

Searching for the Answer for China's Fertility Puzzle: Data Collection and Data Use in the Last Two Decades

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Abstract

China's fertility level has become a matter of considerable debate since the early 1990s. Despite the widespread concern of data quality, however, a recent literature review has revealed that there has been a lack of systematic examination of major fertility data in terms of their collection, specific problems, and use in demographic research. This paper first examines five major fertility data sources, and then identifies a number of problems in producing and using fertility data and further discusses their implications. Finally, it addresses some issues relating to China's controversial 2000 census results and the extremely low fertility. The paper concludes that the prevalent uncertainty about fertility level is not only related to the problem of data quality, but also a result of misusing fertility data and exaggerating the problem of under-registration, and more importantly, the failure to appreciate the nature of changing society and the birth planning program.

China's fertility level has become a matter of considerable debate since the early 1990s. According to the 1982 One-Per-Thousand Fertility Sample Survey and 1990 census, the Total Fertility Rate (TFR) fell from 5.7 in 1970 to 2.3 in 1989 (Coale and Chen, 1987, SSB, 1993). Like those derived from the early censuses and fertility surveys, these results were widely accepted. The confidence in China's fertility data, however, was shattered when the result of the 1992 national fertility survey were released, which showed that the TFR reached 1.65 in 1991 and 1.52 in 1992. These figures surprised the demography community and were rejected immediately as the result of seriously under-registration (Feeney and Yuan, 1994, Jiang et al., 1995b, Zeng, 1996). Despite this widely held consensus, researchers failed to reach an agreement about China's fertility level. The estimated TFRs for 1992 ranged from 1.70 to 2.10, and the high estimate was 1.38 times of the recorded figure (Jiang et al., 1995a, Zeng, 1996). Following that, the inter-censal sample survey reported an even lower fertility, and the recorded TFR was only 1.46 in 1995 (SSB, 1997). Again, it was concluded that this resulted from flawed data collection and the actual fertility would be much higher. The estimates made by the Chinese government and scholars varied between 1.69 and 1.87 (Zhang et al., 1997, Yu and Xie, 2000, Qiao, 1998). It had been hoped that these long-standing disagreements would be settled by the 2000 census. But rather than solving China's fertility puzzle, the census recorded a TFR of 1.22, which sparked further controversies and led to another round of debate and fertility estimation. While some researchers were convinced that China's TFR was as low as 1.58 at the end of the twentieth century, others insisted that it was still around 1.8 or higher, which was 1.48 times of the recorded fertility (Yuan et al., 2003, CPIRC Research Group, 2003, Guo, 2004b, Zhang, 2004, Retherford et al., 2004, Zhang and Cui, 2003).

The controversy about China's fertility level and the difficulty in solving China's fertility puzzle are undoubtedly related to the under-registration problem that has been frequently found in China's fertility data. Since the early 1990s, there has been a growing concern about the data quality. Many researchers and government officials are convinced that the quality of China's fertility statistics has deteriorated. China's State Statistical Bureau (SSB) and other data-collecting agencies have also become less confident about the data they gathered. A similar tendency has been found among researchers who have been more willing to accept fertility estimates of a higher level

rather than those of a lower level. The high estimates for 1992 and 1995 fertility rates, like those cited in the previous paragraph, were all made immediately or a couple of years after the relevant data were released, while the low ones were not made until the 2000 census results became available. Despite the widespread concern about the data quality, however, the review of recent literature has revealed that there has been a lack of a systematic examination of China's major fertility data with respect to their collection, specific under-registration problems, and use in demographic research. Some major differences between various types of fertility data have often been neglected. Confusion in using and interpreting these data has existed widely. The adjustment of recorded fertility rates sometimes has not been justified adequately.

This paper starts with an examination of China's five major types of fertility data, particularly the main difference between them. Then, it identifies a number of problems in producing and using China fertility data and discusses their influence. Finally, it addresses some issues relating to China's controversial 2000 census results and the extremely low fertility. The paper concludes that the prevalent uncertainty about China's fertility level is not only related to the problem of data quality, but also results from misusing fertility data and exaggerating the problem of under-registration.

China's major fertility data

Demographic data obtained from five major sources have been widely used in the study of fertility since the early 1980s. They are (a) *Hukou* statistics generated by China's household registration system; (b) birth planning statistics produced by birth planning offices at various administrative levels; (c) results of population censuses and inter-censal sample surveys; (d) results of annual population change surveys conducted by SSB; and (e) results of national retrospective fertility surveys undertaken by State Birth planning Commission (SPFC) and SSB. They will be examined briefly in this section. In addition to those mentioned above, a large amount of fertility data has been collected by numerous researchers or research institutions. Because there are considerable differences in the characteristics and problems of these data, they will not be discussed here.

a. Household registration data

China's current household registration system has existed since the 1950s. Despite its recent changes, household registration still plays an important part in people's socio-economic life. The Ministry of Public Security (MPS) and its subordinates, public security offices at the urban sub-district and rural township level, administer the registration. According to household registration regulations, every citizen must register with the public security office or its delegates. The head of each household or the person concerned is responsible for reporting population changes such as births, deaths, in- and out-migration that take place in the household. Approval must be obtained before any migration, rural-urban migration in particular (Zhang, 1988).

On the basis of the registration, the local public security office produces summary statistics and report. Then they are forwarded upwardly and further compiled at each administrative level until reaching the central government. These statistics initially served and are still largely used for the purpose of administration and planning. For a long time, statistics derived from household registration were the most important demographic data available for the Chinese population (Banister, 1987).

Information recorded through the household registration is largely self-reported, and it has considerable impact on the interest of each household or individual. This was particularly the case before the 1990s when the household registration was widely used in the rationing of food and many living necessities. Until recently, without registering a newborn timely could lead to the loss of some benefits; but delaying the cancellation of the record of deceased persons might mean a gain of such benefits. They tend to have both positive and negative impact on the quality of the data collected. Equally, actions taken by the government could affect the data quality in similar ways. Because household registration data have been used primarily in planning and administration, the government has all incentives to maintain the data quality. However, refusing to register people (for example those out-of-plan births) has been used as a kind of punishment in some areas. Problems of these kinds could considerably affect the quality of the household registration data.

Two major changes have made it more difficult to collect accurate information through the household registration in recent years. First, the impact of having a household registration on people's socio-economic interest has weakened considerably. For example, living necessities and commodities are no longer distributed through rationing. Finding a job is now less restricted by the household registration status than before. Accordingly, people have become less concerned about registering themselves or updating their registration. At the time when the 1982 census was taken, there were 4.75 million people whose registration status was pending (Zhou, 1986). But according to the 1990 and the 2000 censuses, the number of people whose registration status was pending rose to 8.54 million and 8.05 million respectively (SSB, 1993, 2002b). Second, because of the relaxation of migration control, there has been a great increase in floating population, which is now close to 150 million (SSB, 2002b). Many of these people have left the place of their permanent registration for many years and moved around on a regular basis. The separation of people and their registration has become a serious problem and made it more difficult for the household registration office to keep accurate records of population changes. Consequently, statistics derived from the household registration have become less reliable in reflecting population distribution and its changes.

As far as the study of fertility is concerned, data obtained from the household registration are rather limited, usually the total number of births and crude birth rates (although there is potential of using the household registration for in-depth investigations of fertility changes) (Zhang and Wang, 1997). Despite their crudeness, these data were the only available official fertility statistics before 1982. Since then, the importance of household registration data in the study of fertility has greatly reduced. This is partly due to their deteriorating quality and partly due to the increasing availability of demographic data generated from other sources. Nonetheless, these data are still used in the examination of fertility changes.

b. Birth planning statistics

China's nationwide birth planning program started in the early 1970s. The birth planning office soon began gathering birth planning statistics, which has been regarded as an important means of monitoring and evaluating the program. Since the

formation of the SFPC in 1981, systematic collection of birth planning statistics has been carried out through its nationwide birth planning network.

The birth planning statistics are also based on the routine registration. At the grassroots level, birth planning workers keep records of fertility history, often in the form of birth planning information cards or registrations of other kinds, for every woman of reproductive ages who belongs to their work or administrative units. These information cards or registrations are usually filled by the birth planning workers rather than by women themselves. On the basis of these records, the birth planning workers or cadres produce aggregated statistics and report them to the birth planning office at a higher level. These statistics are then further compiled and forwarded upwardly through the administrative ladder to the SFPC. They are used primarily as indicators of birth planning performance (Chang, 1992).

Because of their double-side role as both program managers and data collectors, birth planning workers could manipulate the statistics at their will. Indeed, it has been found that some birth planning workers and cadres underreported the number of births occurred in the place under their jurisdiction if it exceeded the birth planning quota or birth control target set up by the birth planning office at higher levels (Banister, 1987, Smith et al., 1997, Merli, 1998, Scharping, 2003). Such under-registration may take different forms: for example, omitting the out-of-plan birth, misreporting a higher parity birth as a lower parity one, or delaying the registration for those who have met the parity criteria but violated the spacing requirement.¹ In addition, the difficulty of collecting accurate birth planning statistics also arises from the fact that a growing number of women have become temporary migrants in the last decade. Monitoring their reproductive history has become rather challenging.

China's birth planning statistics have long been notorious for their serious underreporting of births. As early as 1988, a *People's Daily* article reported that 'it had become a fashion across the country to manipulate the birth planning statistic' (People's Daily, 1988: 3). It has been suggested that the problem became more serious after the measure of the so-called 'one-veto-down' was introduced, which gave overriding importance to birth planning in evaluating the work performance in an area and requested the top leader to assume personal responsibility (CPC Central

Committee and State Council, 1991, Zeng, 1996). Realizing the serious distortion of their own fertility data, even the SFPC decided to shift to the SSB data sources in evaluating birth planning performance after 1990 (Peng, 1991).

The SFPC has taken many counter-measures to fight such data manipulation, and of which the most important is to conduct direct surveys at the grassroots level. These surveys have often been carried out in a secret manner by the SFPC staff so as to avoid potential local interference. The investigators are sent to randomly selected villages to interview women about their reproductive histories, and to compare these results with the birth registration made by birth planning workers and the statistics produced by local birth planning offices (Wang and Wang, 1995). The first two surveys were carried out in Hebei and Hubei provinces in 1993. Similar surveys were conducted in other nine central or western agricultural provinces in the 1990s. They show that under-registration of births in local birth planning statistics varied from less than 5% in Shandong province in 1994 to 35% in Hebei and Hubei provinces in 1993 (SFPC, 1993-2000).² These direct surveys have been generally regarded as effective in detecting the birth under-registration.

The SFPC publishes birth planning and fertility statistics every year. Some of these statistics, especially those aggregated at the provincial or national level have been adjusted on the basis of the direct surveys or other considerations. While these data have rarely been used in the in-depth investigation of birth planning and fertility changes, they have been cited frequently in the discussion of China's fertility level and under-reporting of births (see for example: Zeng, 1996, Tan, 1998, Attane and Sun, 1999, Merli and Raftery, 2000, CPIRC Research Group, 2003, Goodkind, 2004).

c. National population censuses and inter-censal sample surveys

Since the founding of the People's Republic, China undertook five national censuses in 1953, 1964, 1982, 1990 and 2000. In addition, two large-scale inter-censal sample surveys were conducted in 1987 and 1995. Because these surveys were similar to the censuses in many respects, they are also referred to as 'small censuses'. Like those conducted in other countries, China's censuses and inter-censal sample surveys were designed to provide accurate information for the national population at a particular

point in time. Because of its huge population, information gathered by these censuses and sample surveys was often lack of detail, although a long form (a more comprehensive questionnaire) was used to collect detailed information from one per cent of the national population when the 2000 census was taken.

The censuses and inter-censal sample surveys were organized by the central government mainly through the SSB and provincial statistical bureaus. Our knowledge about the 1953 and 1964 censuses is limited, because the census authority released only some aggregated results and unit records have never been made available to researchers. The government undertook the third census in 1982. The census data and those collected through the One-Per-Thousand Fertility Sample Survey conducted in the same year had very high quality and provided rich information for the study of China's demographic changes (Coale, 1984, Yu, 1984). Since then, two more censuses and two inter-censal sample surveys have been taken. In addition to tabulated results published by the government, recent census and inter-censal survey data have been used extensively in population research.

Collecting detailed information from more than one billion people is extremely difficult. To ensure the success of each census, the Chinese authority usually took a nationwide campaign to check and update the household registration. They were then used as important references in the census. This indeed played a crucial role in assuring the quality of census results. Despite that, however, training six or seven million enumerators and sending them to a vast country to register the entire national population were very challenging (Li, 1986, Sun, 1997, Zhang and Xu, 2002). It has become more so in recent years because of the increasing population mobility, deteriorating household registration and weakening government control over the citizen. As a result, the quality of recent censuses has declined noticeably. According to post-enumeration surveys conducted after each census, the net under-reporting rate for the 1982 census was 0.04 per cent. But it rose to 0.06 per cent for the 1990 census and 1.81 per cent for the 2000 census (SSB, 1993, 2002b). The under-reporting rate for the 2000 census was 30 times higher than that for the 1990 census and 45 times higher than that for the 1982 census (Sun, 2001). Although it has been four years since the completion of the latest census, Chinese authorities and demographers are still troubled by the undercounts that have been widely found in the census results.

Undercounting young children, especially those who were born close to the time when the census or the survey was taken, has been a major problem often observed in Chinese census and survey data. According to some studies, even the 1982 census under-enumerated children aged 0 to 4. This is indicated by the fact that their number was smaller than that of the same birth cohort recorded by the 1990 census. The comparison of the two sets of census results gives an average inter-censal survival rate of 103 per cent, which is simply not possible (Zha et al., 1996). Similarly, children of younger ages were also under-enumerated in the 1990 census. The comparison of its results with those of the 2000 census indicates an inter-censal survival rate of 106 per cent for those aged 0 to 4 in 1990 (Zhang and Cui, 2003). Under-registration of this kind appeared more serious in the 2000 census. According to the unadjusted result, the number of children born in 1999 was 11.9 million, even lower than those obtained from the household registration (13.7 million) and birth planning statistics (12.9 million) (SFPC, 2000, MPS, 2000, SSB, 2002b). This is one of the major causes that give rise to the confusion surrounding China's fertility level.

d. National annual population change surveys

Besides the censuses and the inter-censal sample surveys, the Chinese government has also conducted nationwide population change surveys annually since 1982. The survey data are used mainly for monitoring population changes and providing required demographic information during the inter-censal period. The SSB is the primary agency responsible for organizing the survey and publishing its results (Yue, 1990).

The SSB annual survey focuses on population changes such as births, deaths and migration. It is designed by the SSB and implemented by its provincial offices. The sample is generally selected using stratified, multi-stage cluster and proportional probability sampling procedures, and the current sample size is about 1.2 million people (Wu, 1997). The information is collected through household interview. The reference time of the survey is 30 September each year since 1993 and statistical methods are used to estimate population changes in the whole year (Hu, 1994). Since 1989, the annual survey has enumerated people with increasingly more *de facto*

factors. The SSB and its provincial offices have revolved the selected sample every year so as to prevent intentional data manipulation. After each survey, the SSB has also conducted intensive post-enumeration check up to evaluate survey results, starting from 1993.

Results of the annual population change survey are usually released in the *Statistical Communiqué of National Economy and Social Development*. These results, especially the aggregated population figures and demographic rates, are often adjusted according to the outcome of the post-enumeration survey and other considerations, although unadjusted data sometimes are also published in tabulated form in the *China Population Statistics Yearbook* (SSB, 1991-2002). They have been regarded as the most important demographic data collected during the inter-censal period and used widely by government officials and researchers. However, because the SSB does not release the unit record data, they have been hardly used by academics for in-depth analysis of fertility changes.

Since the annual population change survey samples only about one per thousand of the national population and is conducted by statistical professionals and well-trained enumerators (in comparison with census takers), the quality of the survey results is relatively high. According to the post-enumeration check up carried out after the 1993 and 1994 annual surveys, the under-report of crude birth rate was 6.9% and 6.4%, respectively (Jia and Sai, 1995).

During the period from 1982 to 1990, the number of births estimated on the basis of the annual population change survey was often smaller than that recorded by the census. This is related to the fact that the 1990 census was based on updated household registration and its quality was rather high. In addition to that, this could result from both under-recording birth rate (or age-specific birth rate) in the annual survey and errors in determining the sample frame (or the national population) when the survey was conducted (see Hu, 1994). Therefore, even if fertility rates were accurately obtained from the sample survey, errors in determining the sample frame or the total population could still result in an over- or under-estimation of the total number of births (Zhang, 2005). In the 1990s, because the SSB took many measures to improve the annual population change survey, the number of births estimated from

the survey was noticeably higher than that derived from other data sources. This is an important change and will be further examined in section two.

e. National retrospective fertility surveys

In addition to the birth planning statistics, the SFPC and SSB have also conducted a series of retrospective fertility surveys. The first one was the One-Per-Thousand-Fertility-Sample Survey undertaken in 1982. Since then, four more surveys have been carried out in 1988, 1992, 1997 and 2001. The first two enumerated one and two million people respectively, but the number of people sampled by three recent surveys was relatively small. The 1992 survey interviewed 380 thousand people and 72 thousand women of reproductive ages. The relevant figures were 186 thousand and 15 thousand for the 1997 survey, and 177 thousand and 40 thousand for the 2001 survey. Because these surveys interviewed only a sample of the national population, their organizers were able to employ better-trained enumerators to collect detailed information from selected households and individuals. These survey data have been used extensively in evaluating birth planning program and in academic research.

The quality of the 1982 fertility survey data is very high even by world standard (Coale, 1984). Scholars have also agreed that the data of the 1988 Two-Per-Thousand Survey are highly reliable, although underreporting of children, daughters in particular, was discovered in the survey data (Lin and Wang, 1991, Zeng et al., 1993). However, the quality of the 1992 survey was and is still rather controversial. According to the fourth national census, China's TFR was around 2.3 in 1989. But the 1992 survey recorded a TFR of 1.65 for 1991. This has been widely seen as a result of serious under-registration. The survey has also been regarded as a turning point from which China's demographic data started to deteriorate and people confidence in these data began to lose. For these reasons, officials and scholars have also been rather cautious about the quality of the 1997 and 2001 fertility survey results. They have been reported with a low profile and the survey data have been released to only a relatively small number of researchers.

However, our recent study has shown that the under-registration problem in the 1992 fertility survey may not be as serious as has been usually assumed. For example, in

contrast to the under-recording of nearly 30 per cent as suggested by some scholars (Zeng, 1996, Zhang, 1997), its actual under-registration rate for children born in 1991 and 1992 is likely noticeably lower. The under-registration of births observed in the 1997 and 2001 survey data is also relatively low. Detailed analyses of these survey data show that fertility patterns recorded by these surveys are rather consistent, even when they are examined by cohort and by single year (see Table 6). The quality of these retrospective fertility survey data in comparison with those gathered from other channels is relatively high (Guo, 2000, 2004b, Zhang, 2004).

In addition to the five fertility surveys mentioned above, China also conducted an in-depth fertility survey in two large cities and five provinces in the second half of the 1980s, which consisted of a part of the World Fertility Survey. Since there is a lack of controversy about this survey and the survey data have not been used in recent fertility studies, they are not discussed here.

The relationship and differences between China's major fertility data

Data gathered from the five major sources are closely related. They are records of same subjects and reflect various demographic aspects of the Chinese population. The collection and the quality of data obtained from one such source sometimes are strongly influenced by those derived from other data sources. One of the best examples is the use of household registration in censuses and other demographic surveys.

The household registration was China's major data gathering instrument until the early 1980s. It still played a crucial part in censuses and other data collection operations thereafter. For example, before the census, Chinese authorities usually organized a nationwide campaign to check up and update household registers. On the basis of the 'cleaned' records, the list of inhabitants was produced and it was then used as an important reference in the census registration. At the time of the census, enumerators were not allowed to copy the relevant information from the list or the household registration. But they were requested to compare the census enumeration against this list. If disagreements were found between the two, they must undertake further investigation, until the error or the reason was found out. Because of such a

link, reliable household registration data were very important for the success of Chinese censuses. For example, before the 1982 census, 5.7 million local cadres, statistical and household registration personnel were mobilized to check and update household registers nationwide. Through this campaign, they found that double registrations occurred at 6.1 per thousand and omissions at 5.4 per thousand in the registers (Zhou, 1986). All these errors were corrected, and the quality of the household registration data was improved substantially. This was a major reason why the 1982 census achieved very high quality and why its results were very consistent with those derived from the household registration (Li 1983; Zhao 1992). For the same reason, an increasing difficulty in maintaining the high quality of the household registration has contributed to the deterioration of census and survey records in recent years.

Similar links have been widely found between the five types of demographic data. For example, census and household registration data have been used frequently in determining the sample frame for the SFPC retrospective fertility survey and SSB annual population change survey. The completeness of census records and household registration therefore could directly influence the estimation of the requested sample size. Because the birth planning statistics are largely compiled on a *de jure* basis, household registration data have also been used as a key reference in determining whether certain migrants and their children should be included in the local birth planning statistics. According to the *Practical Stipulation of Birth planning Statistics* (SSB and SFPC, 1991), women of reproductive ages (especially in rural areas) are requested to register at the place where they have permanent resident status if they live there or have moved out for less than six months; otherwise they should be enumerated in the place where they currently stay. The newborns are registered in the same place as their mothers. These regulations also define the responsibility of birth planning offices of migrants sending and receiving areas. Because of their close link, problems that exist in household registration such as under-registration and the difficulty in tracing people's movement tend to increase the under-reporting error in the birth planning statistics. In collecting demographic data of these types, the same personnel may be involved in all or some of the operations. Under certain circumstance, data may be taken directly from one source and used in the collection of data of other kinds, although this may violate the data collection protocol.

Similarly, data obtained from one source have often been used to evaluate the quality of data gathered from other sources by both officials and scholars.

Despite their similarities and close links, noticeable differences exist between these five types of data. As has been mentioned in the previous section, these data are collected by different state agencies through different operations, and they often serve for different purposes. Besides, the degree of their comprehensiveness and representativeness varies considerably. Problems discovered in one type of data may differ from those found in data of other data sources. They are some important points that need to address.

Both household registration data and birth planning statistics serve mainly for the administrative purpose. The number of children recorded in these data has been largely through self-reporting: by individuals or households in the case of household registration data or by birth planning workers or cadres in the case of birth planning statistics. In comparison with other three types of data, they are more vulnerable to deliberate mis-reporting or data manipulation. Accordingly, the quality of these data tends to be relatively low (Research Group of Shandong Population Association, 1993, Sun and Qing, 1993).

Table 1 presents numbers of births by years and provides some support to this suggestion. Figures in columns 1 and 2 are numbers of births as recorded by the household registration and SFPC birth registration. Figures in columns 3 and 4 are numbers of births estimated directly from SSB annual population change surveys without adjustment and those recorded by the 2000 census. Figures in the last column are adjusted numbers of births produced by the SSB on the basis of annual population change survey data. From 1991 to 1999, figures derived from the household registration and birth planning statistics were consistently lower than those obtained from the SSB annual population change surveys. They were also lower than those enumerated by the 2000 census over the period between 1991 and 1998. If we assume that the 173.5 million newborns recorded by the annual population survey (the unadjusted figures) were very close to the actual number of births, then some 26 million children went unrecorded in the household registration and birth planning statistics, which registered 146.6 and 147.7 million births respectively. Under-

registration is obviously more serious in household registration data and birth planning statistics than in other data sources. There is an exception however. The number of births recorded by the household registration in 2000 was greater than that directly obtained from other three sources. This was attributable to the pre-census cleanup of household registration data, although it could also result from that some children who were born in previous years were recorded as born in the year 2000 during the update of household registers.

Table 1

Numbers of births recorded by the 2000 census were in general close to the SSB unadjusted figures for the period from 1991 to 1995. But they have been considerably smaller than the latter thereafter except for 2000. This is likely an indication that China's recent censuses and sample surveys, those with a large sample size in particular, have tended to under-record children who were born close to the time when the censuses or surveys were undertaken (Zeng 1996). The comparison of these fertility data also shows that although the SSB unadjusted figures were already the largest for most of the years they have been further inflated. The SSB adjusted numbers of births, which are listed in column six, are noticeably greater than those shown in other four columns. These results and their validity will be discussed later.

Besides the noticeable difference in the completeness of recorded number of births, data obtained from various sources also show under-registrations with different characteristics. One of such examples is the difference in registering births or fertility rates between the SSB annual survey and the SFPC 1997 and 2001 retrospective surveys. Table 2 compares age-specific fertility rates by year, which has been made for women aged 15 to 34 because the 1997 and 2001 survey² interviewed only women of reproductive ages.

Table 2

If there were no registration problems, age-specific fertility rates calculated from the two sets of survey data would be very close with some random variations only. However, while the two series of fertility rates show a close agreement in the age pattern of fertility and in the trend of fertility decline, they exhibit some noticeable differences. First, the annual survey generally reported slightly higher fertility rates than the two retrospective surveys, especially in the year that is close to the time when the retrospective survey was undertaken. But in 2000, the 2001 fertility survey

seemed to have a more complete birth reporting. This is likely due to the fact that compared to the retrospective survey, the annual surveys in general have a higher quality in recording births. In the years when the census or inter-censal survey was taken, however, the SSB fertility data were derived directly from the census or inter-censal survey, which enumerated a much larger population. The difficulty in administering censuses and large surveys at least partly contributes to the more observable under-reporting problem.

Second, at the younger ages (15 – 19 year old), the two retrospective surveys tended to report more births than annual surveys. In contrast, the pattern is reversed in older age groups. These systematic discrepancies cannot be explained simply by the facts that the surveys were organized by different government agencies employing different approach of data collection or that the quality of one survey is superior to the other.

These systematic differences nevertheless are readily interpretable. It has been noticed that China's recent censuses and fertility surveys tended to under-report births, especially those who were out of local birth planning quota and those who were born close to the time of enumeration. This could be observed in both the SPFC fertility surveys and the SSB annual surveys. Differing from the SSB population change survey, the SPFC fertility surveys recorded not only births occurred within one or two years of the survey, but also women's fertility history. Most of their children were born well before the surveys taking place. Therefore, children who were born to women of younger ages (most of them were the first birth) were likely to be reported. In a retrospective fertility survey, under-reporting of these births was less severe, because people must record their first birth before they could record subsequent births, even if the first child was born at very young ages. In contrast, children born to women of older ages might have a higher chance to be missed out if they belonged a high parity birth and were born close to the enumeration.

In the annual surveys, people reported only births taking place in the previous year and their fertility history was not recorded. Under this circumstance, children born to women of younger ages were likely to be missed out, especially those out-of-plan births and those who were born close to the time of enumeration, even if they belonged to the first parity. Similarly, some women might overstate their ages to make

their young-age childbearing less noticeable, which could also lead to a lower recorded fertility rate at younger ages. In contrast, children born to women of older ages might be better recorded. Because the annual survey did not record women's fertility history, this made it easier for older women to mis-report their out-of-plan second or higher parity birth as the first birth. In this case, the birth was recorded although its parity might be mis-labelled. These tended to result in a more complete birth report or a higher birth rate at older ages.

Fertility estimation in the 1990s

On the basis of the above discussion, we now turn to a number of issues, which have considerably influenced our understanding of fertility changes in the last decade.

Since the early 1990s, it has been widely accepted that China's recorded fertility rates have seriously under-recorded the actual fertility level. One of the earliest and probably the most cited papers was published by Yi Zeng first in Chinese in 1995 and then in English in 1996. Facing the very low level of fertility recorded by the 1992 SFPC fertility survey and the widespread speculation that the survey was flawed in data collection, Zeng examined the 1992 survey data and those obtained from other data sources including the results of the SFPC 'direct' or 'special' surveys. On the basis of his evaluation of these data, he suggested that under-reporting of births found by the SPFC 1993 direct survey in Hebei and Hubei provinces could 'represent the average situation in rural areas throughout the country' (Zeng 1996: 33). He then assumed that in the early 1990s, 37.28 per cent of births were under-recorded in the birth planning statistics in rural areas, and in urban areas the under-reporting rate was 18.64 per cent or half of that in rural areas. Based on these assumptions and the number of births reported by the SPFC, Zeng estimated 'the expected true number of births' for 1990, 1991 and 1992. Finally, by comparing these figures with those derived from the 1992 fertility survey, he concluded that the under-reporting rate of the 1992 survey was '16.0 per cent in 1990, 24.8 per cent in 1991, and 27.5 per cent in 1992'. When Zeng published these results, he was rather cautious and pointed out the difference between the SPFC fertility statistics and the 1992 fertility survey data. He also stressed that the under-reporting rate found in the 32 villages in Hebei and Hubei might not accurately represent the average of the rural China, and in urban

areas the under-reporting rate might not necessarily half that observed in rural areas. All these might lead to some differences between the estimated fertility and the real fertility. However, he believed that the 'true level' of China's total fertility 'for 1991-92 was roughly 2.1 or 2.2 children per woman' (Zeng 1996: 32).

Zeng's study had played important part in alerting readers about the under-registration problem in Chinese fertility data, but it was likely to have over-estimated the under-reporting rate. This has been indicated by the fact that among available studies and statistics, some which are listed in Table 3, Zeng's paper suggested the highest number of births and TFRs for the early 1990s. There are two potential reasons that Zeng could have over-estimated the actual fertility level. First, the number of births for 1990, 1991 and 1992 like those reported by the SPFC or provincial birth planning offices might have been adjusted upwardly already before they were published. Studies suggested that after realizing the serious under-registration of local birth planning statistics, some provinces conducted sample surveys and inflated their aggregate fertility data before they were reported to the SFPC. Similarly, the national total of the newborn might not be the 'true' unadjusted figure (see Xie, 1990, Li, 1991, Sun and Qing, 1993, Cai and Zhang, 2000). Therefore, even the birth planning statistics indeed under-counted 37.28 per cent of births in rural areas and 18.64 per cent in urban areas, the estimated number of births might still be greater than the actual one. Second, although under-reporting of births was a widespread problem, there were considerable variations in under-reporting rates across regions.³ The magnitude of under-registration as assumed by Zeng might not represent the average under-reporting rate or not exist in some areas, as he cautiously acknowledged in his paper.

Table 3

During the last ten years Zeng's conclusions have been widely cited, but his caution has been largely ignored. Despite the fact that Zeng's paper was largely about under-reporting of births and fertility level in the early 1990s, his suggestions have been frequently used in the discussion of data quality as the evidence of serious underreporting in population statistics in the 1990s (see for example Tan, 1998, Chen, 1999, Merli and Raftery, 2000, Goodkind, 2004, Scharping, 2003, Attane, 2001). For example, the SSB statisticians appeared to have been greatly influenced by Zeng's analysis, which was used as important supporting evidence in their evaluation of 1995

inter-censal survey results. They suspected that like the 1992 fertility survey, the 1995 ‘small census’ also seriously under-counted the number of births. On the basis of their data evaluation, the fertility rates were adjusted upwardly – crude birth rate from 14.42 to 17.12 per thousand and total fertility from 1.46 to 1.85 (Zhang et al., 1997: 46). In comparison with those estimated by other researchers, the adjusted figures seemed fairly high.

Similarly, Merli and Raftery also used Zeng’s conclusion as a concrete basis for their hypothesis of widespread serious under-registration in birth statistics in their analysis of data quality of local surveys conducted in four counties in northern China (2000: 109). In recent discussion of the quality of the 2000 census, Zeng’s paper and the SFPC ‘special surveys’ results were also used as important evidence to support the argument that newborns and younger children consisted of the overwhelming majority of those undercounted in the 2000 census.

While these studies played their part in improving our knowledge of China’s fertility changes, so far as data evaluation and fertility estimation are concerned they had some limitations. Some studies ignored the remarkable difference in data quality between the SFPC routine birth planning statistics and other fertility data. As has been documented in the previous section, while the SFPC direct survey discovered that the routine birth planning statistics in Hebei and Hubei under-reported 37 per cent births in 1993. It was not the evidence showing that under-registration of the same or similar magnitude also existed in the 1992 SFPC fertility survey or other similar undertakings.

Because it was widely believed that China’s fertility statistics or survey data under-recorded the actual fertility level, government officials and scholars often upwardly adjusted sometimes over-inflated recorded fertility rates in recent years. Even the SSB seemed to have become less confident about its own annual population change survey and post-enumeration check-up results. This can be observed from the comparison of fertility figures presented in Table 4.

Table 4

In this table, the mid-year population computed directly from the SSB released data is listed in column 1. Columns 2 shows the unadjusted crude birth rate series aggregated by the SSB on the basis of provincial survey results. Column 3 presents the SSB

officially released crude birth rate series. Column 4 suggests the estimated adjustment factor series, which quantifies the change made by the SSB, which has been derived through comparing the unadjusted and officially released crude birth rate series. The last column gives the SSB released underreporting rates as 6.9 percent in 1993 and 6.4 in 1994 detected by the post-enumeration check-ups (Jia and Sai, 1995).

As can be seen, the implied actual adjustment factors by the SSB are noticeably higher than those directly found in post-enumeration surveys, for example, 13.88 and 13.45 percent compared to 6.9 and 6.4 percent in 1993 and 1994, respectively. According to these figures, the crude birth rate should be adjusted upwardly from 15.58 to 16.74 per thousand for 1993, and from 15.32 to 16.30 per thousand for 1994. But the SSB adjusted the crude birth rate to 18.09 and 17.70 per thousand for the two years instead. In other words, rather than upwardly adjusting the crude birth rate by 1.12 and 0.98 per thousand, the SSB inflated it by 2.51 and 2.38 per thousand. On the basis of the post-enumeration check-up result, the total number of birth should be increased by 2.54 million for the two years. But the SSB added 5.49 million births to the recorded figure (Jia and Sai, 1995, CPIRC Research Group, 2003). Why did the SSB over-inflate its annual survey results? This, as they themselves explained, partly resulted from their past experience of under-estimation and partly because of the pressure of strong suspicions from both policy-makers and demographers who believed that the underreporting was more serious than what found by them (Zhang, 1995, Yu and Xie, 2000).

Since 1995, the adjustment factors have been varied between 13.3 and 18.8 per cent. Because the SSB has not published the detail of their post-enumeration survey results, we are unable to find out the under-reporting rate as detected by these surveys. However, two speculations can be made on the basis of the fact that the SSB inflated the annual survey crude birth rate by a factor of an average 15 per cent. First, the quality of the annual population change survey further deteriorated during the second half of the 1990s, and the post-enumeration survey did record a higher under-reporting rate in comparison with in the early 1990s. However, there has been no direct evidence suggesting this was the case. Also, if this were indeed what happened, then the SSB should take the responsibility to address this change. Secondly, there were no marked changes in the quality of the annual population change survey and

that of the post-enumeration check-up, but the SSB continued its practice observed in 1993 and 1994. That is to say it continued to use an adjustment factor that is much greater than the under-reporting rate discovered by the post-enumeration survey to inflate the recorded crude birth rate. If this were what actually took place, then the SSB would also need to clarify their procedures and considerations.

One of the major reasons why many scholars convinced that fertility was seriously under-recorded by the 1992 fertility survey is that they found it was difficult to believe that China's fertility could have fallen rapidly to below replacement level at the time. However, there is evidence showing that this was possible. In comparison with in later 1980s, there was no radical change in the age composition and the number of women of reproductive ages in the early 1990s, which is shown in Table 5. An increase in the number of births would not be expected because there was no major change toward pronatalist behavior. On the other hand, birth planning program has been greatly strengthened during the time (Greenhalgh and Winckler, 2001). The proportion of early marriage decreased and the mean age at first marriage noticeably increased (Zhang, 2005). Contraceptives were widely used by women of reproductive ages (Table 5).

Table 5

As Table 5 shows, in comparison with in 1989, there was a noticeable increase in the number of sterilizations and IUD insertions in 1990 and 1991 (column 3 & 4). In addition, there was also a surge in the number of abortions recorded in the early 1990s. There were 10.4 million recorded abortions in 1989. But the numbers reached 13.5 and 14.1 million in 1990 and 1991 respectively. Even if there were no dramatic decrease in the number of pregnancies, the rapid increase in abortions itself could reduce the fertility level considerably.

Our examination of the three SPFC retrospective fertility survey results also suggests that although these surveys have suffered from the under-registration, the quality of the survey data may be higher than generally believed. This is indicated by Table 6, which presents mean numbers of children ever born by birth cohort and by age. As was said in the first section, these surveys were conducted in different years. Their sample sizes were different. Their respondents and to large extent their enumerators were different. If the quality of all surveys were very low or if the quality of one

survey were considerably lower than others, the survey results would be very inconsistent, especially when the surveyed populations were divided into small groups. However, this seems not to be the case. As shown in the last three columns in Table 6, in the year 1991, among the four women cohorts in comparison, only cohorts born in 1971 and 1976, aged 20 and 25 respectively, in the 1992 surveys reported a little lower births than the following 1997 and 2001 surveys. It would be extremely difficult to obtain such a degree of consistency if the survey data had been seriously affected by under-registration.

Table 6

In general, all these results consistently indicate that there has been a rapid fall in fertility since the early 1990s. Our examination concludes that the actual levels of fertility in the 1990s were very likely over-estimated and accordingly the pace of fertility decline was underestimated. As a matter of fact, over-estimating fertility and population growth, just like under-estimating them, is equally a problem. If it is done intentionally, the population figures are still used for the political or other purposes. This is simply wrong. If it is done unintentionally, it shows our thinking is behind the social change, which could cause damage too.

Some issues relating to the controversial 2000 census

The quality of the 2000 census has been highly suspect since the preliminary census results were released in early 2001. Many studies used the SSB adjusted fertility data or number of births as important evidence or benchmark to examine the census quality and estimated that the census may have undercounted between 30 to 37 million births and young children aged below 10 (Zhang and Cui, 2003, Goodkind, 2004, Yu and Wang, 2004, CPIRC Research Group, 2003). While there is no dispute on the census undercounts, however, even at a cursory glance, the claim that the 30-37 million younger children, about 20% of the age cohort, disappeared in the census count is too large to be true. Given what has been discussed above, however, could we confidently assume that the SSB adjusted fertility figures represent China's actual fertility level and change in the 1990s?

It appears that these studies gave too much credit to the SSB official adjustment, as one author suggested that '[I]t is hard to believe that the NBS would choose to inflate

fertility above those levels unless it felt a strong justification for doing so' (Goodkind, 2004: 288).⁴ Nonetheless, it is interesting to note that after the 2000 census, the SSB has adjusted downwardly the national population size for 1998 and 1999, amounting to 1.72 million (see SSB, 1999, 2000, 2002a). Moreover, in addition to the examination of the under-registration of the 2000 census, probably we should also investigate the possibility of the SSB adjustment over-reporting China's recent fertility level.

Quite recently, some demographers, who had the opportunity to access the original census data, revealed a strong internal consistency of data (Retherford et al., 2004, Guo, 2004a, 2004b). For example, the analysis of Retherford et al. (2004) revealed a substantial decline of fertility well across educational, ethnic and regional line. Moreover, a comparison of fertility series between those of the census retrospectively estimated and those recorded in other surveys over the decade (without adjustment) also suggested a close agreement (Figure 1).

Figure 1

As shown in the figure, the recorded fertility series in the 2000 census were lower than in the unadjusted data of SSB annual surveys during the years after 1993. However, using reverse survival method, Zhang (2004) found that up to 11.6 percent births in the year 2000 were actually enumerated into the census but not being reported by their birth mothers, and attributed primarily to the temporary migration of young mothers. Retherford et al. (2004) came to the same conclusion using the own-children method. If applying the 11.6 percent as a correction factor, the census-estimated fertility can be upwardly adjusted to 1.36, not hugely different those recorded in annual surveys in 1999 and 2001 and that retrospectively estimated from the 2001 survey. Pervious examination has suggested surveys in the 1990s may have underreported no more than 10 percent births. Using the 10 percent as a second correction factor, one can further adjust the fertility to 1.50 in 2000. As already discussed, the 2000 census long form may have suffered a little higher underreporting due to much larger sample size than annual surveys. Therefore, the "true" fertility level in 2000 was very likely in the range between 1.5 and 1.6, in close agreement with estimates of other demographers (Retherford et al., 2004, Guo, 2004a, 2004b). All these efforts suggested that the fertility was not so low as 1.22 as reported in the census, but certainly not so high as 1.8 as suggested by the Chinese authority

(Government of PR China, 1994, 2002). Obviously, China experienced a substantial decline of fertility over the course of 1990s and to a very lower level in the year 2000.

Many people believe China is 'special' so the rapid fertility decline is not possible, regarding the speed and magnitude of fertility decline. However, the demographic experiences of many East and South East Asian countries, and of Muslim countries like Iran all experiencing rapid fertility decline in recent decades, suggested this was not the case (Prachuabmoh and Mithranon, 2003, Jalal-Abbasi et al., 2002, United Nations, 1997). Although the rapidity of China's fertility decline was widely recognized, one recent analysis suggested that Thailand and China actually experienced the same pace and magnitude of fertility decline during the period between 1971 to 1975 and 1995 to 2000 (Zhang, 2005). The sudden drop of China's total fertility from 2.30 in 1990 to 1.65 in 1991 as reported in the 1992 survey was immediately rejected. However, one may have a second thought, even not taking into account the great strengthening of China's birth planning program in 1991, in comparison of the experience in South Korea, of which the total fertility suddenly dropped from 2.1 in 1984 to 1.6 in 1986 and then remained stable for a decade (Choe et al., 2004). In fact, some demographers began to argue that this is a usual pattern of 'post transition' trend (Choe, 2004).

Hindsight suggests that too much attention has been put on the data quality rather than appreciating the nature of changing society and the family planning program. This was the basic reason that the fertility issue has been debated for so long and so much but never got conclusive. The continually observed low fertility figures over the decade may have resulted from serious under-reporting, but it is at least equally likely that they reflect a real fertility drop, which seemed more likely given China's strong birth planning program and rapid socio-economic development that occurred in the 1990s (Greenhalgh and Winckler, 2001). Obviously, a correct interpretation of China's fertility data goes far beyond pure numbers, and calls for a complete and thorough understanding of the birth planning program, population statistics, rapid societal changes and their interrelationship that occurred in the 1990s.

Conclusion

The paper made a systematic review of the data collection operations of five major fertility data in China, their respective problems and their interwoven relationship. Then, it showed that the fertility reported in surveys and census in the 1990s and early 2000s were largely consistent, identifying some common misunderstandings and problems in using fertility data in the last two decades. After clarifying some speculations about the 2000 census, it suggested that the fertility declined substantially during the 1990s, and very likely in the range of 1.5 to 1.6 in the year 2000. Subsequently, it concluded that the prevalent uncertainty about China's fertility level is not only related to the problem of data quality, but also a result of misusing fertility data and exaggerating the problem of under-registration. Moreover, it suggested that the basic reason lied in the failure to appreciate the nature of changing society and the birth planning program over the decade.

Notes:

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1. While China's birth planning policy has been widely regarded as one-child policy, people are allowed to have more than one child under certain conditions. For example, in some rural areas couples can have another child if the first birth is a girl. For couples who are not allowed to have two children, the second or the third birth would be considered as 'out-of-plan'. Those who are allowed to do so are also required to space the two births, mostly four-and-a-half year. If the second or the third births has not met the spacing requirement, they are also considered as 'out-of-plan' births (Greenhalgh, 1986, Feng and Hao, 1992).
2. The reported underreporting rates derived from the SFPC direct surveys were: between 5 to 10 percent in Shandong in 1994 and in Sichuan in 1998; around 20 percent in Henan in 1994, in Guizhou in 1996 and in Shanxi in 1998; between 30 to 35 percent in Hebei and Hubei in 1993 and in Gansu in 1995 (SFPC, 1993-2000).
3. As shown in the second footnote, there have been considerable variations in the quality of birth planning statistics, both cross regions and over time. Even in the same province, the degree of the severity of the under-registration could have changed greatly. For example, the quality of birth planning statistics was low in Hubei in the early 1990s, which made it the first target of the SFPC 1993 direct survey. In 1999, the SFPC undertook another random investigation in rural Hubei province. The second survey found less than 10 per cent birth under-registration in local birth planning statistics, much lower than the 35 per cent observed in 1993 (SFPC, 2000).
4. The National Bureau of Statistics (NBS) was previously known as the State Statistics bureau (SSB).

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Table 1 Comparisons of number of births from various sources of population statistics in China, 1991-2000 (in millions)

Year	<i>Hukou</i> birth registration ¹	Birth planning birth registration ²	SSB annually observed figures ³	Estimated births from the 2000 census ⁴	SSB annually adjusted figures ⁵
	(1)	(2)	(3)	(4)	(5)
1991	16.81	16.97	21.21	20.87	22.58
1992	15.10	15.96	19.16	19.48	21.19
1993	14.52	15.70	18.46	18.60	21.26
1994	14.28	15.75	18.35	17.09	21.04
1995	14.40	15.21	17.46	17.56	20.63
1996	14.30	14.55	17.52	15.77	20.67
1997	13.86	13.88	16.64	14.96	20.38
1998	13.43	13.83	16.57	14.48	19.42
1999	13.67	12.88	15.98	11.85	18.34
2000	16.21	12.92	12.18	14.08	17.71
Total	146.58	147.65	173.53	164.74	203.22

Source: The *Hukou* series are from the *National Population Statistics by City and County* (MPS, 1991-2000); the birth planning birth registration series are from the *China Birth planning Yearbook* (SFPC, 1991-2001); the SSB annual observed series are from CPIRC (2003: 10); the 2000 census-estimated series are taken from Zhang and Cui (2003: 27); the SSB annual adjusted series are from the *China Population Statistics Yearbook* (SSB, 2002a).

Table 2 Age-specific fertility rates computed from SSB annual population surveys and SFPC 2001 fertility survey in China, 1991-2000

Year	Source	Age group				Total
		15-19	20-24	25-29	30-34	
1991	SSB 1991	0.0089	0.1712	0.1236	0.0414	1.73
	SFPC 1997	0.0129	0.1732	0.1167	0.0348	1.69
	SFPC 2001	0.0248	0.1800	0.1018	0.0360	1.71
1992	SSB 1992	0.0074	0.1600	0.1114	0.0406	1.60
	SFPC 1997	0.0075	0.1538	0.1061	0.0323	1.50
	SFPC 2001	0.0184	0.1592	0.0962	0.0346	1.54
1993	SSB 1993	0.0077	0.1525	0.1166	0.0370	1.57
	SFPC 1997	0.0161	0.1521	0.0802	0.0265	1.37
	SFPC 2001	0.0178	0.1554	0.0924	0.0226	1.44
1994	SSB 1994	0.0045	0.1389	0.1238	0.0405	1.54
	SFPC 1997	0.0063	0.1313	0.0874	0.0308	1.28
	SFPC 2001	0.0148	0.1430	0.0904	0.0258	1.37
1995	SSB 1995	0.0109	0.1541	0.0918	0.0265	1.42
	SFPC 1997	0.0080	0.1297	0.0959	0.0263	1.30
	SFPC 2001	0.0138	0.1498	0.0916	0.0280	1.42
1996	SSB 1996	0.0073	0.1515	0.1095	0.0314	1.50
	SFPC 1997	0.0048	0.1375	0.0956	0.0256	1.32
	SFPC 2001	0.0120	0.1418	0.0862	0.0254	1.33
1997	SSB 1997	0.0027	0.1293	0.1218	0.0349	1.44
	SFPC 2001	0.0080	0.1260	0.0826	0.0266	1.22
1998	SSB 1998	0.0026	0.1267	0.1193	0.0376	1.43
	SFPC 2001	0.0096	0.1394	0.0882	0.0262	1.32
1999	SSB 1999	0.0026	0.1220	0.1188	0.0400	1.42
	SFPC 2001	0.0084	0.1312	0.0850	0.0282	1.26
2000	SSB 2000	0.0060	0.1145	0.0870	0.0286	1.18
	SFPC 2001	0.0080	0.1470	0.0994	0.0296	1.42

Source: The SSB series are computed using unadjusted data from the *China Population Statistics Yearbook* (SSB, 1991-2002); the SFPC series are own calculations based on the 1997 and 2001 surveys.

Table 3 Number of births and adjusted TFRs from various sources in China, 1990-1993

	Zeng Yi's estimation	1992 survey	2000 census				SSB		
Year	Number of births (millions)	Adjusted TFR	Estimated births (millions)	Observed TFRs	Estimated births (millions)	Estimated TFRs	Adjusted annual births (millions)	Estimated TFRs from SSB adjustment	Unadjusted TFRs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1990	27.54	2.43	23.13	2.04	26.40	2.58	23.91	2.17	2.24
1991	25.96	2.20	19.53	1.65	20.87	1.92	22.58	2.01	1.82
1992	24.40	2.10	17.69	1.52	19.48	1.79	21.19	1.84	1.69

Source: The series of Zeng's estimation and the 1992 survey are taken from Zeng (1996: 32); the TFR series for 1991 and 1992 from the 2000 census series are taken from Zhang and Cui (2003: 27); the TFR for 1990 from 2000 census is from Retherford et al (2004); the SSB adjusted birth series are from the *China Population Statistics Yearbook* (SSB, 1993-2002) and unadjusted TFR series from Zhang (2004); the estimated TFRs based on the SSB annual series available at:

<http://www.sfpc.gov.cn/data/sfpcdata2001-07-19.htm>.

Table 4 Adjustment factors for annual crude birth rate and underreporting rates found by post-enumeration check-ups in China, 1991-2000

Year	Mid-year Population (millions)	Unadjusted crude birth rate (percent)	Officially adjusted crude birth rate (percent)	Implied correction factors for crude birth rate (percent)	Under-reporting rate found by post-enumeration check up (percent)
	(1)	(2)	(3)	(4)=100*(1-(2)/(3))	(5)
1991	1150.75	18.32	19.68	6.91	
1992	1164.95	16.35	18.24	10.36	
1993	1178.45	15.58	18.09	13.88	6.90
1994	1191.85	15.32	17.70	13.45	6.40
1995	1204.85	14.42	17.12	15.77	
1996	1217.55	14.32	16.98	15.67	
1997	1230.10	13.47	16.57	18.71	
1998	1241.95	13.28	15.64	15.09	
1999	1252.75	12.70	14.64	13.25	
2000	1262.65	11.40	14.03	18.75	

Sources: The mid-year population series are own calculations based on the officially released year-end population from the *China Population Statistics Yearbook* (SSB, 2002a); unadjusted crude birth rate series are from the CPIRC (2003); the official crude birth rate series are from the *China Population Statistics Yearbook* (SSB, 2002a); the underreporting rates in 1993 and 1994 found by post-enumeration check-ups are from the SSB statisticians (Jia and Sai, 1995: 30).

Table 5 Number of women of reproductive age (15-19) and birth control operations in China, 1989-1994

Year	Women of reproductive age (millions)	Abortion (millions)	IUD insertion (millions)	Sterilization (millions)
	(1)	(2)	(3)	(4)
1989	302.2	10.38	15.52	8.71
1990	307.7	13.49	15.88	10.02
1991	312.6	14.09	16.82	12.52
1992	316.9	10.42	14.63	8.29
1993	321.6	9.50	13.46	6.14
1994	325.3	9.47	13.21	5.53

Sources: Numbers of women of reproductive age are own calculations primarily based on the 1990 census and 1989-90 life table; the abortion series are from the *China Health Statistics Yearbook* (MOH, 2000); the IUD insertion and sterilization series are taken from Cai and Du (2001: 3).

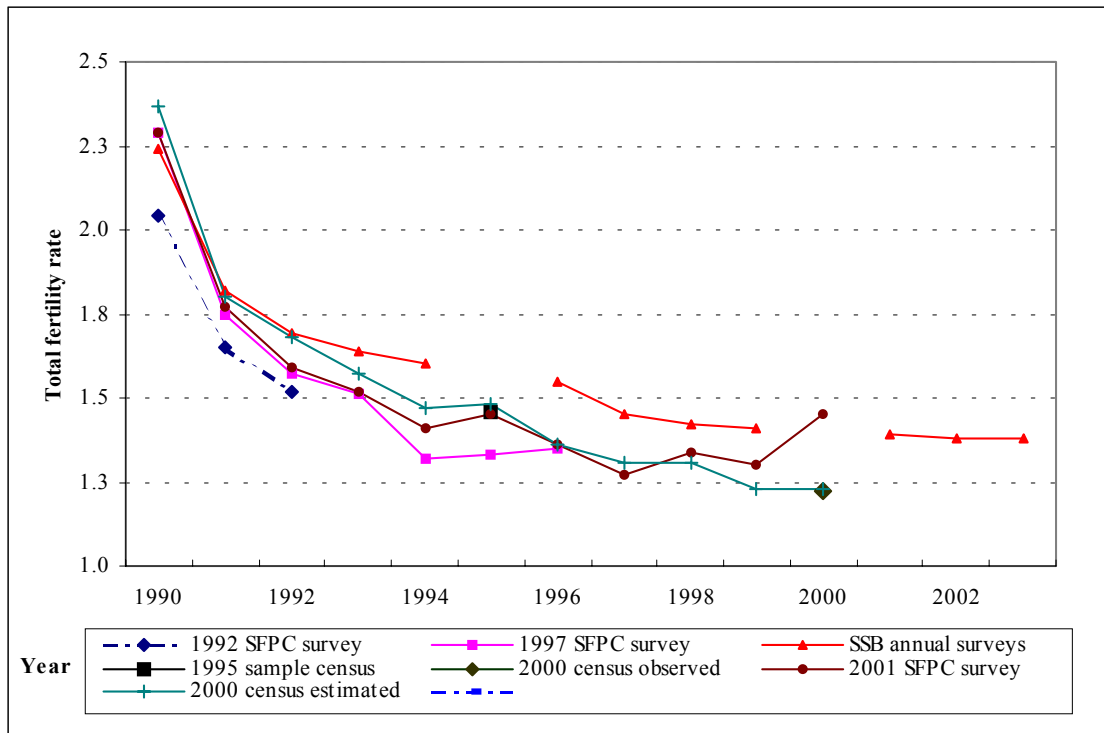
Table 6 Comparison of cumulative fertility of women cohorts born in 1956, 1961, 1966, and 1971 at the age of 20, 25, 30 and 35 in the 1992, 1997 and 2001 surveys in China

Women's age	Surveys	1956 cohort	1961 cohort	1966 cohort	1971 cohort
20	92 survey	0.12	0.11	0.16	0.12
	97 survey	0.12	0.08	0.17	0.14
	01 survey	0.13	0.1	0.16	0.18
25	92 survey	1.02	1.17	1.18	
	97 survey	0.96	1.06	1.29	
	01 survey	0.98	1.11	1.27	
30	92 survey	1.83	1.88		
	97 survey	1.77	1.87		
	01 survey	1.80	1.82		
35	92 survey	2.07			
	97 survey	2.08			
	01 survey	2.09			

Sources: Own calculations based on the 1992, 1997 and 2001 surveys.

Note: Since the 1992 survey only enquired women into their last four parities, the calculations of 1997 and 2001 surveys only include women's first four parities for the purpose of comparison.

Figure 1 Total fertility rates estimated from the 2000 census and selected surveys in China, 1990-2003



Sources: The SSB series of 1991 and 1992 are from Sun and Hu (1992, 1993); after 1993 are from the SSB (SSB, 1993-2002) ; the 1992, 1997 and 2001 SFPC survey series are own calculations.
 Note: The 1997 and 2001 series of fertility rates are truncated at age of 35 owing to data limitations.