistently that China's fertility was very low from the mid-1990s and has stayed at this or a lower level since. Even after adjusted for tempo-effect, the implied life time fertility for Chinese women has been below replacement for nearly two decades. These changes raise many important questions. Why in China, a country with a tradition that was and is still widely seen as very pro-natalist, fertility fell rapidly in the 1970s and is now far below replacement? What can we learn from China's fertility transition? In what way have China's cultural traditions contributed to this great demographic change? This section tries to briefly address some of these questions.

Government Intervention: A Driving Force of Demographic Change

In comparison with fertility decline in most developed countries, China's fertility transition has two remarkable features. First, it started when the level of socio-economic development was low, the society was largely rural, the standard of living was poor, and the formal education was not available for a considerable part of the population. Second, the fertility reduction, especially in the 1970s and early 1980s, was largely driven by a government organized family planning program, which was never seen

in the west and some other parts of the world. Partly because of that, the role played by coercive or punitive measures sometimes have been over-emphasized.

It is worth noting that government promoted family planning programs, which began in India in 1951, have existed in many Asian countries. China's family planning program has been a part of and affected greatly by this general trend. While family planning programs have existed in both developing and developed countries and contributed to their fertility decline, noticeable differences exist between them. Family planning started in the nineteenth century or early twentieth century in many western developed countries. It was largely a private and philanthropic enterprise and primarily for the purpose of granting individuals, especially women, control over their own reproduction. In these countries, family planning was organized and executed mostly by voluntary family planning associations or other kinds of none government organizations. Governments often left family planning education and services to the medical profession and to retailers and pharmacists, and they played no observable role in this great social demographic change. Many governments are still reluctant to give technical assistance in this field. This is closely related to a tradition that in most of these countries, the government had never been the unchallenged arbiter of morals, especially of sexual and reproductive morals. This was role that was claimed largely by the Christian churches.

In contrast, situation in China, as well as in some other Asian countries, has been different. In Chinese history, for example, there were no monolithic religions with firmly organized hierarchies and a tradition of receiving binding moral interpretations from a supreme religious leader. This vacuum was often filled by the emperor who was literally called 'son of heaven' and the imperial government, and by the strong tradition of moral leadership by secular leaders. This was especially the case when national issues were addressed. Thus, it is entirely logical that after learning that population growth was faster than had been expected, China and many other Asian countries, started government led or promoted family programs. Differing from their western counterparts, governments in China and some other developing countries provided not only family planning information and services but also added a moral dimension to family planning through arguing that population control was good for the family and necessary for the country. Moreover, in China and some developing countries, both incentive and disincentive measures were used to implement government family planning policies and to induce people to regulate their reproduction. While some of these measures have been very controversial, it is important to note that the leading role played by the government in family planning is a major

factor that contributes to China's nationwide rapid fertility reduction which took place when its socio-economic development engine was not yet powerful enough to trigger this great change.

Extended Family, Collective Reproductive Strategies and Public Response to Government's Family Planning Programs

That China's government-led family planning could have received a wide support from its large population, which was particular the case in the 1970s, is also related to family systems and reproductive strategies in historical China. In demographic literature, the prevalence of traditional large extended families has often been linked to pro-natalist culture and high fertility. Yet, it is noteworthy that some countries that historically had stem or joint family systems now have the lowest fertility in the world. The influence of certain aspects of such family systems and the reproductive strategies under such systems may have played a non-negative role in recent fertility decline.

Differing from many western countries especially those in northwest Europe, where the nuclear family system dominated even before the industrial revolution, the joint family system prevailed in many parts of China in the past. Under such a family system, the interest of the large family, the continuation of the direct family line (passed from the father to his oldest son), early marriage and early childbearing ware widely promoted.

Such a family system tended to surrender the interest of an individual or a conjugal unit to the large family or even the lineage to which these individuals belonged. Decision-making regarding marriage and reproduction often became a familial or community prerogative rather than an individual's choice. Family members were frequently taught and encouraged to make sacrifices for their families and future generations. Their marriage and reproduction were often strongly influenced by the interests of the extended family or even decided entirely by their seniors. Studies have shown that in some Chinese historical populations, household composition and the status of an individual in the family had a considerable impact on the chance of marrying, time of having children, adoption, and even the likelihood of dying of family members (Bengtsson, Campbell and Lee 2004).

Under the traditional family systems and practice of this kind, marriage and childbearing tended to be affected by the 'collective' decision rather than 'individual' choice. In historical northwest Europe, marriage and reproduction were largely an issue concerning only the couple themselves. To prepare for marriage, the couple involved needed

to accumulate required financial resources, which was particularly difficult when the economy was in down turn. This was a main reason for late marriage in these countries and for the close relationship between changes in real wage and age at first marriage. Under the family system like that in historical China, the consideration of marriage and reproductive strategies was different. Continuing the family line, especially that descending through the eldest son, was of overriding importance. Marriage, reproduction, and adoption were all important means of achieving this goal. To ensure this, marriage and reproduction of eldest sons were often given priority over those of their sisters and younger brothers. Sometimes, the interest of the letter was even sacrificed for this.

These practices have a number of implications. In countries like China it is easier for the government and social elite to assume the role of moral authorities and play a stronger part in guiding or influencing the social behavior and practice. This can also be accomplished with less opposition through the hierarchical political establishment and kinship organizations, such as the lineage and large extended family. This long tradition helps to legitimize or consolidate the government's leading role in family planning. While it is very difficult for westerners to accept government intervention into their private life, for the Chinese, as suggested by Lee and Wang, 'the current family planning program' is to some extent, 'merely an extension of familial mode of reproduction to the local community or beyond' (Lee and Wang 1999: 99). This difference once more demonstrates the importance of social institutions in influencing people's productive behavior and fertility changes.

Traditional Culture, Reproductive Behaviour and Rapid Fertility Decline

In the study of social history, Chinese culture, just like China's historical family system, is also widely seen as favourable to high fertility or very pro-natalist. It has been claimed that 'the fecundity of the Chinese was without parallel' and their 'birth rate was abnormally high' (Mallory 1926: 17 and 87). This was so, because Chinese people wanted to have 'as many children as possible, preferably sons' (Chandrasekhar 1967: 59) and they 'made every effort to maximize the number' of their sons (Wolf 2001: 134). Yet, fertility in China and also in some East Asian populations, which have been greatly affected by Chinese culture but without a strong government-led family planning program, has not only fallen very fast, but also reached a very low level. This paradoxical situation makes a

brief comment on some aspects of China's reproductive culture necessary and useful.

China's traditional culture was not as simple and pro-natalist as often assumed by some scholars. Although pro-natalist ideas were promoted and very likely to have dominated in many places, views about restricting the number of children and practice of controlling family size also existed in the past. As early as Sui and Tang periods (581-907 AD), Wang Fanzhi had already expressed the view that having one capable son was enough and this would free people from vexations and tensions associated with family division. He further suggested that having no children should not be regarded as a problem, as this could free parents from worrying about the compulsory military service and other types of levy and corvee that would be imposed on their children.[10] In the next few dynasties, scholarly discussion of population issues gradually increased, and this is particularly noticeable during the Ming–Qing period (1368–1911 AD) when China's population growth became increasingly perceptible. A number of scholars commented on issues related to China's rapid population growth, population doubling time, replacement level of fertility, the relationship between the growth of population and that of the means of subsistence, and how the population growth may be controlled. One of them, Hong Liang Ji (1746–1809 AD), even earned himself a title of 'Chinese Malthus' for the reason that he developed some theories which were not only similar to but also a few years earlier than those proposed by Malthus.[11]

In addition to the scholarly discussion on issues about controlling population growth, recent investigations in historical demography have shown that in most historical Chinese populations total marital fertility rates were relatively low and usually between 5.5 and 7.0. They could only be seen as moderate in comparison with the so-called natural fertility and marital fertility rates recorded in some historical European populations. While Chinese women historically married young and an overwhelming majority of them would marry, the interval between their marriage and first birth was comparatively long and about 3 years. Their inter-birth intervals were also longer than those recorded in many historical European countries. Furthermore, the mean age at last birth was relatively low among Chinese women and around 38 years. All these are attributable to the moderate marital fertility recorded in the past.

One of the debating issues in the study of China's past fertility behaviour is whether the observed moderate or low marital fertility was due to people's intentional control of family size or merely a result of certain social practices and behaviour. Recent investigations have shown that the claim that whatever the reasons for China's past moderate marital fertility, 'it was not deliberate fertility control' is wrong (Wolf 1985: 177). There is

evidence suggesting that people had the intention to control their family size even in the past.

For example, infanticides were widely observed in the Song Dynasty (960-1279 AD). Scholars and government officials of the time not only recorded the practice that people killed their children if the number exceeded their expectation, regardless of their sex; they also noted or commented on people's motivation of doing so and their desired family size. According to Su Shi (1037–1101 AD), in parts of Hubei and Hunan, 'peasants usually wanted to have two sons and one daughter. If more were born, they would be killed.' Yang Shi (1053–1135 AD) noted that in parts of Fujian 'people had children according to their economic ability. Even the gentry behaved accordingly ... rich families had no more than two sons and one daughter. Middle and lower families generally had only one son.' Also in Fujian, Li Gang (1083–1140 AD) observed that 'people kept only one or two children or sons, and the rest would be killed by drowning.' A similar practice was found in Jiangxi, where according to Zhu Song (1097–1143 AD), 'people wanted to have only two sons, they drowned all the rest thereafter regardless of their sex.' All these records indicate a phenomenon that many people did not want to maximize their family size or the number of their sons. That this practice was recorded by these extremely well-known historical figures provides a clear indication that at least as early as in the Song period, intentional control of family size existed. There were people who wanted '*Ji Chan Yu Zi*' or '*Ji Chan Shou Kou*', which literately means 'having children according to their ability and wealth'. In other words, their decisions to control family size or reproduction stemmed directly from the consideration of their short or long term economic interests.[12]

The above evidence shows an important fact that intentional control of family size is neither an outcome of the China's nationwide family planning program (though strongly promoted by it) nor a result of modernization. It existed a long time ago. If the Chinese could have done so when they felt that controlling the family size was necessary for their families in the past when they were subjected to the influence of the traditional culture, it would be nature or not too difficult for them to response positively to the call for controlling fertility when they were persuaded or realized that it would be good for the country and their families in the 20th century. This at least partly explains the early success of China's family planning program, the rapid fertility reduction in the 1970s and the further fertility decline ever since.

Concluding Remarks

One of the major purposes of this study is to examine China's recent fertility changes. Available evidence has shown that fertility patterns recorded by recent censuses, one-percent population sample surveys, national fertility surveys and annual population change surveys are largely consistent. According to most of these censuses and surveys, China's TFR had fallen below replacement in 1991. Since then, it declined further to a lower level. China has become a country with far below replacement fertility.

China's recent censuses, population sample surveys, fertility surveys and population change surveys were affected by under-registration problems. Recorded (or unadjusted) fertility therefore was very likely to have been lower than the actual fertility level. However, under-registration rates found by available post-enumeration surveys and a number of studies that evaluated the quality of recent fertility data are lower than those indicated by government-adjusted fertility statistics. Evidence that could sufficiently justify the government-endorsed fertility level is not available.

While it would be useful, the focus of this study is not to estimate China's recent fertility, but rather to show that most of the evidence has suggested that China's recent fertility has been lower than those adjusted and published by Chinese authorities. Even after under-registration of a reasonable magnitude has been taken into consideration, China's recent fertility is still much lower than the level of replacement.

It is important to note that while the government-led family planning has played an important part in China's fertility transition, at its early stage in particular, China's rapid fertility reduction is also contributable to some other factors. The impact of China's traditional culture, social institution and reproductive behaviour is not as simple as often being assumed. Evidence shows that intentional control of family size existed in the past. Chinese traditional culture enclosed elements that were not particular pro-natalist. Population pressure and the necessity of balancing the growth of population and subsistence were discussed by Chinese scholars and government officials. Certain social practice and institutions tended to surrender the right of individuals including their right to marry or have children to their extended family. All these, in one way or another, may have played a non-negative part in China's recent fertility reduction.

While it has discussed some factors that have contributed to China's rapid fertility transition, this paper was not designed to investigate the question why China's fertility has fallen to far below replacement. Systematically explaining the causes of very low fertility

that is confronting many populations in the world is an important and challenging task. It is beyond the scope of this study and needs to be addressed by another paper.

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End Notes

1. For 1991, 1992 and 1993 annual population change survey results are not available. For 1995, 2000 and 2005, the statistics are obtained from national population censuses or one-percent population sample surveys.

2. Here, we assume that all births take place among married women. This is still true for the majority of Chinese population, which is reflected in published fertility statistics including those obtained from these surveys. Therefore, adding unmarried women does not affect the number of births. We can use the number of married women in each age group recorded by the 2006 fertility survey to divide the ratio of married women to single women in the same age group as recorded by the 2005 one-percent population sample survey. This will make the proportion of married in each age group the same between the two populations.

3. More data will make average TFR_n and average MAC_n for the period more reliable, but they will not alter the magnitude of change in MAC_n (measured by the r_n) because this is obtained from only the MAC_n of start year and end year.

4. Guo found that postponing births during 1990 to 1995 made the TFR lower than TFR' by 0.109 on average, but in the period of 1996 to 1999 the tempo-effect increased to 0.232, and the composition by parity were 36.9% for the first birth, 56.6% for the second birth, and merely 6.5% for the third and above births. Therefore, Guo suggested that under this circumstance, focus on only mean age at first marriage or mean age at the first birth may not be enough in examining the tempo-effect.

5. In estimating the under-registration rate for the 2000 census, we simply assumed that the 2005 one-percent population sample survey did not have under-registration, and that proportions of population sampled in all age groups are the same and they all equal to the reported sample size, which is 1.325 percent of the national population. That these assumptions may not always hold could affect the estimated under-registration rate.

6. The CBRs listed in column 3 in Table 6 are computed using the number of births recorded in the 12 months before the time of enumeration and the total population recorded at the time when the survey was undertaken rather than the number of births in the specified year and its mid-year population. Since the annual population change survey was conducted at the end of September or October, strictly speaking, the computed rate is not the same as conventional CBR, although the two should be very close. In this study, the figures shown in column 3 are used to approximate the CBRs in specified years.

7. For 1995, the CBR in column 3 was computed from the 1995 1% mini-census sample data. For 2000, the CBR was computed from the 2000 census 9.5% sample data.

8. These figures are very close to those acknowledged by the statistical authority after the 1995 one-percent population sample survey. They suspected that this survey, like the 1992 fertility survey, might have seriously undercounted the number of births. On the basis of this consideration and their data evaluation, they upwardly adjusted recorded fertility rates: from 14.42 to 17.12 per thousand for the CBR and from 1.46 to 1.85 for the TFR (Zhang, Yu and Cui 1997: 46). This implies an under-registration of 15.8 per cent for the CBR and 21.1 per cent for the TFR. Later, the TFR has been further adjusted to 1.78.

9. According to an available explanation, the NBS decided to inflate its annual survey results in such a manner partly because of its past experience of underestimation. In addition to that, the practice was also a response to the strong suspicions of both policymakers and demographers who believed that the underreporting was greater than they had found (Zhang 1995; Yu and Xie 2000). Qiao's speculation may be seen as another possible reason, which suggests that the NBS might have used the upper bound of the

estimated reporting error interval as the underreporting rate to make the adjustment (Qiao 2005; also see Jia and Sai 1995).

10. The scholar who made these comments in his poems was Wang Fanzhi, who lived in the Sui (581–618 AD) and early Tang (618–907 AD) period. For more details see The Transcription of Wang Fanzhi's Poems, by Zhang (1983).

11. For a detailed discussion on these ideas and suggestions, see Zhao (2006).

12. For a detailed discussion and these citations and their sources, see Zhao (2006) and the listed references.

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