Socioeconomic Differentials in Birth Masculinity in China *

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Summary:

We examine in this paper the relationship between birth masculinity and socioeconomic levels in China. Both 2000 and 2005 data suggest the presence of a nonlinear relationship between the sex ratio at birth and socioeconomic status, with a lower sex ratio at birth observed among both the poorest and the richest households. This inverted-U pattern is significantly different from what is observed in India and what has been assumed previously for China. Multivariate analyses indicate that this pattern persists after the introduction of several other covariates of birth masculinity such as ethnicity, fertility, migration status, age or parity. These results suggest that further economic advances and socioeconomic mobility could contribute to the return to normalcy of the sex ratio at birth.

Key words: Asia, China, sex ratio at birth, socioeconomic differentials, gender, discrimination

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1 Introduction

The upward trends in sex ratio at birth (SRB) observed since the 1980s in several Asian countries correspond to a new manifestation of existing gender bias (Croll 2000; Miller 2001; Attané and Guilmoto 2007). The resulting change in sex structures since the 1980s is likely, two decades on, to cause a marriage squeeze of unusual severity in affected countries. Given the potential sex ratio crisis, it is of major importance to monitor the current process of demographic masculinization and to understand its various social and economic correlates.

Existing analyses of SRB levels and differentials in China, India and South Korea have stressed several associated factors such as regional patterning, differences between religious or ethnic groups, and birth order (parity). To a large extent, regional variations in birth masculinity observed within countries such as China and India tend to reflect differences in son preference, a feature closely related to anthropological features such as kinship systems.[1] Two further dimensions also appear to be closely linked to the rise in the proportion of male births: the pressures exerted by fertility decline and birth control regulations on couples wishing to give birth to at least one son, and the growing supply of efficient sex selection technology based on prenatal diagnosis. In contrast, the social and economic development, which as a process has dramatically altered the Asian landscape over the past decades, may on the contrary be seen a harbinger of future decline in gender bias as illustrated by the current decline in SRB levels observed in more prosperous South Korea. Increased prosperity and social modernization may in fact facilitate spontaneous social change towards greater gender equity that would bring about a turnaround in birth masculinity (Chung and Das Gupta 2007).

This paper explores how far indicators of socioeconomic status (SES) in China relate to gender preferences and attitudes as revealed by levels of sex ratio at birth. Previous research based on province-level statistics has suggested that the sex ratio at birth in China tends to increase with socioeconomic level, a phenomenon also observed in India. This could have worrisome implications in countries characterized by rapid economic growth. In this paper, we will use two different sets of data to demonstrate that the relationship between socioeconomic status and birth

masculinity is more complex that previously assumed. While the SRB increases with socioeconomic level for the first two quintiles, a reverse decline is also visible among the richer groups. In other words, except for the poorest segments of China's population, better socioeconomic status is associated with reduced birth masculinity. This finding may partly account for the overall SRB stagnation observed over the last decade in China coinciding with a period of rapid economic change.

Our paper begins with a brief review of the current process of demographic masculinization in Asia and of the role of socioeconomic differentials. We then describe the data available to study variations in sex ratio at birth and the results of the analysis of the 2005 data. The next part presents the results of two multivariate analyses based respectively on 2000 and 2005 data, confirming the inverted-U pattern of the SES-SRB relationship. The paper then concludes with a discussion of the policy implications of our findings.

2 Sex ratio and socioeconomic differentials

2.1 Sex ratio at birth in China

The rise in sex ratio at birth observed in China is linked to the growing number of selective abortions of female foetuses, which has been enabled by the spread of prenatal screening technology (Zeng et al. 1993; Gu and Roy 1995; Chu 2001; Wu et al. 2006; Qi and Mason 2005). SRB levels started to grow steadily in the late 1980s, reached 111.3 male births per 100 female births in 1990 and 119.9 in 2000 according to the long-form questionnaire (Gu and Xu 1994; Lv 2003). This high level of reported SRB has little changed since then even if a minor decline is detectable: the 2005 intercensal survey put the SRB at 120.5 and the official estimate for 2009 at 119.5 is similar while the first 2010 census estimate is 118.1 (Li 2007; Li et al. 2007; NBS 2010). Well-known features of SRB variations in China include regional differentials and the parity effect (Zhang 2005; Cai and Lavely 2007). The latter effect stems from the fact that gender discrimination is usually negligible for first pregnancies, but hike up for later births. Census data also indicate that there are substantial regional differentials: several provinces to the West such as Xinjiang or Tibet appear to have been barely affected by the national trends up to 2005, while sex ratio at birth in some provinces of East or Central China has been estimated at record levels above 130 (NSB 2007). High SRB levels appear to be in some measure linked to the distribution of the Han majority group across the country (Attané 2007). It should be emphasized that large disparities in birth masculinity also exist both within the Hans and across minority groups.[2]

2.2 Socioeconomic factors and high SRB

Socioeconomic status is theoretically linked in various ways to sex ratio outcomes. Initial biological studies of worldwide variations in sex ratio at birth indicated higher proportions of male births among privileged groups, but such variations can also be attributed to fatal mortality (Teitelbaum and Mantel 1971; Chahnazarian 1988). But apart from estimation issues related to sex differentials in birth reporting, today's rise of the proportion of male births need to be considered with respect to three different factors: availability of sex selection technology (supply), son preference (demand) and low fertility pressure (spontaneous fertility decline and population policies) (Guilmoto 2009). Regarding supply variables, we should also expect a positive link as higher education and income levels tend to facilitate information about and access to modern sex selection technology. Similarly, low fertility among higher SES groups exacerbates the need for sex selection as the risk of remaining sonless rises among smaller families. This picture may be reinforced in China's case since the family planning policy tends to be stricter for urban or more affluent populations. The influence of SES on demand variables (son preference) is more ambiguous. While women tend to be economically valued among the poorest families with no assets, this may be less the case in the middle of the social hierarchy, especially among landed households in which land rights are often transmitted along the male line.

Several aspects of improved individual socioeconomic status tend to militate for higher SRB levels. However, unequal gender values tend to dissipate among the urban middle-classes in which women enjoy better education and employment opportunities, and gain a higher degree of autonomy in society. As a result, the existence of biased gender norms and attitudes would be expected to weaken with social and economic modernization. This phenomenon represents probably one of the few ways by which higher development levels and individual SES indicators could distinctly lower down birth masculinity.

The relationship between socioeconomic status and the proportion of male births has already been examined in other Asian countries and is often positive. For instance, disaggregated data from the recent 2009 census indicate that SRB tends to rise with SES quintile in Viet Nam.[3] India's case is especially revealing. Several socioeconomic and developmental indicators have been indeed found to be associated with gender discrimination in India. The most detailed investigations of the "prosperity effect" can be found in Agnihotri (2003) and Siddhanta et al. (2003), who show how expenditure levels are positively related to birth masculinity. Similarly, geostatistical analysis by

Guilmoto (2007) based on the 2001 census at district level identifies economic development as one of the major correlates of high SRB, along with anthropologic composition of the population and distinct spatial processes.

Insert here Figure 1

India is a textbook case for a positive relationship between socioeconomic status and birth masculinity. More recent data from the latest National Fertility and Health Survey (2005-06) can be used to illustrate variations by socioeconomic status (SES) in a way similar to what is done for China later in this paper. As with demographic and Health Surveys, the NFHS offers the standard division of households into SES quintiles. In Figure 1, we show the respective SRB levels for each quintile: the relationship between SES and SRB is strong and positive, with birth masculinity ranging from a normal level among the poorest households to levels distinctly above 115 for the highest SES strata (see also Jha et al. 2011).

2.3 Socioeconomic factors and Chinese sex ratio

In comparison, relatively little is known about the social and economic correlates of high sex ratio at birth in China. One reason is the paucity of appropriate sample data, especially as birth masculinity is influenced by a host of different factors (parity, ethnicity, residence, etc.). The inadequacy of socioeconomic variables derived from Chinese surveys and censuses is another reason and, as a result, education is often used as a proxy for socioeconomic levels. The absence of appropriate analysis of socioeconomic differentials is especially regrettable in view of the considerable rise in inequality observed in China since the economic reforms that were initiated during the late 1970s (World Bank 2009; Appleton et al. 2009). With a Gini ratio of 0.49 according to the latest UNDP estimates, China has become a far more unequal country than many other Asian nations, including India (UNDP 2005). This signals the need to relate social inequity to gender outcomes in China.

Results of previous studies on socioeconomic differentials in China have been somewhat ambiguous. For instance, census data suggest that there is a positive link of SRB with education up to at least 1990 (Gu and Roy 1995), and a regression analysis of 1990 literacy data also suggests the same (Guilmoto 2005). However, a review by Banister (2004) fails to detect the independent effect of education or income variables on sex ratio. Sex ratio data from the 2000 census do not lead to any clear association between education variables and birth masculinity. Summarizing available

research on the causes of the preference for sons, which is a key factor behind inordinate SRBs, Tan (2008) considers economic factors to be less prominent than traditional Confucian gender attitudes, a view reinforced by a more anthropological reading of the situation across Asia (Das Gupta 2010). Lavely and Cai (2004) have also conducted a regression analysis of sex ratio variations in 2000, based on a restricted number of variables, with no socioeconomic linkage emerging from their analysis. Some studies stressed the impact of sex differentials in infant mortality and its links with the SES of mothers, but this is not the main factor for higher child sex ratios (Han and Li 1999; Li and Zhu 2001; Li 1993a, 1993b).

The relationship between SRB levels and fertility policies in China has long been debated. While some like Yuan and Shi (2005) tend to deny it, other studies strongly support the existence of such a link (Cai 2007; Zhang 2005; Zhu et al. 2009). Guo's multilevel analysis (2007) also concludes that fertility policies influence birth masculinity. Chen et al. (2008) further identify high-SRB groups such as the populations with agricultural *hukou* (registration) or with lower education. But it should be borne in mind that the strict one-child policy is applied only in cities and more developed regions. Elsewhere, especially among the rural population, couples are allowed to have a second child after the birth of a daughter: as a result, the SRB among second and later births tends to be very high as sonless parents often resort to sex selection to ensure the birth of a boy. Thus, in 2005, first births had a sex ratio at birth of 108.4 as opposed to 143.2 for second births and even higher values for later births. As expected, the SRB of first births in urban areas is higher: 111.4 in towns and 109.7 in cities. This can be explained by the fact that birth-planning regulations are more drastic in urban areas, with very few couples able to have a second birth. Yet, the SRB among first births in urban areas remains modest compared to SRB levels observed for higher birth orders, showing that only a relatively small proportion of urban residents resorts to sex selection during the first pregnancy. Moreover, the SRB of second births is lower among urban residents than in rural areas. These observations suggest that apart from the specific effects of fertility policies, son preference is probably less pronounced in towns and cities than in the countryside.

This notwithstanding, Attané (2009) has recently presented a systematic examination of regional variations in gender discrimination based on earlier 2000 census data. The socioeconomic covariates of high SRB identified in her analysis are somewhat difficult to interpret, since they point to both a poverty effect (regional poverty and lack of health structures) and a prosperity effect (measured by higher education and increased access to the media). In line with the general considerations outlined previously, this paper argues that economic and social modernization is

indeed positively linked to prenatal discrimination and higher SRB levels in China. This implies, in particular, that the current economic development in China may act as a stimulus for further degradation in SRB levels. While this hypothesis may not square with the stalling of the SRB values observed over the last decade, it remains the most substantial analysis of the role played by socioeconomic differentials. Our analysis based on data at a finer scale will show, however, that while socioeconomic status is associated with higher birth masculinity among the poorest quintiles, prosperity tends on the contrary to be associated with lower SRB levels among better-off social groups. In other words, beyond other important factors–such as anthropological differences accounting for the spatial patterns of SRB–, further socioeconomic uplift in the country may reduce prenatal discrimination against girls in the future.

3 Data and model specification

3.1 Data and variables

In the absence of exhaustive birth registration statistics for China, our SRB analysis relies on the census and survey data. Census tabulations refer either to age and sex population distributions, but provide very little detail for in-depth analysis. Sample survey datasets offer richer materials to study the predictors of birth masculinity, but the sensitivity of SRB calculations to sample size is, however, a potential weakness of sex ratio analysis.[4]

We will use in this study data from the 2000 census and the 2005 1% intercensal survey, two sources corresponding to a time period characterized by apparent stabilization of SRB levels in China. The 2000 census and the 2005 survey are almost identical in design and content, except for a few variables introduced in 2005–such as migration status and social insurance– and a new definition of "current residence", which is closer to the "de facto" approach. But the format in which they will be processed is different.[5] Data from the 2000 census refer to tabulations by county (*xian*), the lowest administrative level available in the census. Variables used for 2000 therefore refer to *county average values* such as age-specific sex ratios or minority population percentage.[6] The 2005 data are in contrast based on individual and household data. The 2005 subsample used in this paper was systematically extracted with interval sampling by the Chinese National Bureau of Statistics from the original data of the 1% national survey conducted in 2005. It includes 2,585,481 persons – about 2 per 1000 of China's population. From this subsample, we created a new sample of 24,898 recent births, containing all particulars related to individual births (such as sex and parity) as well as those of the mothers and their corresponding households.

The key variable used in our analysis is the sex ratio at birth available from the 2005 birth sample. For the 2000 data, it is measured as the sex ratio below one, an indicator slightly influenced by sex specific differentials in child survival. Several independent variables used in the regression analysis are available from both sources (see the variable description in the Appendix). Indicators available only for the 2000 counties for instance include age structure, proportion of divorcees, and proportion of multigenerational households or county-level demographic indicators. In contrast, information such as parity or previous births, or a detailed description of housing and amenities, is only available from the individual 2005 sample. In order to make results comparable, our final statistical analysis is mostly restricted to domains covered in both sources.

Some variables may also be poorly specified or, conversely, too detailed, as for social and economic variables. We have for instance a large number of variables describing housing or socioeconomic characteristics of individual counties. Similarly, no less than 28 variables describe county-level educational characteristics, and another 15 variables pertain to marital status. In such cases, we have performed a preliminary factor analysis in order to synthetize the raw variables. For county averages from the 2000 census, we have relied on standard principal components analysis (PCA). Starting with a set of variables linked to a common domain, we construct a synthetic indicator based on the first factorial dimension –accounting usually for more than 60% of the overall sample variance. This method's most useful application is the construction of a single index of socioeconomic status (SES) from no less than 49-odd available independent variables: 24 variables detailing education levels, and 25 variables on employment status, work sector and occupation. The resulting first component accounts more than half of the total variance with an eigenvalue of 25. Other county-level variables were also aggregated to construct three additional factor scores for multigenerational households, population aging, and divorced or remarried population.[7]

Principal component analysis, however, is inappropriate for the 2005 individual sample, in which many variables are dummy or qualitative variables. We have therefore used the multiple correspondence analysis (MCA), a technique tailored to analyze the relationship pattern between categorical variables (Abdi and Valentin 2007). The computation of the SES indicator is based on the following four categorical variables: education level (7 values), occupation (7 values after reclassification of the original 65 survey categories), salary (reclassified in six categories), and social insurance. Insurance is included in the SES indicator in view of both its correlation with other socioeconomic variable and its link with SRB variations illustrated below. The first MCA factor,

which accounts also for more than half of the sample variance, has been retained as synthetic indicator of socioeconomic status for the mothers of the 2005 sample.[8]

3.2 Statistical analysis

The dependent variable is the sex ratio at birth, computed as county-level average (2000 county data) or a dichotomous variable (2005 birth sample). For 2000, we will model SRB variations with a standard OLS regression, in which the average sex ratio levels are correlated with other variables for the 2,368 available counties. While such regional ("ecological") analyses are not without limitations (Steel et al. 2006), they provide the main sources for comparative analysis of SRB determinants in various settings (Kim and Song 2007; Guilmoto 2008; Lavely and Cai 2004). Our model is similar to that used in Attané's (2009), though her analysis is restricted to 30 provincial units–a scale we consider as unsuitable in view of the provinces' size and inner SRB heterogeneity.

For the 2005 individual birth sample, we use a loglinear (logit) analysis to model the occurrence of a male birth, using the additional variables related to the mother and household as covariates as was done with India (Bhat and Zavier 2007; Retherford and Roy 2003). The main drawback of this method is that the probability of male birth is only marginally affected by social causes such as gender discrimination. In the absence of sex selection, the sex of most births remains chiefly random. The contribution of sex selection to the overall variance of birth masculinity is therefore modest since a majority of parents do not practice it. With less than 25,000 recent births in our sample, the logit modelling of the occurrence of a male birth can be expected to be far less robust than linear regression analyses of SRB variations at county level.

4 Social and economic variations in birth masculinity

This section comprises the results from the statistical analyses of sex ratio variations in China based on the two different datasets. Some findings for 2005 confirm SRB differentials already known from the tabulations published by the Chinese Bureau of Statistics. Other results presented here are new, because they are based on specific individual or household variables that have never so far been used in sex ratio analysis. [9]

4.1 SRB differentials in 2005 with individual and household variables

Table 1 brings together some of the most interesting variations observed from the 2005 sample and also features the significance level derived by a chi-square test.[10] The parity effect is one of the

most common dimensions of SRB differentials in Asia. As reported in the 2005 original tabulations, birth masculinity at 108 is almost normal for first births in China, but jumps to 141 for second-order births and to 156 for subsequent births (which are however far less frequent). Using details of the mother's birth history, it is also possible to underscore here the specific role played by the absence of a previous male child as described in previous studies: in our sample, the SRB jumps to 193 for second and higher parity among mothers with no son. We also observe that the curve of SRB by mother's age follows a typical inverted-U profile, peaking above 125 male births per 100 female births before the age of 30.

The lower SRB figure observed in cities points not only to the higher proportion of first-order births, but also to a lesser intensity of son preference as previously indicated. The number of ethnic groups and provincial units in China prevents us from attempting a detailed analysis based on our sample, but the SRB is distinctly low in minority (non-Han) groups, and less developed provinces in the west of the country, features already observed in 2000 (Cai and Lavely 2007; Banister 2004).

One characteristic that is less often examined for want of appropriate data is the migration status of the mother, which may be better captured in the 2005 sample survey than the previous 2000 census because of the new definition of residence. Our results demonstrate that migrant mothers, namely women who moved in from a different locality over the last five years, report a very high sex ratio at birth (134). Even if the proportion of migrants among recent mothers amounts to less than 7% of our subsample, this difference appears significant. Some mothers may be able to give birth to boys because they are migrants and manage to escape stricter fertility limitations or prohibitions on sex selective abortions in their home community. Higher birth masculinity may also reflect the migrants' social vulnerability and stronger dependence on a patriarchal household system. Another hypothesis would relate the higher SRB level among migrants to a corresponding higher level of underreporting of female births. Our database does not, however, allow for testing further hypotheses on the exact causes of this high SRB level among migrants. Another interesting finding of our analysis is the moderate SRB level (112.5) observed among mothers who are neither the wife nor daughter-in-law of the household head, but household heads or married daughters living with their parents. This indirectly points to various less common gender arrangements –ranging from uxorilocal family systems to female-headed households. Such configurations have long been associated with greater women's autonomy and higher status, features that are also related to lower levels of gender discrimination (Ma 1997; Li et al. 2000).

4.2 Socioeconomic differentials related to sex ratio at birth

In this section, we will focus on some lesser-studied socioeconomic characteristics of parents and their relationship to SRB variations. Table 1 shows sex ratio to be slightly higher among households with no access to running water and this association of SRB with poverty is also observed from 2000 data by Attané (2009). But this initial conclusion appears somewhat misleading, since all other household indicators in the analysis point to a rather different relationship. For instance, lower SRB values are found among children born in households with modern amenities such as individual toilets (112) or a bathroom with hot water (115.5). In fact, most all features typical of better housing –such as private apartment, gas or electricity used for cooking, modern toilet and bathroom– correspond to populations with lower SRB levels.[11] This apparently negative relationship between masculinity of births and living standards is confirmed when the education and employment of the mother are included: higher education and better occupation are also linked to lower SRB levels.

Insert here Table1

The standard list of occupations and job positions provides somewhat inadequate variables to capture social stratification. In contrast, the new variables on the type of social insurance benefits have proved extremely meaningful for our analysis. In this relation, it should be stressed that the deep restructuring of China's economy since the 1980s involved a dramatic reduction in state sector jobs and that the protection system had to be entirely revamped (Selden et al. 1997). Several new social programmes were initiated such as the *Di Bao* system for guaranteeing basic life necessities (World Bank 2009). In the 2005 survey, workers were asked if they participated in three different social insurance programmes: pension, unemployment and medical insurance.[12] Table 1 indicates that mothers benefiting from at least one of these insurance programmes display one of the lowest SRB levels observed in our sample. This parallels results from a study of the rural pension program.[13] It should be reminded at this juncture that the majority of workers in today's China retire without any form of pension after retirement and that rural workers are especially disadvantaged in this regard. In 2008, only 166 million workers participated in the basic pension programme while some 124 million people had unemployment insurance (NBS, 2009). Half of the elderly in rural areas depend primarily on family support. Health care coverage was also rather infrequent at the time of the surveys (World Bank 2009).[14] While the number of participants in new social insurance programmes is growing rapidly, especially since the reforms introduced in 1997, they still correspond to a relatively small share of the workforce and the system is still in its infancy in the

countryside, with less than 15% of rural workers covered (Salditt et al. 2008; Nielsen et al. 2005). Children still offer the main source of security for the old age population, especially since the 1996 law on the elderly clearly stipulated children's obligation to provide economic support for their parents.

A slightly higher SRB estimate is also observed among women working in the agricultural sector. The importance of male progeny may therefore vary by employment sector and status. It is, in particular, crucial to distinguish the gender attitudes of peasant households from that of urban workers enjoying better employment guarantees. This in turn can be related to the varying nature of Chinese family systems and to the labour contribution of male children. Sons in rural areas where the patriarchal system is stricter are likely to work jointly on land with their parents (Bossen 2007). Conversely, gender obligations within the household tend to weaken in other sectors of the economy: in non-agricultural families from the more modern, organized sector, parents tend to rely less on their sons for the welfare of the household or for future old-age support. The reasons for this may be twofold: on the one hand, the contribution from grown-up children is of lesser importance in the more individualistic setting of a modern economy, often characterized by the existence of insurance schemes as mentioned previously. Dependence on sons is thus likely to be weaker. In addition, individual economic capacity and household rights may also become less gender-asymmetrical in modern urban sectors. In such cases, improved women's status and economic position may gradually undermine age-old son preference based on traditional gender arrangements.

The most visible aspect of this transition lies in the transformations of the family structure and living arrangements, corresponding in particular to the lower frequency of multigenerational households in urban areas (Zeng and Wang 2003). An additional illustration of such trends may be found in the 41% of urban women who declared in 2000 that family property should equally divided between sons and daughters (as opposed to 18% of rural women) rather than preferentially given to sons (NBS 2004). While inheritance in the countryside is often based on local customs and tends to favour sons, urban residents are more likely to resort to the existing legislation such as the new 1985 law promoting gender equity in order to ensure their rights to family property (Sheng 2005).

4.3 The nonlinear effect of SES class on sex ratio at birth

The two SES indicators derived from the 2000 and 2005 sources confirm the rather complex relationship prevailing between socioeconomic status and SRB levels. Each sample has been

divided into five socioeconomic quintiles and the average SRB values (after proper demographic weighing) of each quintile are plotted in Figure 2 separately for 2000 counties and 2005 women.

Insert here Figure 2

These two charts are somewhat remarkable for several reasons. First of all, they show the existence of almost parallel effects of SES ranks on SRB levels in 2000 and 2005. This is all the more noticeable considering that SES indicators for 2000 and 2005 have been computed by using different factor analysis techniques. Moreover, the two partitions in SES quintiles compared in this figure are different since we have ranked counties in 2000 and women in 2005. But for both sets of data, the relationship appears similar. In addition, the somewhat smoother variations among county quintiles depicted in the left chart of Figure 2–compared to the wider fluctuations in the 2005 series (with SRB ranging from 111 to 126)– can be explained by the fact that counties remain are more heterogeneous and always include very poor or very rich households.

The second important point is that this relationship appears to be nonlinear, a trait already hinted at in our preliminary discussion. Figure 2 demonstrates the initial jump in SRB values from the first SES quintile to the second quintile. In fact, the lower SRB among the poorest quintile corroborates the low value reported in the 2003 Rural and Urban Household Surveys (World Bank 2009: 177). The apparent increase in the first two SES quintiles may result from specific factors, since poverty in China coincides to a large extent with the remote uplands to the West of the country, with little industrialization, lower urbanization levels, few natural resources, poor land and minority populations (Fan and Sun 2008). Several other factors such as higher fertility, the absence of strict birth regulations, and anthropological features of non-Han populations are indeed related both to low preference for sons and to higher poverty levels.

The SRB appears to be at its highest among the second quintile, a group that includes a significant part of the poorest Han peasantry. From the second SES strata for 2000 and 2005, SRB declines continuously as the socioeconomic status of counties or women improves, however. In both curves, SRB decreases from its highest values (124 and 126, respectively) in the second quintile to the lowest values (114 and 111, respectively) in the highest quintile. While sex ratio at birth remains above the biological level among the richest, there is a pronounced difference from other SES groups, indicating the reverse effect of prosperity on birth masculinity.

This figure serves as a helpful summary of a somewhat confused situation in which the ultimately positive role of socioeconomic status on gender equity is partly concealed by the effect of regional underdevelopment in the Western provinces. It also confers to upward socioeconomic mobility a pivoting role in birth masculinity, generating an initial increase in SRB levels, followed further along the social scale by a gradual diminution in gender discrimination.

4.4 Multivariate models of SRB variations in 2000 and 2005

The associations between SRB levels and individual, household or county characteristics highlighted so far provide a large number of indications as to the heterogeneous distribution of birth masculinity in China. But given the risk of multicollinearity, a multivariate analysis is required to better assess the independent contribution of these factors to SRB variations and check in particular if the association between SRB and SES may be due to other factors such as policy fertility, ethnicity or rural/urban differentials.

The ordinary-least square regression is used to model the variations in 2000 county SRB levels while the analysis of the 2005 subsample is based on a logit model of the probability of a male birth. Results are shown in Tables 2 and 3. The only non-census variable added here is the official fertility norm (policy fertility) as calculated by Gu et al. (2007), a figure quantifying provincial variations in birth regulations. The logit analysis of the 2005 births appears more fragile and several variables are only weakly correlated to the occurrence of a male birth due to the limited size of our birth sample.

Insert here Tables 2 and 3

Our multivariate model confirms the role of several variables that had already been identified in the previous analysis. For instance, the 2005 model shows that age retains an independent, nonlinear impact on SRB, even when the parity effect is accounted for. Both younger and older mothers give birth more frequently to girls than women in the central child-bearing age groups. As expected, parity and an absence of previous male offspring also remain strongly correlated to high SRB across all women.

The local impact of birth control policies is potentially considerable in view of the importance of the Chinese government's intervention in family planning (Scharping 2003; Greenhalgh and Winkler 2006). This provincial level of fertility regulations is strongly statistically correlated to

SRB in both models as shown in other studies (Zhang 2005; Guo 2007): in areas with the strictest birth limitations, SRB is shown to be significantly higher than elsewhere. This confirms the overall impact of population policies implemented by regional authorities upon the extremely high levels of birth masculinity observed in several areas of East China. Limitations on second or later births act as a further pressure to abort unwanted pregnancies among parents who insist on having at least a son. [15] Once fertility regulations are factored in, fertility levels —measured as the local TFR level in each regression—are *positively* associated with high SRB. This means that whenever fertility regulations are poorly enforced and fertility higher than expected the overall proportion of male births tends to increase, a testimony of the patriarchal drive behind higher fertility.

The frequency of multigenerational household is significantly associated with low SRB in 2000, but this variable is not available for 2005. So is the frequency of divorce and remarriage in 2000, but is not significant in the 2005 sample. This suggests that it is not so much the single status of divorcee or remarried which reduces SRB, but rather the regional frequency of divorce and remarriage. Divorce has long been culturally discouraged in traditional Chinese society and has remained rare until the early 1980s (Zeng 2002; Zhang and Gu 2007). Higher frequencies of divorce and remarriage in Chinese counties therefore reflect the pace of social change in Chinese society and should be read as a sign of the emergence of less traditional family arrangements, which are probably less burdened by age-old patriarchal values favouring male progeny.

Several social and geographical characteristics remain good predictors of the overall SRB level, but their impact varies in our two models. For instance, the minority variable is no longer significant in the multivariate model for 2005 even it remains strongly associated with low birth masculinity in 2000 counties. Interestingly, urbanization in 2000 and individual migration status in 2005 are significantly correlated to high SRB. The latter observation[16] confirms the relationship between residential mobility and birth masculinity already illustrated in a migration study conducted in Shenzhen by Wu et al. (2007). The specific position of unregistered migrants–people with rural or agricultural *hukou*–is characterized by a trade-off between freer geographical and economic mobility, and a loss of access to public goods and entitlements.[17] This means in particular that by moving to cities, migrants may escape close administrative monitoring of their demographic behaviour and their compliance with fertility regulations is more difficult to ensure. Moreover, urban migrants are usually excluded from the social insurance benefits such as pension or unemployment guarantees that we have seen are closely associated with low SRB levels (World Bank 2009; Nielsen et al. 2005). The rapid increase in spatial mobility and in the corresponding

volume of the "floating population" is one of the most characteristic features of China's new demographic regime (Zhao and Guo 2007; Fan 2008b).

Turning now to socioeconomic status and birth masculinity, we use here the SES quintile shown on the previous charts (the second quintile with the highest SRB level is taken as reference group). Its link with SRB previously emphasized is confirmed in our multivariate modelling. It retains its curvilinear dimension in both models, even though the correlation is more pronounced for the 2000 county sample than for the birth sample. This effect remains present independently of other social and demographic variables.[18]

5 Conclusion

5.1 Synthesis of findings

The objective of this paper is to use a newly released sample from the 2005 survey in China to revisit the relationship between demographic masculinization and socioeconomic stratification. We started these investigations with some feelings of uncertainty, if not frustration, owing to the rather ambiguous findings of previous studies on the nature of the linkages between prenatal gender discrimination and the rapid socioeconomic transformations of Chinese society. Contrary to the rather straightforward conclusion of studies devoted to India, research on the socioeconomic determinants of higher sex ratio at birth in China has led to a somewhat perplexing picture in which enhanced discrimination is at times linked to indicators of both poverty and prosperity.

In our analysis, we have endeavoured to use new and more disaggregated data. One of our starting hypotheses was that the relationship was mediated by a host of other factors, such as the demographic context of mothers with no previous male offspring, the geographically intricate patterns of gender discrimination, and the effect of local birth control policies. The interprovincial migration factor has emerged along the way as an additional correlate of high sex ratio at birth, suggesting that the specific demographic behaviour of migrants should be further investigated. In view of the wide income differentials between rural and urban households, at a ratio of 1 to 3.3 in 2008 (NBS, 2008), the share of migrants in cities is unlikely to falter in the future and may further inflate urban SRB levels. Another interesting variable is the question concerning social insurance as progressive decline in birth masculinity appears closely associated with the various insurance schemes that were introduced in the 1990s after the demise of the so-called “iron rice bowl” system (guaranteed employment in the state sector and social security) which previously existed (World

Bank 2009). These findings therefore point to the potential contribution of structural transformations (migration, social protection) accompanying China's rapid economic growth to the changing levels of sex ratio at birth in the country.

The most interesting finding is that the relationship between socioeconomic status and birth masculinity is not linear, a feature explaining some of the inconsistent statistical associations noted in previous research on these issues. This contradicts the positive impact of socioeconomic status on the intensity of SRB distortions posited in the past. As the confirmation of an inverted-U association requires strong empirical support, we added to the analysis of the 2005 birth sample a county-level analysis of SRB variations in 2000. Both statistical analyses confirm the more complex process in which socioeconomic status in China influences discriminatory behaviour. The very first step out of poverty corresponds to a rapid increase in the proportion of male births, even when other important demographic or ethnic variables are controlled for. But birth masculinity peaks among the lower peasantry in rural areas, and any further increase in social status is then associated with lower SRB levels, i.e. greater gender equity and less pronounced son preference. This explains in particular why the lower fertility observed in urban areas–due in part to stricter birth planning regulations–does not result in higher levels of prenatal sex selection among the first births.

The divergence between China and India (Figure 1) in terms of SES-SRB interactions could hardly be more striking. SRB in China peaks for the second quintile while the SRB is at its highest in India in the richest quintile. These variations reflect of course the imperfect comparability of socioeconomic quintiles across countries: the lower SES segments of India's population are significantly poorer than China's corresponding segments. This is also true of differences in fertility levels. But comparison of China with India also helps to reframe our analysis in a historical perspective. Deteriorating sex ratios should be interpreted as a cumulative or path-dependent process within regions and countries, akin to innovation mechanisms used to describe the progression of fertility decline (Casterline 2001). One of the characteristics of transitional patterns is that they affect different social groups at different periods. Hence, average SRB values combine the distinct trajectories of regions and social groups.[19] Demographic masculinization as a process could be divided into two different stages. During the first stage, when the new sex selection technology made its appearance in Asia, it was first appropriated by higher-SES groups before spreading to the rest of society. This typical pattern of top-down propagation may be due first of all to supply and low fertility factors, which corresponds closely to India's case. It may also apply to

China until the 1980s, in view of an initially positive link observed between literacy and SRB. Over the second stage, the new discriminatory behaviour spreads progressively to other social groups because of easier access to sex selection and further fertility decline. But at the same time, the SRB may ultimately begin to return to normalcy among the more prosperous social classes who give up the patriarchal structure typical of the traditional rural economy. This accounts for the negative relationship between birth masculinity and socioeconomic status among the four richest quintiles observed in China. This also corresponds roughly to South Korea's pathway. More importantly, our results suggest that socioeconomic status may emerge as a key variable for interpreting the downturn in SRB levels recently detected in several Asian countries including China (Das Gupta et al. 2009; Guilmoto 2009).

5.2 Policy implications

In spite of the importance of future gender imbalances, the roots of the current SRB stagnation and of its potential decline in China are still poorly understood. In this final section, we will reflect on the three intermediate variables of sex selection—viz. low fertility, access to sex selection technology, and gender preference—to assess their contribution to changes in birth masculinity in China and their sensitivity to policy initiatives.

The fertility factor will probably not have a positive role on birth masculinity levels in the future, unless family planning regulations are completely relaxed in China (Zeng 2007). Currently, one of the more liberal provisions of the fertility policies is to allow a second pregnancy in rural areas following the birth of a girl (Zhang 2005). If more people were allowed to have a second child, this would firstly result in a higher birth rate, but this may not correct at all the current inordinate sex ratio at birth if son preference remains entrenched. As far as "supply factors" is concerned, it is also difficult to imagine that any restriction on access to sex-selective abortions could have a sizeable impact on birth outcomes. After all, prenatal sex determination has long been prohibited in China (Li 2007; Tan 2008; Zheng 2007). As early as 1994, the national law on Maternal and Infant Health Care clearly stipulated that prenatal sex identification was forbidden for non-medical reasons. This interdiction was reiterated over the years in several legislations affecting family planning administration and the national population policy,[20] but with no clear effect on gender discrimination and the overall SRB level. The reason for this poor impact lies in the lack of effective enforcement. Behind this relative failure to halt sex selection also lies the basic political contradiction between the need for fertility regulations and the fight for gender equity, in which

birth control objectives have long received priority in China and hindered efforts in other domains (Greenhalgh and Winkler 2005).

Finally, the "demand component" of sex selection could become the main force behind any long-term decline in sex ratio at birth. It is only when the need for a son and the specific aversion for female births decline among the population that birth masculinity is likely to return to its normal biological level for good. But behind the preference for sons, there is a large array of cultural, social and economic dimensions that are themselves susceptible to exogenous transformations, be they the structural impact of societal transformations in China or the interventions targeted at discriminatory attitudes and practices. Among the latter, the “Care of Girls” campaign features prominently because it combines economic initiatives to correct gender inequality and an effort to propagate new gender values. The impact of this still recent project and its overall costs remain to be assessed in order to gauge its actual effectiveness in lowering sex ratios (Eklund forthcoming). But what the findings of this paper indicate is that improving living standards and providing better social insurance may constitute a substantial lever for changes in gender attitudes in China.[21] A specific structural factor is the educational progress. Recent projections of human capital in China document the irreversible effect of age structures on the educational revolution taking place in China (Samir et al. 2008). If education levels remain associated with gender attitudes in the same way that SES groups are, cohort replacement will by itself bring new generations with higher educational attainment into the adult age groups. In the long run, this may bring down birth masculinity.

Our findings are based on indirect measurements of socioeconomic status and on a limited birth sample for 2005. They need to be further tested, especially with results from the 2010 census. Furthermore, the fact that birth masculinity among the highest SES quintile in China today is well above the biological standard demonstrates that the decline in sex ratio is today far from over. Without the involvement from government or civil society organizations, and greater access to social security and retirement benefits in the countryside, the return to normalcy of birth masculinity will take many more years to come.

6 Appendix: Variables used in the analysis of the 2000 counties and of the 2005 birth sample

Variable description	Value and unit	Dataset
Sex ratio below one	Boys per 100 girls	2000
Minority population	% of the population	2000
Urban population	% of the population	2000
Migrants (interprovincial)	% of the population	2000
Multigenerational household	PCA factor score*	2000
Household members above 65	PCA factor score*	2000
Divorced and remarried population	PCA factor score*	2000
County-level fertility	2000 TFR	2000
Policy fertility	Children per woman	Gu *et al.* (2005)
Socioeconomic status (SES)	PCA factor score*	2000
SES quintile	PCA factor score*	2000
Male birth	Dummy	2005
Minority	Non Han ethnic group	2005
Residence in city	Dummy	2005
Age	Age of the mother	2005
Age squared		2005
Parity	1, 2, 3+	2005
Previous male birth	Dummy	2005
West China	West China vs. East and Central China	2005
Migrant	Has moved since 2000	2005
Status in household	Neither spouse nor daughter of the household head	2005
Land-based occupation	Works on land	2005
Insurance	Any type of social insurance (unemployment, medical, pension)	2005
Modern, individual toilet type	Dummy	2005
Bathroom with warm water	Dummy	2005
Divorced or remarried mother	Dummy	2005
Socioeconomic status (SES)	MCA factor score*	2005
SES quintile	MCA factor score*	2005
Regional fertility	Province-level TFR (2000)	2005

Notes:

- 2000 dataset: county-level average of 2000 census variables (n= 2,368 counties)
- 2005: household and mother variables of births during the last 12 months reported by women aged 15-49 years in the 2005 survey (n= 24,898 births)
- PCA (Principal components analysis) and MCA (Multiple correspondence analysis) methodology described in the text

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Tables

Table 1: Sex ratio at birth according to selected variables in China, 2005 subsample

Variables	**Sex ratio at birth (SRB)**
Birth parity	
First birth	108.0***
Second birth	140.6***
Third or subsequent birth	156.4***
No previous male birth (all women)	123.7***
No previous male birth (with parity >1)	192.8***
Characteristics of mother	
Ethnic Minority	111.3**
Residence in city	114.8**
West China	111.8***
Migrant	133.7**
Status in household	112.5*
Land-based occupation	122.5*
Insurance	112.6***
Housing characteristics	
Housing with less than 3 rooms	115.0**
Housing shared by multiple households	132.4**
Housing with no running water	122.5**
Housing with gas or electricity used for cooking	115.0*
Housing with modern individual toilet	112.0**
Housing with modern bathroom	115.5**

Note: ***p<0.01; **p<0.05; *p<0.10

Table 2: Multivariate regression analysis of variations in sex ratio below one year of age, Chinese counties, 2000 census.

Explanatory variables	**Coefficient**
Ethnic minority	-.066***
Urban	4.102**
Migrants	11.827
Multi-generational household	-.635**
Household members above 65	.429
Divorced and remarried	-2.455***
County-level fertility	3.119***
Policy fertility	-4.366***
First SES quintile	-1.755*
Third SES quintile	-1.899**
Fourth SES quintile	-5.359***
Fifth SES quintile	-8.902***
Constant	121.850***
n	2,368
r^2	.1474

Note: Variables described in Appendix; ***p<0.01; **p<0.05; *p=0.10

Table 3: Logit model of probability of male birth, sample from the Chinese 2005 intercensal survey

Explanatory variables	**Coefficient**
Demographic characteristics	
Age	.05487**
Age (squared)	-.0011***
Birth parity	
Parity	.4264***
Previous male birth	-.6562***
Mother's characteristics	
Minority	-.0517
Urban	-.015501
Divorced or remarried	.1054
Migrant	.1392***
Regional fertility	
Policy fertility	-.1942***
Province-level fertility	.08612*
Socioeconomic status (SES)	
First quintile	-.0737*
Third quintile	-.017
Fourth quintile	-.0440
Fifth quintile	-.0837**
Constant	-1.0176***
Model fit statistics	
n	24,898
Log likelihood	-16982
Pseudo r^2	0.0105

Note:

Variables described in Appendix; ***p<0.01; **p<0.05; *p=0.10

Figures

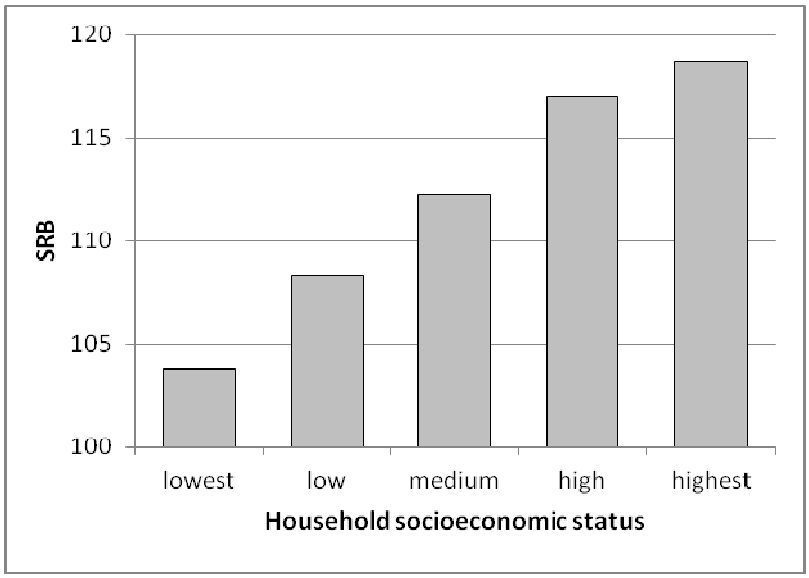

Figure 1: Sex ratio at birth in India by socioeconomic quintile, 2000-06.

Source: calculated by the authors from NFHS-3 data

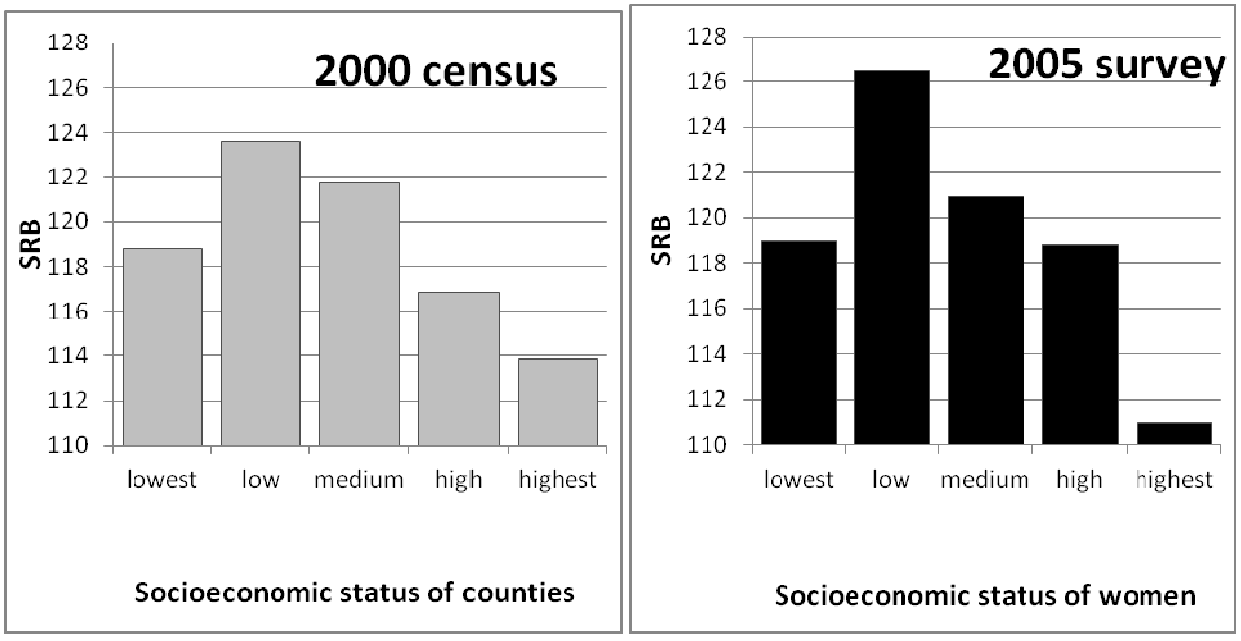

Figure 2: Sex ratio at birth in China by socioeconomic quintile, 2000 counties and 2005 women

[1] The pronounced spatial patterning of child sex ratio in China is examined in Guilmoto and Oliveau (2007). For a recent historical and anthropological interpretation of these regional variations, see Das Gupta (2010).

[2] For instance, some minority groups–such as the *Zhuang*–also display high levels of birth masculinity. Moreover, there are also considerable variations within Han-dominated regions: in Hubei, for example, whose population includes no less than 95% of Han Chinese, sex ratio at birth was almost normal (below 110) in 2000 in 25% of local counties, but reaches extremely levels (above 140) in another 25% of counties.

[3] About Viet Nam, see UNFPA (2010). No clear link between high SRB and SES levels emerges from this analysis of Korean data for 1994 and 2000, even if there is a clear negative link with gender preference (Kim and Song 2007; Lin 2009).

[4] For instance, the 5% confidence interval of a SRB of 105 computed over 10,000 births ranges from 101 and 109.

[5] There are no similar datasets from both 2000 and 2005 surveys to carry out a directly comparable analysis: 2005 data are not provided at county level, while no appropriate individual sample from the 2000 census is available.

[6] In 2000, China was divided into province-level units, prefecture-level units and counties. Counties had an average county population of 438,000 inhabitants. 2368 counties are available for our analysis.

[7] These three factor analyses were based on the following three different subsets of 2000 county variables: four variables describing the percentages of multigenerational households, four variables related to the presence of population above 65 in the household, and four variables describing the proportions of divorced and remarried populations among men and women. Details on the factor analyses available form the authors.

[8] Two socioeconomic indicators (insurance and salary) used in the 2005 factor analysis of SES characteristics are not available from the 2000 county tabulations.

[9] For studies using the 2005 sample, see NSB (2008).

[10] Variables without significant SRB differentials and collinear variables are not shown in this table.

[11] On recent trends in housing inequality in China, see Wang (2003)

[12] Other important programmes found in both rural and urban areas include work injury insurance, maternity insurance, and the *Di Bao* social assistance programme (World Bank, 2009).

[13] Ebenstein and Leung (2008) interpret the participation in pension programs as a consequence of sonlessness. See also Bhattacharjya et al. (2008).

[14] The newly introduced rural pension scheme (*Xin Nongbao*) may rapidly improve the situation. (O'Keefe and Wang 2010)

[15] No peak has however been detected in areas with TFR around 1.5 children, where second births are conditional to the first birth of a daughter.

[16] County-level interprovincial migration is also associated with high SRB, but the coefficient is no more significant when the urban variable is included.

[17] On unregistered urban migration, see Solinger (1999) and Fan (2008a).

[18] For colinearity reasons, the model for 2005 does not include the insurance variable since it has been already including in the SES indicator.

[19] A longitudinal approach to SRB changes within given regions or social groups would be necessary to provide an additional confirmation. One rare such study shows that the initial rise and subsequent decline in birth masculinity took place earlier in South Korea among higher SES groups (Chun et al. 2009).

[20] The prohibition and related penalties feature in the articles 35 and 36 of the *Population and Family Planning Law of the People's Republic of China* promulgated in 2001.

[21] This corroborates the preliminary analyses of the South Korean SRB decline (Lin 2009; Chung and Das Gupta 2007)