MINISTRY OF PLANNING AND INVESTMENT
GENERAL STATISTICS OFFICE

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SEX RATIO AT BIRTH IN VIET NAM: NEW EVIDENCE ON PATTERNS, TRENDS AND DIFFERENTIALS

Ha Noi, May 2011

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PREFACE

The Viet Nam National Population and Housing Census 2009 (VNPHC2009) was conducted at the beginning of April 1st, 2009 under the Prime Minister"s Decision No. 94/2008/QD-TTg dated 10th July, 2008. This was the fourth population census and the third housing census ever conducted in Viet Nam since 1975. The purpose of this census was to collect basic information on population and housing of the Socialist Republic of Viet Nam for national development planning for the period of 2011-2020.

A recent important demographic phenomenon that has caught the attention of policy makers, researchers, and the public is the imbalance of the sex ratio at birth (SRB) that Viet Nam has been experiencing since the early 2000s. The sex ratio at birth, defined as the number of boys being born per one hundred girls, has experienced an increase in the past years, indicating an intentional intervention in the otherwise biologically stable equilibrium of the number of boys and girls born in a society. In order to have reliable data for monitoring and projection on the trends of this phenomenon in Viet Nam, the UNFPA has been providing technical support to the General Statistics Office (GSO) in collecting, analysing and disseminating data on the SRB from the annual population change surveys since 2006 and now also from the Viet Nam Population and Housing Census 2009.

The results of the 2009 census data analysis have shown that the SRB in Viet Nam has increased to a value of 110.6 boys per 100 girls in 2009, which is a significant deviation from the natural range of 104-106 boys per 100 girls.

The Government of Viet Nam is paying special attention to this emerging imbalance in the sex ratio at birth. It is recognised that pre-natal sex selection is a direct cause for the SRB imbalance. This is an illegal behaviour according to the regulations stipulated in the population ordinance issued in 2003 by the National Assembly Standing Committee and the Government decree No. 114 issued in October 2006. The gravity of this issue for Viet Nam was once more underlined in the National Strategy on Population and Reproductive Health for the period 2011-2020. Therefore, it is necessary to continue to analyse available data and continue research in order to monitor the SRB at national and sub-national levels in order to better inform interventions on policy and programmes.

This monograph titled ***"Sex Ratio at Birth in Viet Nam: New Evidence on Patterns, Trends and Differentials"*** uses the 15% sample data of the 2009 census and provides the most comprehensive and updated information to readers on the current trends of the SRB in Viet Nam. It also provides relevant information on the geographic and socio-economic characteristics of the SRB phenomenon in the country, and attempts to provide scenarios of possible future evolution of this indicator and the impact it may have on society.

The General Statistics Office of Viet Nam would like to express its special thanks to the United Nations Population Fund for their financial and technical support in the Viet Nam Population and Housing Census 2009, especially for data analysis and preparation of this monograph. We also would like to express our sincere thanks to Dr. Christophe Z Guilmoto for his great effort in analysing the data and developing this monograph. Our gratitude also goes to other national and international experts, UNFPA staff and GSO staff for their hard work and valuable inputs during the development of this monograph.

We are honoured to introduce a special publication with an in-depth look into a topic of interest among researchers, managers, policy makers as well as the whole society. We are looking forward to your inputs and comments on this monograph to improve the quality of the GSO's coming publications of detailed analyses of the Viet Nam Population and Housing Census 2009.

General Statistics Office of Viet Nam

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ABBREVIATIONS

GSO	General Statistics Office
TFR	Total Fertility Rate
SES	Socio-Economic Status
SRB	Sex Ratio at Birth
CSR	Child Sex Ratio
UNFPA	United Nations Population Fund

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EXECUTIVE SUMMARY

The Sex Ratio at Birth (SRB) oscillates around 104-106 male births per 100 female births in most countries of the world, but its level has gradually increased over the last 25 years in several Asian countries, particularly in China and India. Viet Nam"s case has long drawn the attention of observers since no increase of the SRB had been observed in the country, in spite of the presence of several preconditions such as a rapid reduction of birth rates, modernization of the healthcare sector, and a traditional preference for sons.

Since 2000, several signs of a rising proportion of male births were however noticed in the estimates derived from annual population surveys conducted by the GSO. The following study presents a comprehensive analysis of the statistics based on the 15% sample of the 2009 Population and Housing Census confirming the recent rise in SRB, estimated at 110.6 male births per 100 female births during the 12 months preceding the census. Further analysis of the census data shed light on some of the main distinctive features of SRB in the country.

- While no general differences between the SRB rates of the rural and urban areas are noticeable, there are considerable regional variations within the country. Thus, many provinces, most notably in the Central Highlands region, display SRB levels close to the biological average. In contrast, the SRB in other provinces reaches levels of 115 or 120 and above. This is in particular the case in the Red River Delta region, and specifically in its rural communes. The province-level map highlights the strong regional patterning of Sex Ratio variations.

- The SRB is significantly higher among third and higher-order births (115), although prenatal discrimination is already observable among first births (110.2). A further breakdown of the SRB by gender composition of previous births reveals that abnormal SRB"s are systematically associated with the absence of a son in the family.

- Higher SRB levels are closely associated with education levels, ranging from 107 to 113 according to the number of schooling years. A high SRB is also strongly correlated with indicators of better housing quality and ownership of various household items. A synthetic indicator of household living conditions demonstrates that while the SRB among the poorest quintile of the population is at a normal biological level of 105.2, it rapidly increases with better socio-economic conditions to reach levels around 112.5 among the more prosperous quintiles.

- A multi-linear model of birth masculinity in Viet Nam indicates that in addition to birth order, most identified variables – such as socio-economic level, region, female autonomy (education, migration) and ethnic minority – have an independent effect on SRB variations. This means that the recent increase of the SRB cannot be attributed to a single social or economic factor.

- An indirect estimation technique reveals that the inception of the SRB rise in Viet Nam can be dated to 2005. The signs of a slightly earlier beginning in some regions or among some social groups may have become apparent in 2004.

A separate section explores the implications of the recent SRB increase on the current population structures and also presents findings of population forecasts for the period 2009-2049. Demographic simulations resulting in different SRB scenarios beyond 2005 illustrate how the current excess of male births will inevitably translate into increases in the overall Sex Ratio of Viet Nam"s population at a later stage as well as in growing sex imbalances among the adult population of marriageable age.

The study closes with a discussion of options for policy interventions which may accelerate the halting of the increase of current SRB levels and facilitate a return to normalcy in the near future. It is important to note here that there are, however, very few documented cases of specific or singular effective policy responses to sex imbalances at birth. In comparison for example South Korea"s unique experience of an SRB downturn points to the possible effects of several different factors occurring simultaneously such as stricter control of prenatal diagnosis, implementation of new laws, and rapid socio-economic change.

There is probably no unique way to invert the SRB increase trend generated by long-standing gender inequity in a society. Due to recent progress with regard to fertility decline and the provision of quality health care services, any successful effort towards the reduction of excess male births through targeted interventions and advocacy campaigns today will lead to a parallel decrease in the number of Viet Namese men condemned to delayed marriage or bachelorhood in the future. Qualitative field studies and continuous monitoring of birth imbalances in the country will provide the necessary data to implement an effective strategy and intervention for reducing the current excess of male births.

1. SEX RATIO AT BIRTH AND SEX SELECTION IN ASIA

The Sex Ratio at Birth (SRB) oscillates around 104-106 male births per 100 female births in most countries of the world. The minor variations which can be observed are attributed to biology, age, parity and other factors that are still not well understood. However, the Sex Ratio at Birth is known to have gradually increased in several Asian countries over the last 25 years, with China and India featuring prominently on this list. In a few specific regions the SRB has even reached extreme values of 125 or 130 and above. This is most notably the case in regions of East China or Northwest India, where the SRB has been growing steadily since the late 1980"s and where sex levels above 120 have not been uncommon since 2000 (Table 1).

Table 1: Sex Ratio at Birth in various countries, 2004-2009

Country / regions	SRB	Period	Data type
Albania	111.5	2008	Birth registration
Armenia	115.8	2008	Birth registration
Azerbaijan	117.2	2007	Birth registration
China (Mainland)	120.6	2008	National estimate
Jiangxi Province	137.1	2004	1% pop. census
Anhui Province	132.2	2004	1% pop. census
Shaanxi Province	132.1	2004	1% pop. census
Georgia	111.9	2006	Birth registration
India	110.6	2006-08	Sample registration
Punjab State	119.6	2006-08	Sample registration
Haryana State	118.0	2006-08	Sample registration
Rajasthan State	114.9	2006-08	Sample registration
Montenegro	109.6	2004-08	Child Sex Ratio
Pakistan	108.9	2003-07	Demographic and Health Survey
South Korea	106.4	2008	Birth registration
Sources: national statistical offices, UNFPA (2010), Eurostat			

The potential determinants for this apparent rise are numerous and include under-registration and other measurement issues. In some countries like China, under-enumeration of female births (and of young girls) may thus have artificially inflated the observed sex ratio figures to some extent. But in spite of possible statistical problems, the root cause for such rises seems to be the tendency among a significant share of couples to opt for selective abortions of female fetuses in order to avoid the birth of girls. Since abortions are poorly registered

and information regarding the sex of aborted fetuses is never available, the real magnitude of sex selective abortions remains unknown and can only be deduced from the excessive proportions of boys as measured at birth. In the absence of direct measurements of sex selective abortions, local surveys have in detail documented the strong preference for boys expressed by couples in China and India and their attempts to abort female fetuses after preliminary prenatal sex identification (Attané and Guilmoto, 2007; Miller, 2001).

The rise of SRB levels has also been observed in other smaller countries of Asia and South-East Europe as Table 1 indicates. In several cases, the excess of SRB appears to be limited to about 5 male births per 100 female births. But in countries in the Caucasus such as Armenia and Azerbaijan, SRB levels started to increase almost 20 years ago and have since reached levels above 115. Besides several studies of China and India, there are almost no qualitative field investigations to document the practice of sex selection in these countries. However, higher SRB"s detected from birth statistics appear to always be linked to three distinct factors observed in these countries: a strong preference for boys in society, the availability of both prenatal sex identification and abortion facilities, and low or moderate fertility levels. In addition to the lack of ethnographic surveys attesting to the specific contribution of these factors, the lack of reliable statistical sources due to the absence of effective birth registration or of recent census data further limits insight in the causes of SRB trends. At present it is therefore difficult to claim knowledge regarding the true extent of SRB distortions in the world, beyond the information regarding the countries mentioned in Table 1.

Understanding the reasons behind son preference and the demand for prenatal sex selection requires the identification of three necessary preconditions (Guilmoto, 2009). The first and leading prerequisite is the presence of an underlying preference for sons across society. This explains why parents, even in widely different contexts, insist on bearing a son. This complex phenomenon is guided by both traditional attitudes inherited from the past and by modern social considerations fuelled by recent transformations in society. The second precondition relates to the existence of modern healthcare infrastructures necessary for prenatal sex identification and selection. It is important to keep in mind that in a number of Asian countries prenatal diagnostic or safe pregnancy termination facilities are not commonly available. The third precondition relates to the occurrence of a low fertility rate under which circumstance bearing fewer children automatically increases the risk of remaining sonless. The census data do help to identify regional, social and economic characteristics of those population groups that are more inclined to practice prenatal sex selection.

While prenatal sex selection in itself corresponds to an obvious manifestation of acute gender bias, population scientists have also drawn the attention of policy makers towards the future implications of distorted sex structures. Indeed, the relative deficit of female births currently observed in many countries will automatically translate into a parallel decline in the proportion of women at all ages in the future. Population structures will therefore bear the mark of today"s sex selection practices during the forthcoming decades, creating an unheard of socio-demographic situation characterized by a long-term demographic preponderance of males. As indicated by a number of social scientists, this sex imbalance will have an impact on family formation processes and family structures as well as, more specifically, on the prevailing marriage systems. In brief, young men will find themselves in surplus in relation to the dwindling proportion of women of the same generation and as a result, may face serious difficulties to find a spouse. Delayed marriages among men and increasing rates of singlehood are distinct possibilities in view of the future shortage of marriageable women.

This, in turn, will affect family systems in the future, especially in view of the fact that since a very long time family systems have been patrilineal (i.e. following the male line of descent) in these societies and that almost no man has remained unmarried in the past. A significant proportion of men condemned to remain single will therefore find themselves unable to perpetuate the traditional patriarchal family. Since in Asia the SRB only became significantly biased at the end of the 1980"s or later, merely a small proportion of the affected population has thus far entered the marriage market. It is therefore too early to assess the ways marriage systems will adjust to this growing sex imbalance and how this will have an impact on other aspects of the social structure such as on the role of women in society, e.g. by increased Gender-Based Violence and increased trafficking of women. Several preliminary studies have already explored different aspects of the male surplus on the marriage patterns and social systems[1].

In view of the context of the sex ratio changes in Asia overall, Viet Nam"s case has since long drawn the attention of observers since for a long time no increase in SRB had been observed in the country. Census figures and survey data failed to demonstrate any distinct sex imbalances at birth or among young children, despite the presence of several facilitating preconditions such as a rapid reduction in birth rates, modernization of the healthcare sector, and a traditional preference for sons in many families as already described by Haughton and Haughton (1995). Since 2000, a number of signs of a rising proportion of male births were however observed due to estimates derived from the annual Population Change and Family Planning surveys conducted by the GSO. Further estimates based on births recorded in the health facilities were later published and confirmed this trend (Bang et al., 2008). In 2009, the first detailed monograph on the issue of Sex Ratio at Birth in Viet Nam was published by UNFPA which confirms a regular rise of SRB levels after 2000 (UNFPA, 2009). Based on both limited survey and birth data, this study puts forward an SRB level of 111 in 2007, while emphasizing both its rapid increase as observed during the previous five years and the existence of wide regional differentials within Viet Nam.

The census conducted in Viet Nam in 2009 however provides the most recent data and a range of additional statistics regarding the sex imbalances of births during the last decade. The study at hand thus presents a comprehensive analysis of these data based on the 15% census sample. It not only confirms most of the trends detected in a previous report on the topic published by UNFPA, but also sheds additional light on the mechanisms and correlations of sex imbalances in the country.

[1] See for instance Edlund et al. (2007), Kaur (2008), Le et al. (2007), Shakti Vahini (2003), Wei et al. (2009).

2. OVERVIEW OF THE 2009 CENSUS: SAMPLING, DATA STRUCTURE AND KEY VARIABLES

In the absence of a civil registration system providing yearly updates regarding series of births classified by sex, the next best source for studying birth differentials constitutes the population census data. Census figures present the following advantages: sex and age are reliable variables collected during census operations; many other social and economic variables are simultaneously collected which can be used for examining related trends and socio-economic correlates; census data are exhaustive; and data are usually available by detailed administrative subdivisions. The present study is based on the 15% sample of the 2009 census and comprises original tabulations of various individual and household variables. The census will give rise to a large number of detailed tabulations in the near future, but this 15% sample is essential to carry out an in-depth analysis of the Sex Ratio at Birth in Viet Nam. The additional advantages of this dataset are numerous, starting with the fact that its considerable size allows for various disaggregated analyses (see Appendix 1). Moreover, raw sample data provide access to variables that will not be tabulated in detail in the census volumes. They furthermore offer a unique opportunity to produce exploratory cross-tabulations relating the sex of births to lesser-studied characteristics of mothers and their households.

The sample is a part of the exhaustive census record file, but is based on a much more comprehensive census (long-form) questionnaire than the short questionnaire form which was used for the rest of the population. It includes all the information collected during the population and housing census of 1st April 2009 (census reference date). The sample accounts for 15 per cent of the country"s total population, estimated at 85,789,573 persons. More precisely, it includes data from 3,692,042 households and 14,177,590 persons. These constitute two different files (respectively the household file and the individual file) which were subsequently linked by a unique set of identifiers based on province, district and household number.

The sample has been drawn in a way to ensure statistical representation of all province and district administrative units, as well of rural and urban areas in the country. As a result, some areas have been oversampled and the total number of observations is greater than 15 per cent (16.5 per cent of all individual records are part of the sample). Records included in the sample therefore needed to be adequately weighted and all findings used here are based on the separate weights provided by the GSO for individuals and households. It should also be noted that the sample includes only standard family-based households and no "institutional households" such as school, hostel, police, military or jail populations. As shown in Table 2 census variables cover a large array of social, economic, demographic and geographical characteristics of the population and households.

Table 2: Main census variables

	Number of variables
Individual sample	
Location details: rural/urban, region, province	3
Demographic characteristics: sex, age, relationship to the household head, marital status	4
Migration status	2
Educational characteristics: literacy, highest degree, number of years of schooling	4
Ethnic and religious affiliation	2
Employment and job: employment status, activities, work sector (for respondents above 15 years of age)	11
Number of children ever born and surviving, sex and date of births at last deliveries including multiple births (women aged 15-49 years)	4
Household sample	
Housing status and ownership	4
Housing characteristics: surface, number of rooms, construction materials, etc.	5
Amenities: lighting, cooking fuel, drinking water, toilet	4
Household goods: TV, telephone, computer, two-wheelers, etc.	8

In total, about 50 variables are available for the analysis, but the number of variables relevant to the study of the SRB is smaller. The main census variables in the current study of the sex ratio are age, sex, and last birth and therefore these deserve a more comprehensive presentation:

- Age is measured here in years based on the month and year of birth. A detailed analysis of the age and sex pyramids suggests the existence of limited age heaping. However, this phenomenon is restricted to the aged population and is therefore of little concern in a study like the present one which is focusing on the child population.

- The question of "last birth" refers to the "most recent" birth, including births that occurred to older women in a more distant past. The question is restricted to women aged 15-49 years and may be subjected to record bias such as the omission of dead children, especially for older births.

- In the 2009 census the question regarding last births has been formatted to allow for the reporting of multiple births e.g. twins or triplets. As a result, the number of births is consequently higher than that of the corresponding women reporting a birth. Individual births have therefore been re-weighted (using the original weight of the mother divided by the number of simultaneous births she reported).

Specific misreporting remains a possibility. This may be due to various reasons including that people may underreport the births of their third and later children in view of the local fertility

policy, and especially misreport the number of live births but die afterward. However, no obvious sex differentials are detectable with regard to under-registration in Viet Nam (like the alleged underreporting of female births in China).

Two major concepts used in the course of the current study are the Sex Ratio at Birth and the Child Sex Ratio. A brief description of these measurements is given below (see also Appendices 2 and 3).

- The Sex Ratio at Birth is the number of male births per 100 female births. The biological standard across the world is usually close to 105. It should be borne in mind that SRB estimates are relatively sensitive to sample size (Appendix 1). For the current study the SRB has been computed for the births occurring during the previous 12 months (from April 1, 2008 to March 30, 2009). Using a longer period may introduce a significant bias (Appendix 2).

- When SRB estimates are missing or unreliable, the Child Sex Ratio as computed for the population below 5 years of age is relied upon.

3. THE CURRENT LEVEL OF THE SEX RATIO AT BIRTH IN VIET NAM

Census sample data provide a direct estimate of the SRB based on the births during the last 12 months as reported by women on the 1st of April 2009. Based on these 247,603 reported births, the SRB is estimated at 110.6 during the one year period from April 2008 to March 2009[2]. Taking into account random fluctuations in sample size, the actual SRB is estimated to lie within a range from 109.7 to 111.5 (with a 95% confidence interval).

As Table 3 indicates, this value matches previous estimates derived from other sources. In particular, the SRB estimate is almost identical to that of 110.8 obtained by the Ministry of Health based on births recorded in 2008 by health facilities in the country. The latter estimate is based on a larger number of births, but as it is restricted to births reported in health centers, it may be vulnerable to unknown estimation issues related to the extent of misreporting and selectivity bias. The 110.6 estimate is also close to a previous estimate of 111 for 2007 put forward in a previous study (UNFPA, 2009). The estimate derived from the annual population survey remains close to other SRB estimates as well, in spite of the much smaller number of births recorded. When comparing these two sources, the census sample estimate most likely offers a more robust figure.

The estimate of 112.6 shown in Table 3 stems from the age and sex distribution from the census sample and corresponds to children aged less than one year (and therefore born during the last 12 months). This sex ratio appears significantly higher than the ratio calculated from births reported by mothers during the previous 12 months. The reason for the difference with other estimates is probably due to the sampling weights used in the computation (see Appendix 3 for detail). This suggests that age specific sex ratios for children derived from the sample, i.e. the data based on children aged less than 12 months, may be inflated, and that tabulations based on the exhaustive census age distribution, i.e. data based on the births during previous 12 months, may provide more reliable figures.

[2] The SRB reported in the Census publication (Central Population and Housing Census 2010) is slightly lower at 110.5, with a 95% confidence interval ranging from 109.5 to 111.6. This estimate is based on the number of women (and not on births).

Table 3: Recent sex ratio estimates by source

Nature of data	Sex Ratio at Birth	Period	Number of live births	Source
Census 2009: births during the previous 12 months	110.6	04/2008-03/2009	247,603	2009 Census Sample
Births reported by health facilities	110.8	2008	1,458,537	Ministry of Health
Annual survey: births during the previous year	112	04/2007-03/2008	23,475	2008 Population survey
Census 2009: children aged less than 12 months	112.6	04/2008-03/2009	262,272	2009 Census Sample
SRB estimate	111	2007	Various sources	UNFPA (2009)

There is no doubt that the current SRB level in Viet Nam of 110.6 deviates significantly from the standard biological value of 105. The gap between the observed and standard biological values is 5.6 per 100 and corresponds to 2.6% of the total number of births, or 5.3% of all male births. This shows that it only takes a small increase in the proportion of male births to seriously disrupt the SRB.

The SRB estimates for Viet Nam can also be compared with recent estimates for other countries and regions, as shown in Table 1. SRB levels are often found to be significantly higher elsewhere in Asia, e.g. in China where the SRB was estimated at 121 in 2008 by the Chinese Bureau of Statistics[3]. A 1% survey conducted in China in 2005 pointed to several provinces where birth masculinity rose above 130 as well. Similarly, the SRB appears higher in countries of the Caucasus or in Albania. When compared with other countries, Viet Nam finds itself on par with the most recent estimate for India based on the Sample Registration Survey. In India, several States have registered SRB levels close to 120, while the SRB may appear normal in other regions such as West Bengal or Kerala (UNFPA 2010). India"s acute regional heterogeneity in terms of birth masculinity variations is in fact rather similar to what will be described for Viet Nam hereafter.

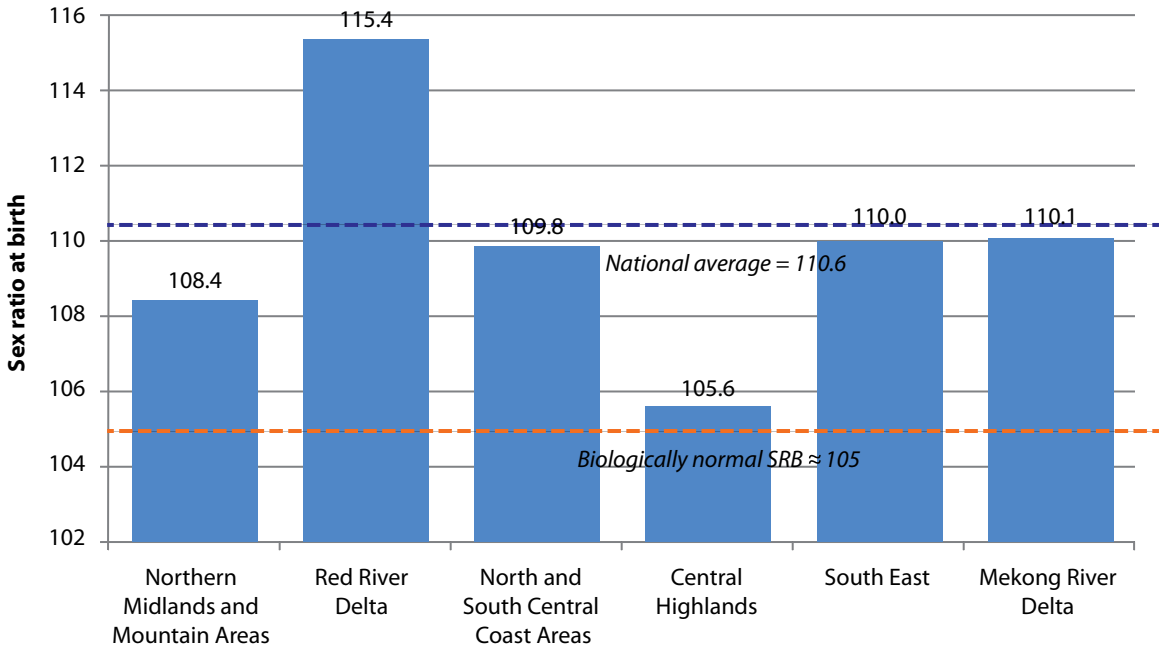
[3] This high figure for China may be partly exaggerated due to selective underreporting of female births.

4. REGIONAL VARIATIONS

In all countries where the SRB has increased during the last two decades, not all regions and social groups have been uniformly affected. One of the major dimensions of the manifestation of the SRB is its regional variation as the analysis of data from China and India illustrate. Geographical analysis of SRB values in Viet Nam supports similar findings.

Figure 1 summarizes the observed variations in the SRB levels in the six regions and demonstrates clearly that the surplus of male births is not uniform across the country. The Central Highlands region, both less populated and less developed than other regions, is characterized by the lowest level of live male births (105.6) throughout Viet Nam, corresponding to the biologically normal average observed elsewhere in the world. The other five regions, however, exhibit higher SRB levels, contributing to the skewed national average of 110.6. Among these, the Red River Delta appears particularly distinct with an average SRB of 115.4, significantly above the national figure.

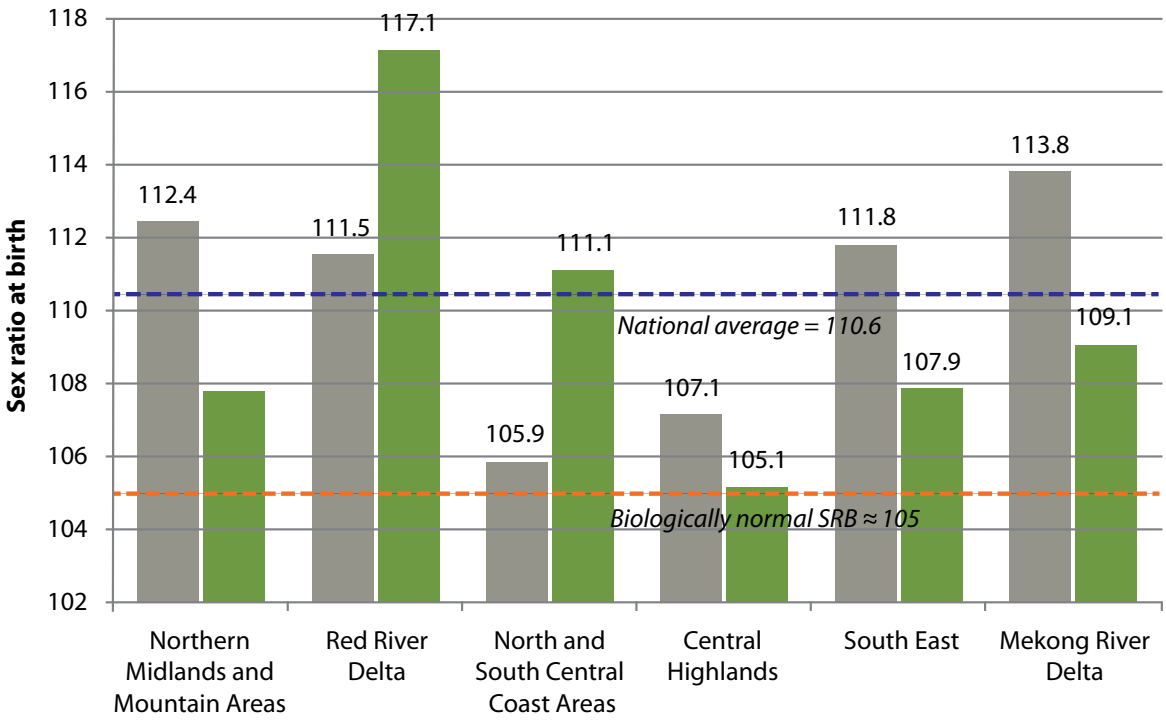
Figure 1: Sex Ratio at Birth by region



The disaggregation of rural and urban areas highlights an additional and interesting feature of regional SRB variations in Viet Nam. To start with, the aggregate national level shows no apparent difference between rural (110.6) and urban (110.7) levels of the SRB. This is a somewhat surprising finding, since rural/urban differentials are a typical trait of birth imbalances in other Asian countries. For instance, town dwellers often enjoy better access to modern sex selection technology than the rest of the population, while the birth of a son is especially dear to peasants in rural areas. But there is obviously no such easy demarcation in Viet Nam.

Further analysis however paints a more complex picture. Disaggregation at sub-national levels reveals that the Sex Ratio at Birth imbalance in the northern parts of the country is significantly higher in the countryside than in urban areas. This is most notably visible for the Red River Delta region, where the rural SRB is 117 compared to 111 in the urban areas. The same differences are also noticeable in the adjacent North and South Central Coast areas by at least 5 points (Figure 2). On the contrary, a high SRB elsewhere tends to be more of an urban than a rural phenomenon. This can be observed in the provinces of the south where the urban SRB is about four points higher than its rural equivalent. This also holds true in the Central Highlands where sex selection remains rare. These findings point to complex sociological processes. On the one hand, sex selection has become very popular among rural households of North Viet Nam, a region that tends to be culturally more traditional. While the current low fertility levels have exacerbated the risk of remaining without a son overall, the need for a son is probably at its strongest among peasants of the Red River Delta[4]. But in the rest of the country, the demand for a son appears stronger in the urban areas. The impact of better health facilities in towns and of the lower fertility levels may explain this situation to some degree. However, it seems that the mechanisms presiding over the spread of sex selection in the country have operated differently in North Viet Nam than in the rest of the country.

Figure 2: Sex Ratio at Birth by region and urban/rural areas

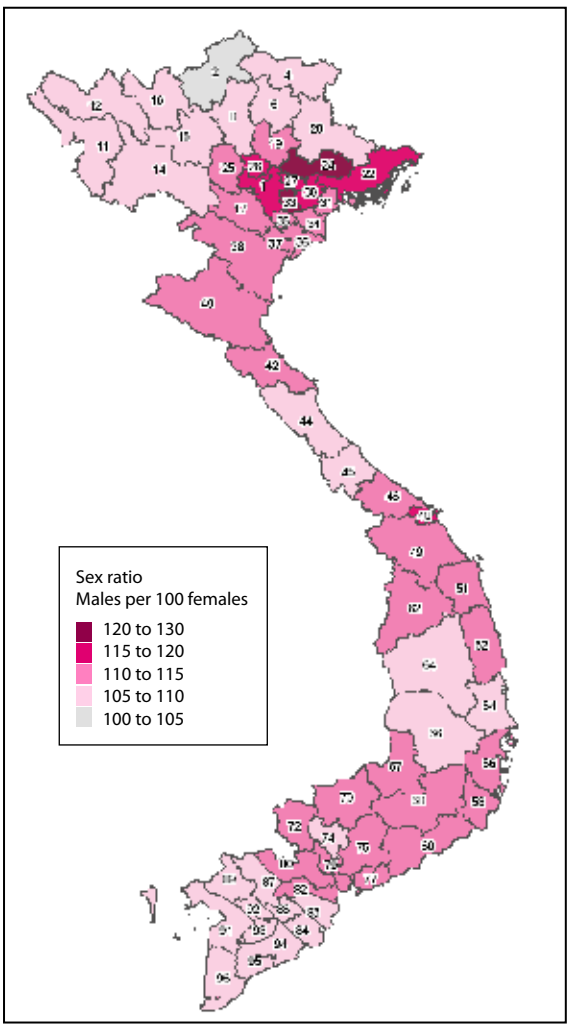


In view of regional heterogeneity, it is important to examine trends at the provincial levels. However, the number of recent births reported in each of Viet Nam"s 63 constituent provinces is at times too small to allow reliable estimates. In fact, the number of recent births reported by mothers is above 10,000 only in two provinces (out of 63), namely Ha Noi and Ho Chi

[4] Without sex selection, about 25% of the families with two children will have, on average, no son. Currently, average fertility is lower than two children per woman in many rural areas of North Viet Nam.

Minh City. Such low numbers are bound to bring a considerable amount of statistical uncertainly into the overall SRB calculations. Appendix 4 contains province-level SRB estimates as well their corresponding confidence intervals[5]. For reasons mentioned above, it is preferable to explore provincial variations by using the Child Sex Ratio (calculated from the under-five population). This indicator is mainly influenced by imbalances during the previous five years (2004-2009). However, it must be kept in mind that it may also be slightly affected by infant and child mortality sex differentials and other biases. In particular, the Child Sex Ratio tends to underestimate the actual SRB of the corresponding birth cohorts since higher biologically male mortality tends to gradually reduce this sex ratio with age. Another bias which is not corrected here, relates to the effects of the sample"s weighting system, in which the number of male children may get overinflated (see Appendix 3).

Figure 3: Child Sex Ratio by province



Code	Name	Code	Name
1	Ha Noi	49	Quang Ngai
2	Ha Giang	51	Binh Dinh
4	Cao Bang	52	Phu Yen
6	Bac Kan	54	Khanh Hoa
8	Tuyen Quang	56	Ninh Thuan
10	Lao Cai	58	Binh Thuan
11	Dien Bien	60	Kon Tum
12	Lai Chau	62	Gia Lai
14	Son La	64	Dak Lak
15	Yen Bai	66	Dak Nong
17	Hoa Binh	68	Lam Dong
19	Thai Nguyen	70	Binh Phuoc
20	Lang Son	72	Tay Ninh
22	Quang Ninh	74	Binh Duong
24	Bac Giang	75	Dong Nai
25	Phu Tho	77	Ba Ria - Vung Tau
26	Vinh Phuc	79	TP Ho Chi Minh
27	Bac Ninh	80	Long An
30	Hai Duong	82	Tien Giang
31	Hai Phong	83	Ben Tre
33	Hung Yen	84	Tra Vinh
34	Thai Binh	86	Vinh Long
35	Ha Nam	87	Đong Thap
36	Nam Dinh	89	An Giang
37	Ninh Binh	91	Kien Giang
38	Thanh Hoa	92	Can Tho
40	Nghe An	93	Hau Giang
42	Ha Tinh	94	Soc Trang
44	Quang Binh	95	Bac Lieu
45	Quang Tri	96	Ca Mau
46	Thua Thien - Hue		
48	Da Nang		

[5] Province-level SRB estimates are reproduced in the Central Population and Housing Census (2009b).

Figure 3 displays more pronounced spatial variations than suggested by the regional averages shown in the previous figure. For example, the Child Sex Ratio depicted on this map ranges from a moderate value of 104 in Ha Giang Province to a highest figure of 124 recorded in Hung Yen Province.

Variations in the sex ratio are to some extent due to sample size, but out of the 63 provinces in Viet Nam, it is indeed possible to identify 17 provinces where the Child Sex Ratio does not deviate significantly from 105 (see Appendix 4 for statistical detail). These are mostly located in the Central Highlands or in the Northern Midlands and Mountain Regions, both areas characterized by lower economic, social development and urbanization levels and by a significant prevalence of minority populations. In contrast, the remaining 46 provinces reported abnormally high Child Sex Ratio levels, eight of which recorded 115 or above. Among them, the provinces of Bac Giang and Hung Yen which are adjacent to Ha Noi were found to exceed 120. While data are not available for levels below the province, it is most probable that, if measured, some individual districts within these provinces would display even higher SRB levels.

Several "hot spots" of SRB or pockets of high sex ratio provinces are visible on the map, such as the region around Ho Chi Minh City in the South East. However, the most distinct cluster of sex ratio imbalance is observed in the northern plains of the country. Provinces located within the triangle formed by Vinh Phuc to the West, Hung Yen in the South and Quang Ninh to the East display Child Sex Ratio figures above 115. Interestingly, the highest values are not observed in the metropolitan provinces of Ha Noi or Hai Phong, but in the more rural provinces of Bac Giang and Hung Yen. This cluster had already been identified by other sources (Guilmoto et al. 2009). The map above can also be related to the province-level SRB estimates available from the Ministry of Health for 2008 (see the spatial analysis in Appendix 5). These estimates are derived from birth data collected from the health facilities in the country. When plotted side by side, both maps reflect the same geographical distribution of high sex ratios in spite of minor discrepancies between both data sets.

Seen from a more global geographical perspective, the map depicting child sex ratios in Viet Nam therefore presents a rather coherent pattern of spatial distribution, with adjacent provinces recording similar high (or low) values. The fact that this spatial patterning is far from random can also be illustrated by the strong level of spatial autocorrelation measured from the province-level SRB estimates (Moran"s index of 0.46). Further geo-statistical analysis of the sex ratio distribution confirms the presence of a distinct cluster of high sex ratios in the province of Bac Ninh in North Viet Nam. Interestingly, no other such spatial cluster is statistically significant anywhere, including in the Southern regions.

Rural North Viet Nam remains the most distinct core area for the spread of excess male births in the country. This geographical patterning indicates that the diffusion of prenatal sex selection may have initially occurred from a cluster of rural localities of the Red River Delta. It follows that sex selection could be gradually spreading to adjacent areas and more importantly, that the process of diffusion of sex selection practices will affect more provinces in the future. The progression elsewhere, especially when based on the urban structure, presents a less distinct geographical profile. However, it is well possible that in areas like the Central Highlands which have thus far remained immune to prenatal selective behaviors, the SRB might slowly deteriorate in the future, a process already illustrated by the significant rise of urban SRB rates observed in this region (Figure 2). Elsewhere, the SRB may continue increasing in the forthcoming years. The steady rise of the SRB during the last couple of years as revealed by the quantitative analysis of the age structure (see section below for more detail) constitutes a testimony to the current upward trends.

5. SRB AND BIRTH ORDER

Sex selection in Asia is mostly caused by the widely spread belief of an unmet need for sons. Thus, families who already have one son or more are far less concerned than families who have failed to give birth to a son. As a result, the SRB in Asia tends to vary across birth order (or parity). In almost all countries affected by birth imbalances, the proportion of male births is found to be almost normal for the first birth and augments progressively for later births: a larger proportion of parents with female offspring tend to attempt another birth and this additional birth is characterized by a higher frequency of boys. The SRB increase among later births is therefore determined by the overall fertility level: when the average family size declines, the probability of remaining without a son increases. On the contrary, in settings where women can have three or more children, the risk of having only girls is lower. In particular, when fertility choice is unconstrained by social or political regulations, women with female child will more easily opt for an additional pregnancy in the hope of begetting a son. This is the reason why in countries like China where fewer women bear more than one child the sharpest SRB rise is observed for the second birth, compared to India where the overall fertility level is higher.

Until now, no reliable estimates of SRB by parity have been available for Viet Nam as samples have been too small for disaggregated analysis. The current preliminary study has suggested however that the SRB distribution by parity did not follow the general pattern of the regular SRB increase exactly as birth order augments (UNFPA, 2010). The 2009 Census data demonstrated that this is indeed the case, but also documents the variations related to the gender composition of the family.

Figure 4 illustrates the occurrence of births during the last 12 months classified by the total number of births as reported by the mothers. The proportion of women who had three or more births has considerably diminished during the last decade and now stands at 16%.

Figure 4: Sex Ratio at Birth by birth order

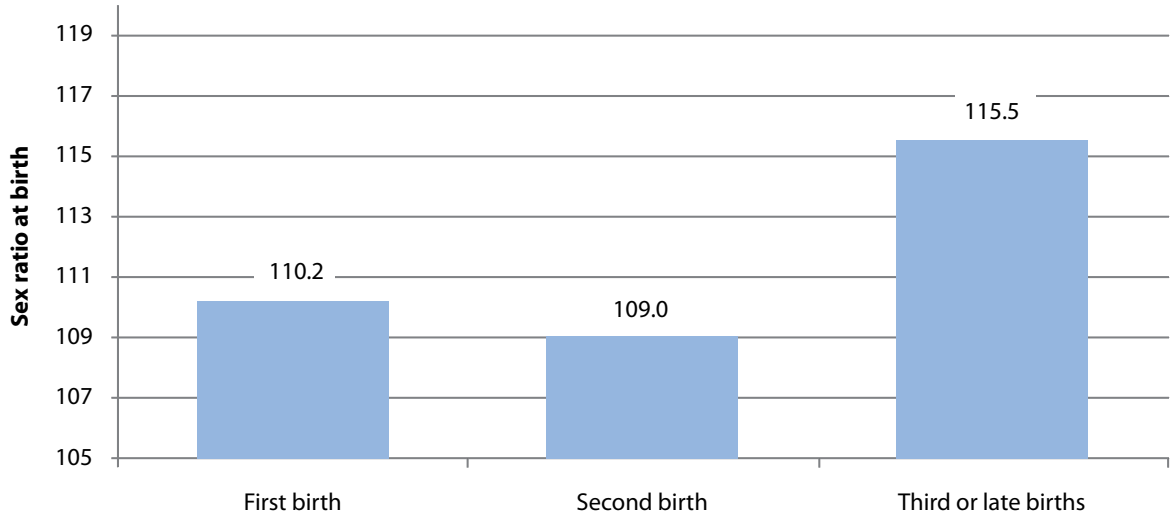


Figure 4 displays the SRB levels in 2008 by birth order and confirms that the SRB in Viet Nam conforms only partly to patterns observed elsewhere. The sex ratio for all parities is significantly above the biological standard. This means in particular that some parents discriminate against female fetuses during the first pregnancy, a feature rarely reported in other countries. Unexpectedly, the SRB is slightly lower for parity 2. But as expected, the SRB at 115.5 for third and later births is significantly higher than for previous births. This is not surprising in view of the low fertility level in the country: the wish for a son following the birth of a daughter is often reason enough to have an additional child. For parents with two children, which is the family norm in Viet Nam, having a third child is a family decision with many implications and sex selection thus becomes a tool to avoid the birth of a girl. Yet, in comparison with other Asian countries where SRB levels for higher-order births may easily exceed 140[6], the rise by parity in Viet Nam looks rather moderate. One reason could be that some Viet Namese parents already opt for prenatal sex selection during their first two pregnancies. But another reason is that a majority of parents still do not feel a need for prenatal selection.

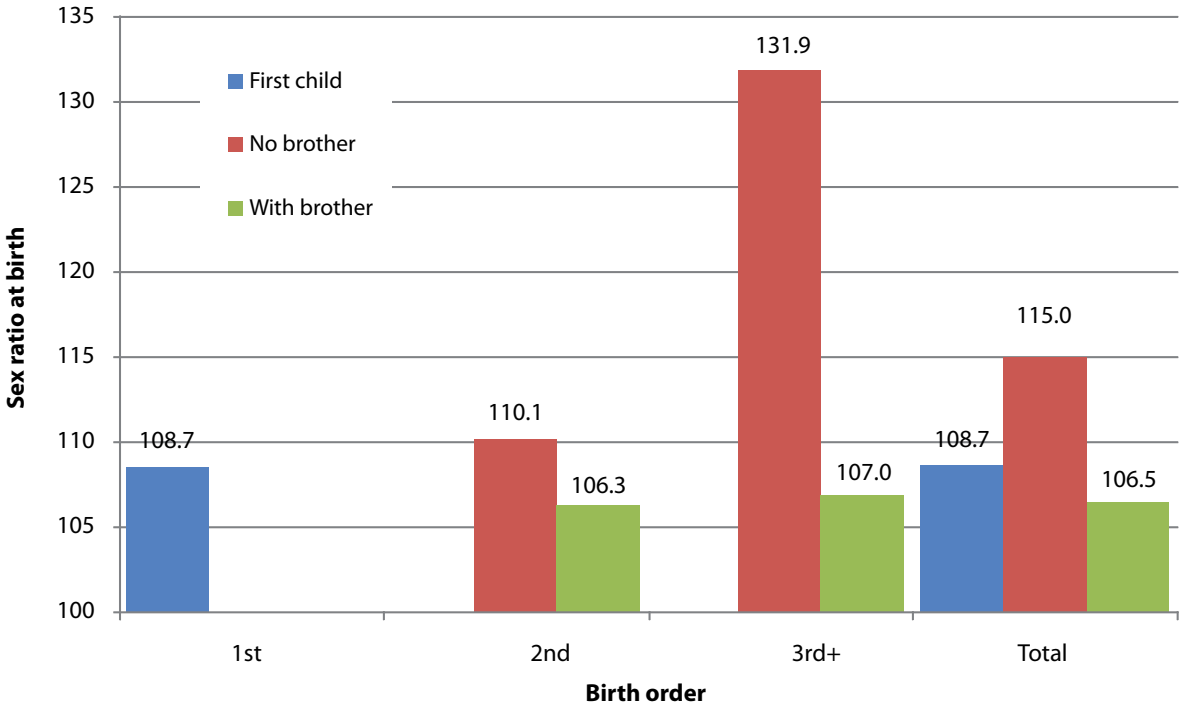
No rural/urban variations emerge in the sex ratio by parity at the national level. Once again, the sub-national disaggregation brings to light interesting patterns by distinguishing the first two parities (first and second births) from later parities (third and higher-order births). Parity differentials tend to be unremarkable in all regions except one, the Red River Delta, where an abrupt rise of SRB levels is observed from the first and second births (110) to the third and later births (152). This is an extreme value which corresponds to an excess of almost 50 per cent more than the expected amount of male births. While based on a small subsample of 7,500 births, the high SRB figure for later births in the Red River Delta stands corroborated by additional estimates obtained from larger samples such as births during the last three years or the total child population. In this mainly rural part of Viet Nam, the desire and need for a son appears to be very strong as the ritual and economic importance of sons is paramount in the traditional patriarchal peasant family[7]. In addition, the early implementation of family planning regulations in this area may have encouraged many parents to avoid "unnecessary births" of girls at all cost.

The family reconstitution method described in Appendix 6 is based on a reconstructed sibling population and allows for a more detailed analysis of the effect of family composition on the sex of the last births. Contrary to previous data based on births, these estimates are based on surviving children and resulting sex ratios are therefore slightly biased downward. This is illustrated by the Child Sex Ratio by birth order computed for children aged less than one: 108.7 (first child), 108.1 (second child), 115.1 (third or later child). These figures are slightly lower than those derived from reported births (Figure 4).

[6] The Sex Ratio of Birth for parity 2 in China e.g. was 143 males per 100 females according to the 2005 1% sample census.

[7] The patriarchal system existing in rural North Viet Nam is e.g. described in Werner (2009), Gammeltoft (1999) and Bélanger (2002).

Figure 5: Sex Ratio at Birth by birth order and presence of an older brother, reconstructed sibling population by year of birth



Sex ratios shown in Figure 5 further disaggregate each child rank by the previous gender composition of the siblings, by distinguishing children with only older sisters ("no brother") from children with at least one brother ("with brother"). This distinction is not applicable to first births. The difference observed when an older brother is present, is striking. Among children with brothers, the sex ratio remains close to normal levels (106-107). But among children without a brother, the sex ratio first jumps to 110 for the second child and climbs further to 132 for third and later children.

These estimates are computed for the small sample of children below age 1[8], but the calculation can be extended to the entire population born less than five years before the census. When this is done, the previous observations are confirmed once more: in the population aged less than five years, the sex ratio of children of birth order 2 is 108.9 without a brother, but rises to 122.6 for children of higher birth order. With this larger sample of children, the sex ratio of third children (121.5) and of later children (126.3) in the absence of brother can even be distinguished. In contrast, for children who have a brother already, a sex ratio in the range of 104-106 is displayed.

Except for the first births, the sex ratio mechanisms described here broadly conform to a patriarchal model of family building. When the first child is a daughter, the pressure of a male birth gradually builds up. Among certain families the recourse to sex selection becomes a necessity for the latter pregnancies which reduces the proportion of girls among subsequent births. Incidentally, such a linkage between birth order and the SRB constitutes a strong

[8] There are e.g. only 13,000 children of rank 3+ with no older brother.

confirmation of deliberate prenatal selection, even if direct quantitative evidence of sex selective abortions is missing. While there are in theory various reasons for explaining the sex imbalances at birth (enumeration issues, selective misreporting, biological determinants, etc.), none of them would account for the differences between birth orders and for the jumps in sex ratio levels associated with the absence of a previous male birth in the family.

This said, it must be added that the census sample data in fact depict a slightly more complex picture than expected. The SRB levels among families without a son are indeed high, but it is especially felt for the third birth due to the birth planning regulations in Viet Nam. However, at the same time, the SRB reaches distinctly above the biological standard among first order births, a distortion far more pronounced than in China or India[9]. This feature is not without consequence since these first order births constitute more than 45 per cent of all births in the current sample –and this share is bound to grow as fertility continues its course of decline. As a result, the impact of sex selection for first births on the overall SRB is proportionally larger than on higher order births, which occur less frequently. A further analysis of these first births and of the possible determinants of its higher masculinity has failed to identify specific factors accounting for this difference, as higher SRB levels among first births seem to be common among all categories of the population in which sex selection is observed. Apart from the Red River Delta, the only region that may stand out in this respect is Ho Chi Minh City where the SRB for first births is 115. The number of births involved (10,400 first births) confirms the statistical significance of this high SRB, and calls for additional field research to understand the reasons for this rather extreme sex imbalance of first births in Viet Nam"s most prosperous metropolitan area. Very low fertility levels (1.45 children per woman in Ho Chi Minh City) and easy access to modern sex selection facilities are no doubt favorable factors for the prevalence of sex selection. In terms of demand however the contrary would be expected, namely that son preference and the patriarchal system are far less severe in this advanced urban environment than for instance in the more rural areas in the North.

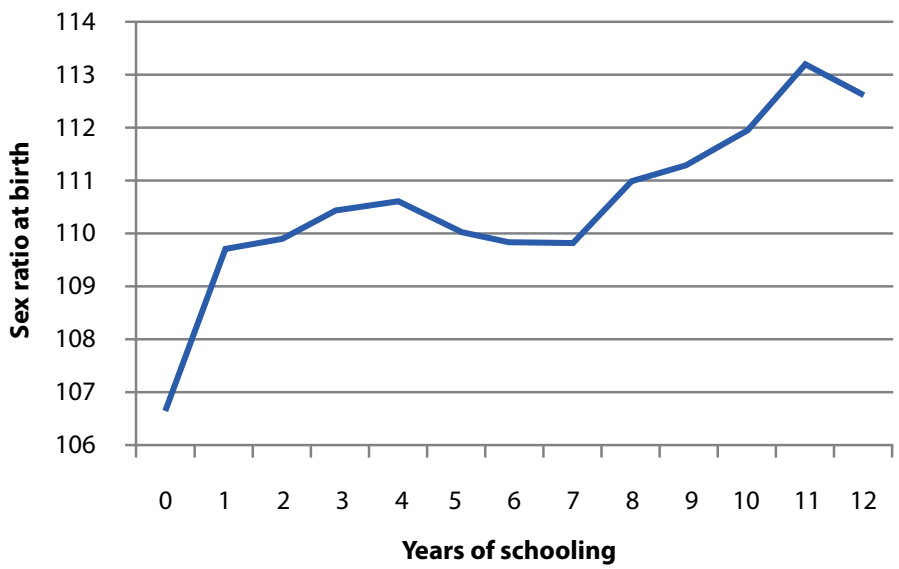
[9] The sex ratio of first births was 108 in China according to the 2005 survey.

6. SRB DIFFERENTIALS BY DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS

The census provides a variety of other social and economic indicators which makes it possible to draw a more precise outline of the characteristics of those population groups that practice sex selection in the country (Table 2). Furthermore, while published census tabulations usually offer little information regarding the links between birth masculinity and socio-economic features, the access to the 2009 census sample has allowed a detailed study of these relationships through examination of the SRB based on various categories of women or households. In the following section the specific impact of some of the main demographic, social and economic variables on the SRB imbalance will be reviewed and subsequently, a synthesis of key factors will be provided. First of all, several demographic characteristics of mothers are used to identify deviations from the average level of birth masculinity. E.g. among groups with a lower SRB, women who are the head of their household (108.8) can be identified, as well as single or divorced women (100.0), even if the corresponding numbers of births remain limited. In contrast, birth masculinity is found to be higher among women above 30 years (112.6), although it must be kept in mind that this may result from the frequency of high parity pregnancies in this age category rather than from the effect of age itself. A multi-linear analysis described further below will clarify the respective effects of the various determinants identified here.

Level of education is usually one of the major determinants of demographic behavior and the census sample confirms this hypothesis. Significant variations in the SRB occur when it is computed for different maternal education levels. These variations range from 107.4 for illiterate women (7 per cent of the birth sample), and 107.1 for women with a primary level education and below, to 111.4 for women with secondary level education while reaching 113.9 among college and higher educated mothers.

Figure 6: Sex Ratio at Birth by number of years of schooling of the mother



The same positive correlation between education levels and SRB imbalance is also observed when taking into account the estimated number of years of schooling[10]: women with more than 10 years of schooling report the highest proportion of male births (SRB=113.2), even if the corresponding birth sample for the most educated women tends to be small. Figure 6 plots the respective SRB levels of recent births to women classified by number of schooling years[11] and illustrate the positive linear association between schooling and birth masculinity. A major gap is observed: for women who never had any education, the sex ratio stays below 107, which is close to normal biological levels. Among women with some schooling, SRB tends to stagnate around the average national level of 110.6. Only for women with more than 6 years of schooling, the SRB soars.

This positive link between education and sex selection is at first view counter-intuitive, since higher human capital among women should in theory undermine the traditional features of son preference that leads to sex selection behavior. However, this association with education is in fact caused by the specific effect of other intermediary variables that are strongly linked to the educational levels of women: access to information about modern sex selection, higher standards of living and access to modern healthcare facilities, as well as lower fertility and the associated higher risk of remaining without a son.

Further in-depth analysis of the sample data indicates that the SRB among minority (non-Kinh) women is relatively low at 105.9. However, a systematic analysis of women"s individual characteristics did not reveal any broad association between birth masculinity and several presumably important variables such as employment status, religion, and migration status. Slightly higher SRB"s were computed for women working in the government sector (112.4) or women who had not worked during the week preceding the census enumeration date (111.9). Even though these variations were modest, they were further tested in a more synthetic statistical model of birth masculinity. This model will be presented in a section below.

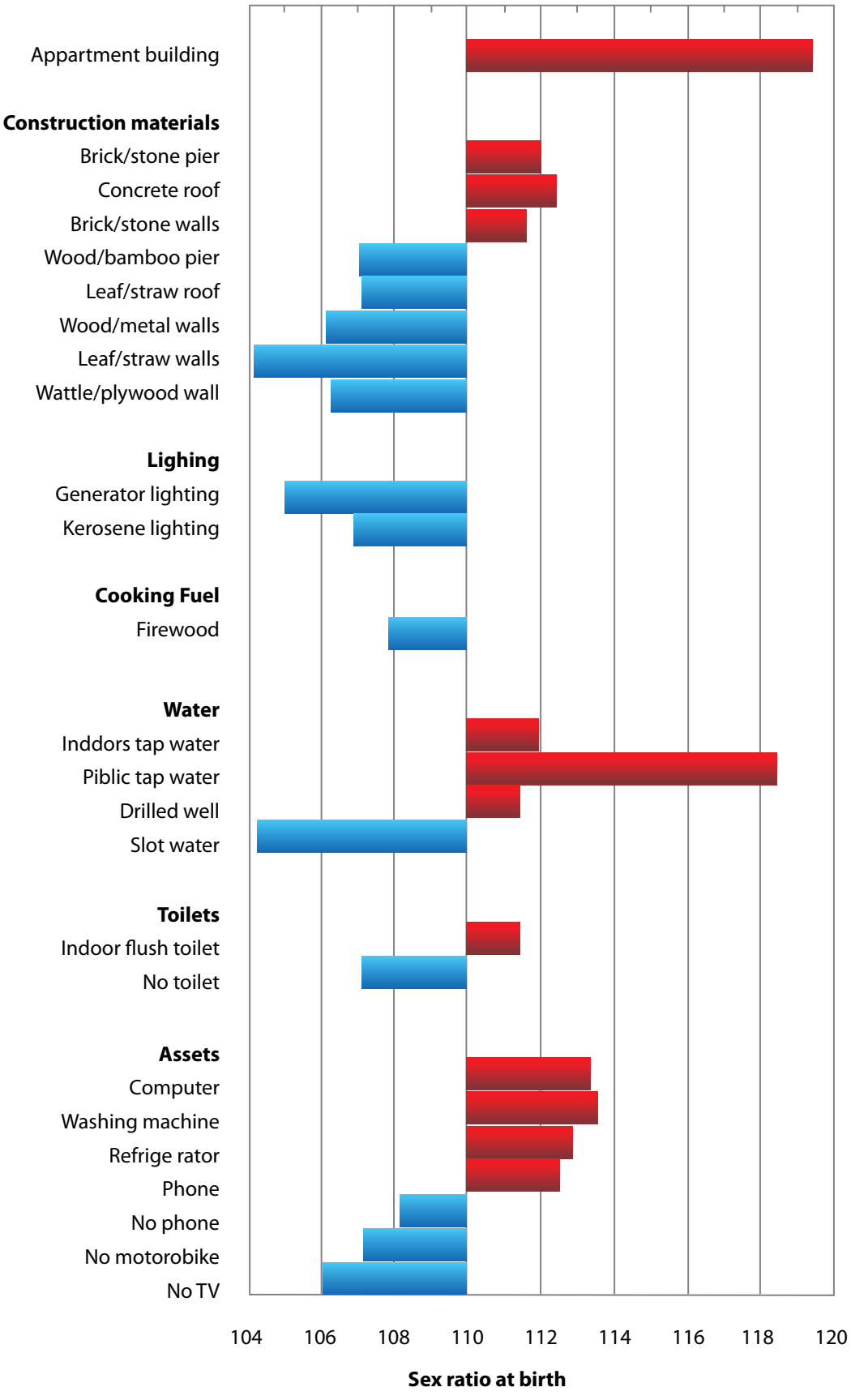
Household variables referring to housing quality or to the assets of a household can also be used to fruitfully compare SRB variations after linking each birth with the characteristics of the mother"s household. Figure 7 lists some of the most meaningful results, by displaying in blue the variables associated with a low SRB and in red those associated with a high SRB.

It can easily be observed that indicators typical of underprivileged households such as poor toilet facilities, absence of electricity for lighting, or houses made of wood, bamboo or leaves are systematically associated with SRB levels that are close to the biological average. The lowest SRB figures were measured for the following particular characteristics: leaf and straw walls, drinking water obtained from slots, and use of a generator for the provision of electricity. On the contrary, the highest SRB values were found among households with access to public tap water, and residence in apartment buildings or houses built with quality construction materials. The information regarding household assets tells a similar story: the lowest SRB"s are found for families who do not own a TV or motorbike, while the proportion of male births is at its highest among households who do have a computer and other modern appliances in their home.

[10] This indicator is slightly different from the previous education variable as the highest grade has been converted into the 12-year general education system here.

[11] Data have been averaged over three successive years in order to correct the effect of small numbers.

Figure 7: Sex Ratio at Birth by housing and household characteristics



7. LIVING STANDARDS AND BIRTH MASCULINITY

Household characteristics such as ownership of modern equipment, type of drinking water source or housing construction as examined in the previous section do not possess explanatory power by themselves when it comes to son preference and SRB imbalance. Directly relating the proportion of male births to the using of a washing machine in households does not make sociological sense unless these variables are considered to be indirect proxies of each family"s socio-economic level. With this in mind, a synthetic indicator based on household and housing characteristics was constructed, ranking all households – and their members – by standards of living (procedure described in Appendix 7). With this indicator, births can then be divided according to the socio-economic status (SES) of the mother"s household, and be classified into five quintiles, ranging from the poorest 20% to the richest 20%.

Figure 8: Sex Ratio at Birth by socio-economic quintile of the mother

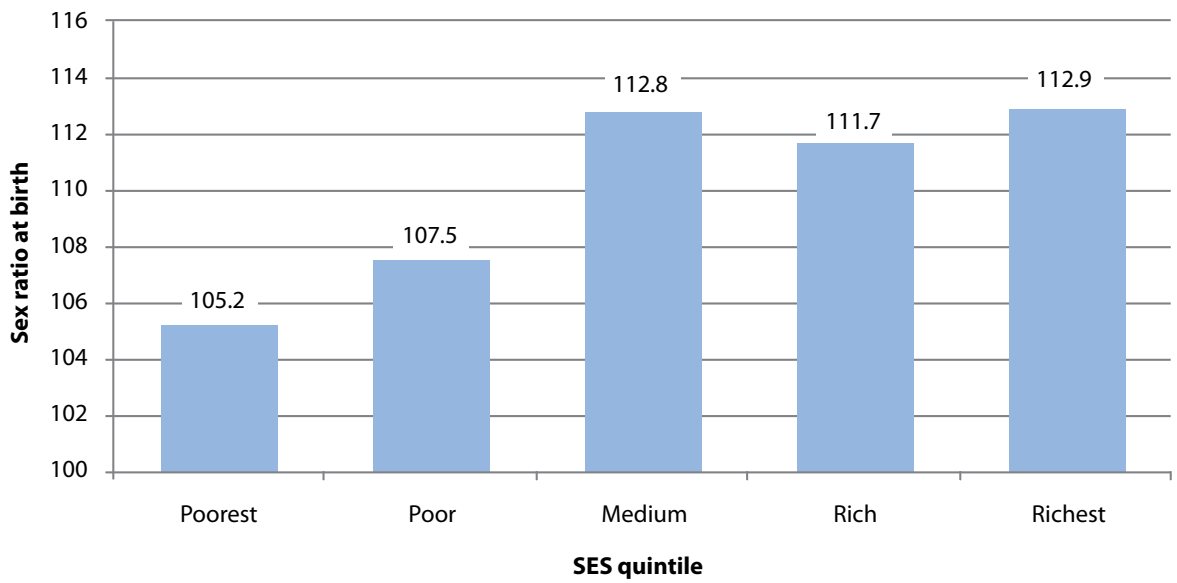
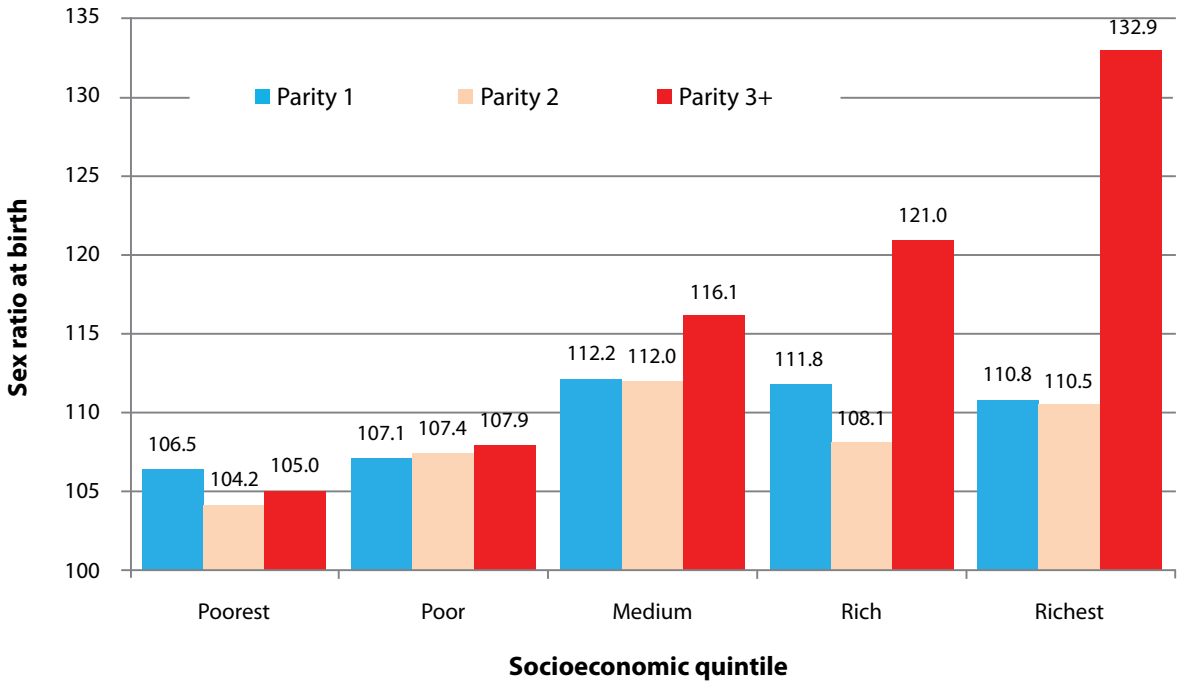


Figure 8 summarizes the findings of the analysis of SRB values and the mother"s status of the socio-economic quintile. The relationship seems clear: on the left side, that the poorest quintile of the population is characterized by a SRB close to 105. Such a value corresponds to a normal proportion of male births, as was already observed with regard to other individual characteristics of mothers such as illiteracy or ethnic minority. With increasing socio-economic status, the SRB also gradually increases, moving to 107.5 in the second SES quintile and reaching 112.8 in the middle-income group. In fact, the top three quintiles which account for 60% of the country"s population appear somewhat similar in terms of birth masculinity with levels hovering around 112. The major difference between socio-economic strata therefore relates to the poorer half of society, i.e. exit from poverty seems to be closely associated to an increasing discrimination regarding the outcome of birth. To a large extent, these socio-economic variations in SRB levels mirror the differences already observed in maternal

education levels (Figure 6): while the range of socio-economic differentiation is slightly larger, the same demarcation between very low levels of social development (illiteracy, poverty) can be observed on one hand, and college education or above-poverty living standards on the other hand.

When disaggregated by parity, the variations across socio-economic quintiles tend to be reinforced. Figure 9, which displays the SRB by socio-economic quintile and by birth order, demonstrates that the rise of SRB levels for lower-parity (first and second births) births still levels off in the middle quintile. However, for higher-order births (parity 3+), the increase in birth masculinity is regular and continuous, moving from a normal level of 105 among the poorest mothers to 133 among the most prosperous. Even if this latter category accounts for a limited number of births, the findings do illustrate the conduct of prenatal sex selection by the better-off parents following their first two births. The figure also indicates that son preference for the first and second births increases with socio-economic level, but that the variations are far less pronounced than for later births.

Figure 9: Sex Ratio at Birth by socio-economic quintile and birth order



Another way to assess the strength of son preference is to examine differential parity progression ratios, i.e. the probability to have an additional child when regarding the sex composition of the family (Haughton and Haughton 1995). With the advent of modern contraception, couples became capable to adjust the size of their families based on the children already born and their sex. This gender bias is common for Viet Nam and explains in particular why the final birth to a woman more often results in a boy than in a girl (see Appendix 2). The computation of parity progression ratios requires a detailed birth history for all women–a type of information the census does not collect– and is therefore not feasible. However, using the family reconstitution method (Appendix 6), it is possible to estimate the probability that a couple has an additional child depending on the sex composition of the siblings, thus demonstrating that the absence of an older brother augments the probability to have a younger sibling in the family.

This particular indicator was explored to determine possible differences between SES groups as well. Computations of it are based on the population of children less than 15 (born since 1994) while estimating the probability to find a younger sibling in the family. The focus for this indicator has been on second-order children since the progression ratio from 2 to 3 children is the most sensitive in Viet Nam whereas the national TFR has been below 3 for more than a decade. For each family with at least two children as classified by the SES quintile, the probability to find a third child was measured depending on the presence, or absence, of boys among the first two children.

Figure 10 summarizes the findings. The first two decreasing curves - in blue - correspond to the frequencies of the presence of a third child in families which have two children already. As can be expected, the probability to have a third child declines as the SES increases: a direct reflection of the negative association between socio-economic level and fertility. However, when there is a boy among the first two children already (dotted line), the progression ratio is distinctly lower than for families without a son (straight line). This gap is visible across all SES groups. This indicates that son preference is a powerful drive for family enlargement which pervades all sections of society. In fact, the absence of a male child in Viet Nam affects the probability to have a third child nearly as much as the socio-economic status of the family.

Figure 10: Probability to have a third child by socio-economic quintile, Sex Ratio and presence of a previous son

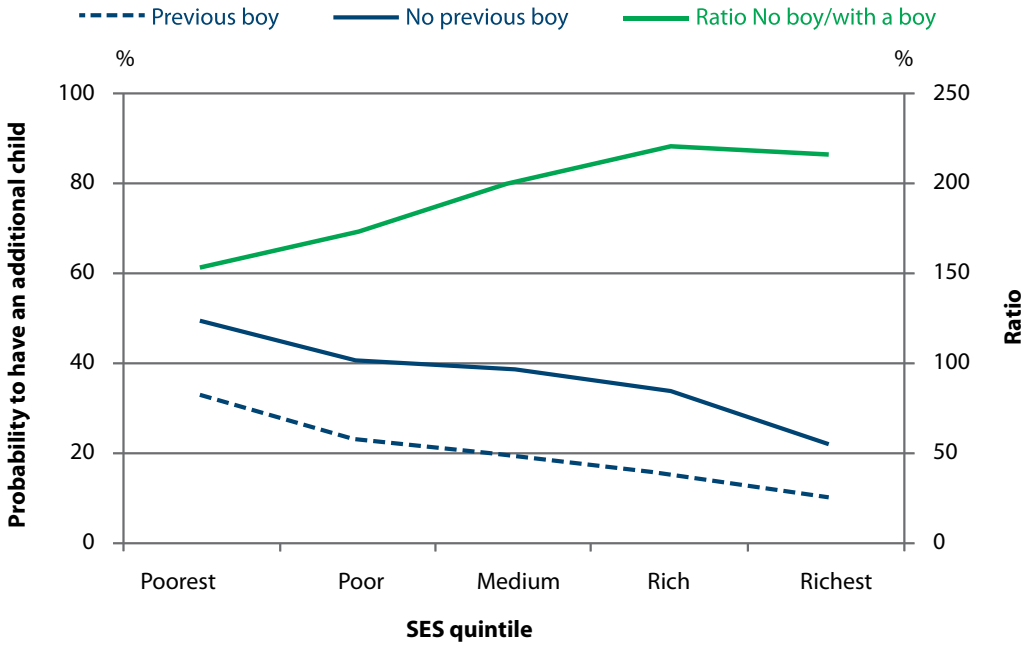


Figure 10 above also shows that the relative risk to have a third child in the absence of a boy – expressed here as the ratio of both probabilities – tends to increase with SES: it is about 1.5 higher in the lowest quintile, but it increases to levels close to 2.2 for the highest quintiles. The effort to have a son in the absence of a previous male child is therefore proportionally larger among richer families, which in turn has an obvious impact on sex selective behavior. Similar to what the previous Figure 9 illustrates for a more recent period, it is reconfirmed that among well-to-do families, the sex ratio of this additional birth will be strongly biased towards boys due to the access to modern sex selection technology.

The lessons learned from the preceding figures are unambiguous: in a society with an intensity of son preference, socio-economic status emerges as one of the strongest correlates of birth imbalances. Several intermediary factors may account for this link, such as the easier access to modern technology available in urban health facilities. Furthermore, better-off households with more educated women and better financial means tend to have easier access to information and are therefore more likely to be the forerunners with regard to gaining access to modern prenatal sex selection equipment. Another factor typical of the richest and most prosperous households is low fertility, which tends to exacerbate the desire for prenatal sex selection.

8. A SYNTHETIC ANALYSIS OF THE MAIN DETERMINANTS OF SRB VARIATIONS

The factors accounting for variations in the proportion of male births are numerous and often redundant. An attempt has therefore been made at summarizing the major determinants of the highly imbalanced SRB with a synthetic multi-linear regression. The statistical model used here is a logistic regression of recent births, using birth of a boy child as the dependent variable. All births about which adequate information existed (including SES status) were included in the regression and were weighted. It must be noted here that such log linear modeling of the probability to have a male child is limited given the fact that a large majority of births are randomly distributed among boys and girls.

Table 4 shows the relative strengths of various potential determinants which contribute to the rise of the SRB. It should be emphasized here that most variables which proved non-significant were removed from the results presented here. Some of those - e.g. religion, rural/urban, and multi-generational households - were already found insignificant in the preliminary analysis. Other variables were removed because of their co-linearity with other variables (e.g. education, or age) or because of their limited level of significance. On the other hand, some new variables were included when they proved to be significantly associated according to this multi-linear model.

Table 4: Determinants of male births among recent births

Probability of a male birth	Odds Ratio	Standard error	Z ratio	Significance
Parity 2	0.98	0.011	-1.47	0.142
Parity 3+	1.05	0.015	3.52	0.000
Head of household	0.96	0.017	-2.28	0.022
Never married	0.88	0.054	-2.09	0.037
Not migrant	1.03	0.013	2.01	0.045
Minority	0.96	0.014	-2.62	0.009
Central Highlands	0.95	0.017	-2.84	0.005
Red River Delta	1.04	0.012	3.18	0.001
Work in agriculture	1.03	0.014	2.16	0.030
State sector	1.03	0.016	1.89	0.059
Quintile 3 (medium)	1.03	0.015	2.08	0.037
Quintile 4 (rich)	1.04	0.017	2.66	0.008
Quintile 5 (richest)	1.05	0.019	2.47	0.013
Weighted logistic regression of male (vs. female) births. n= 174,417 births Log likelihood = -120641.28				

A first set of control variables relates to birth order. The only meaningful difference subsisting here relates to parity 3+ (third or higher-order births) which induces a significant increase in the SRB imbalance.

The second set of variables corresponds to the socio-demographic characteristics of the mother and indirectly refers to women"s status. While age plays no role, women who are heads of their household appear to have significantly fewer boys than the rest of women (who are usually spouses or daughter-in-laws of the household head). Similarly, singlehood among mothers tends to decrease the Sex Ratio at Birth. These women may belong to less unorthodox or less traditional families in which the male presence (father, husband, and father-in-law) appears less prominent and in which patriarchal norms may be weaker. As a result, the traditional preference for sons seems to exert a lesser influence on women"s fertility choices. The next variable -migration status - may refer to the same process since sedentary women are found to display a higher SRB: in other words, migrant women have a lower SRB, an observation that can also be interpreted as an effect of increased autonomy and agency among more mobile women. But the exact nature of the possible causal link between on the one hand, marital status, status in the household and migration, and on the other hand an imbalanced SRB, remains unclear. According to a reversed logic about patriarchy, it may thus be argued as well that women who fail to give birth to a boy are precisely the women who also failed to marry or to live with their husband.

The next set of variables refers to the ethnicity and region of women, with effects similar to what has been observed earlier. However, the multi-linear model demonstrates that these three variables (i.e. minority, Central Highlands, Red River Delta) all have an independent effect on birth masculinity. For instance, the low SRB measured in the Central Highlands is not simply the consequence of low SES levels or of ethnic composition. Labor and living standards are included in the last set of variables and also play an independent role with regard to influencing SRB levels as was observed earlier. This is visible for the highest three quintiles as well as for women working in the primary sector (mostly farmers). Births to women employed in the state sector also exhibit a higher level of masculinity. These different variables however refer to rather diverse populations which include women from agricultural families, state employees as well the upper half of society. Lack of further details regarding their socio-economic classification prevents the undertaking of an in-depth analysis of the social groups identified in this analysis.

As a conclusion, we may emphasize the role played by the three social and demographic determinants that in previous literature have been identified as influencing the SRB: son preference, fertility level and access to sex selection (Guilmoto, 2009). The first factor, preference for sons, is illustrated by the clearly lower SRB among more autonomous women, and in areas and communities where weaker forms of patriarchy prevail. On the contrary, the traditional norm in favor of male births is stronger among peasant households or in the Red River Delta. The second factor with a strong bearing on a high SRB relates to the demographic situation and the average number of children: the parity effect in particular is an indirect consequence of fertility decline and of the probability to remain without a son. While fertility cannot be measured from individual data directly, its impact on SRB is probably mediated by parity as well as by socio-economic status and education. The third factor likely to affect the SRB corresponds to the availability of and the access to sex selection technologies. This is illustrated by the link between higher birth masculinity and the SES quintile. The Sex Ratio at Birth remains unrelated to urban residence where private healthcare facilities tend to concentrate however. A better indicator would probably be the distance from a woman"s residence to the closest city as this may partly account for the lower SRB observed in the rural regions found in mountainous areas such as the Central Highlands.

9. A RECONSTITUTION OF RECENT SRB TRENDS

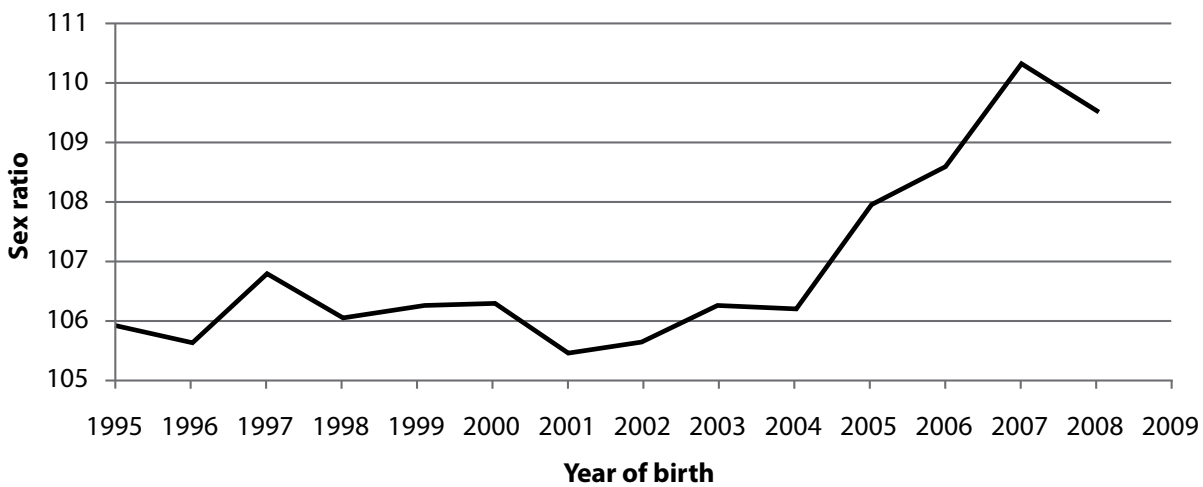
While the 2009 census provides major evidence of the extent of sex imbalance at birth, several previous estimates have already been available since 2000. Most of them were derived from the annual population surveys conducted by the GSO, while other figures were taken from the recent collection of birth reports gathered by the Ministry of Health. But as can be seen, data from the annual series since 2001 are rather fluctuating without displaying a clear trend: a likely consequence of the limited number of births reported in each annual population survey.

Table 5: Annual SRB estimates by source, 2001-2009

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009
Annual Population Surveys	109.0	107.0	104.0	108.0	106.0	109.8	111.6	112	
Census									110.6
Births in health facilities							111	110.8	
Source: Annual Population Surveys (various years); 2009 Census estimate; Ministry of Health									

A previous review of these results suggested that the SRB rise started to increase slowly after 2000 and that this rise accelerated after 2004 (UNFPA, 2009: 22). Census data and indirect techniques offer a way to re-examine recent trends. A closer look at the age and sex distribution of children under 10 reveals the following[12]:

Figure 11: Sex ratio of children by year of birth, based on reconstructed siblings



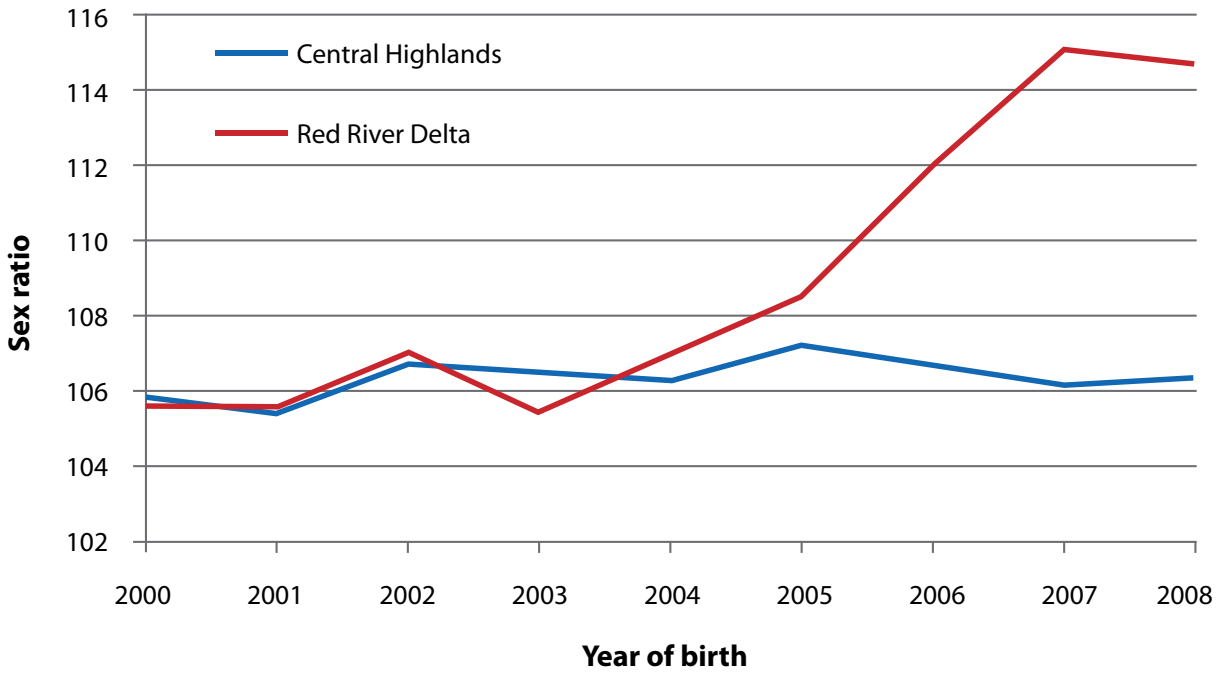
[12] In this computation, household sampling weights rather than individual weights have been used to correct variations in regional sampling for reasons explained in Appendix 3.

Figure 11 is based on the sex ratio of the population by single age, subsequently reclassified by year of birth (e.g. children aged 2 correspond to 2006). The figure shows annual fluctuations around 106 during the period 1995-2004 followed by a rapid increase until 2007, and finally a minor decrease in the year preceding the census. It may first be observed that 106 is a sex ratio slightly above the biologically normal value, especially since it applies to children now aged 5 years or over and may therefore be affected by higher male mortality compared to female mortality in the same birth cohort. Factoring in sex differentials in mortality, the original Sex Ratio at Birth of these birth cohorts would in fact be above 107.

The most interesting observation is that the series of data depicted in graph 11 suggest that the increase of the sex ratio at the national level has taken place only after 2004–even if an increase is already becoming perceptible after 2002. The rate of increase of the SRB during the five years preceding the census has been almost 1 point per year.

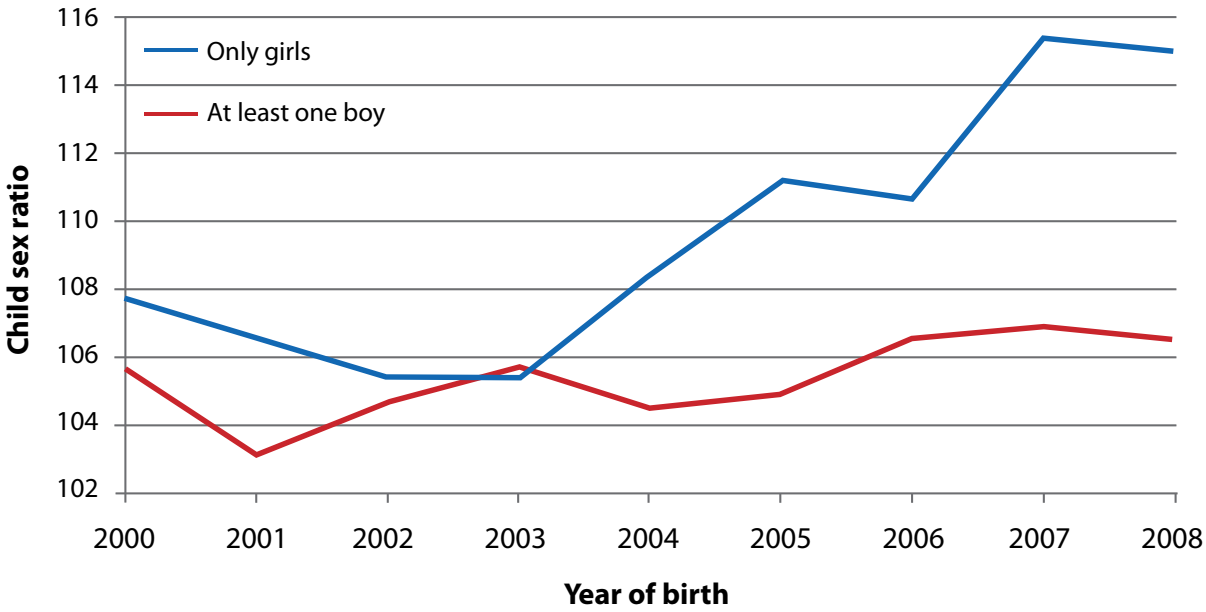
Thanks to the family reconstitution method a more detailed series of data can now be examined, including figures based on the previous composition of the family (Appendix 6). Figure 12 e.g. shows the sex ratio of the child population classified by year of birth and characterized by opposite SRB levels for two regions in Viet Nam. In the Central Highlands, the sex ratio curve stays flat with some fluctuations around 106 (here data are smoothed because of the small size of birth cohorts in this region). No trend is apparent. In the Red River Delta region, yearly fluctuations are also visible initially, but especially noteworthy is the steep rise of the SRB which becomes clear from 2004 onward: from 106 to 115 in about five years. This pace of increase is far more rapid than for the country as a whole and seems to start one year earlier.

Figure 12: Sex ratio of children by region, based on reconstructed sibling population by year of birth



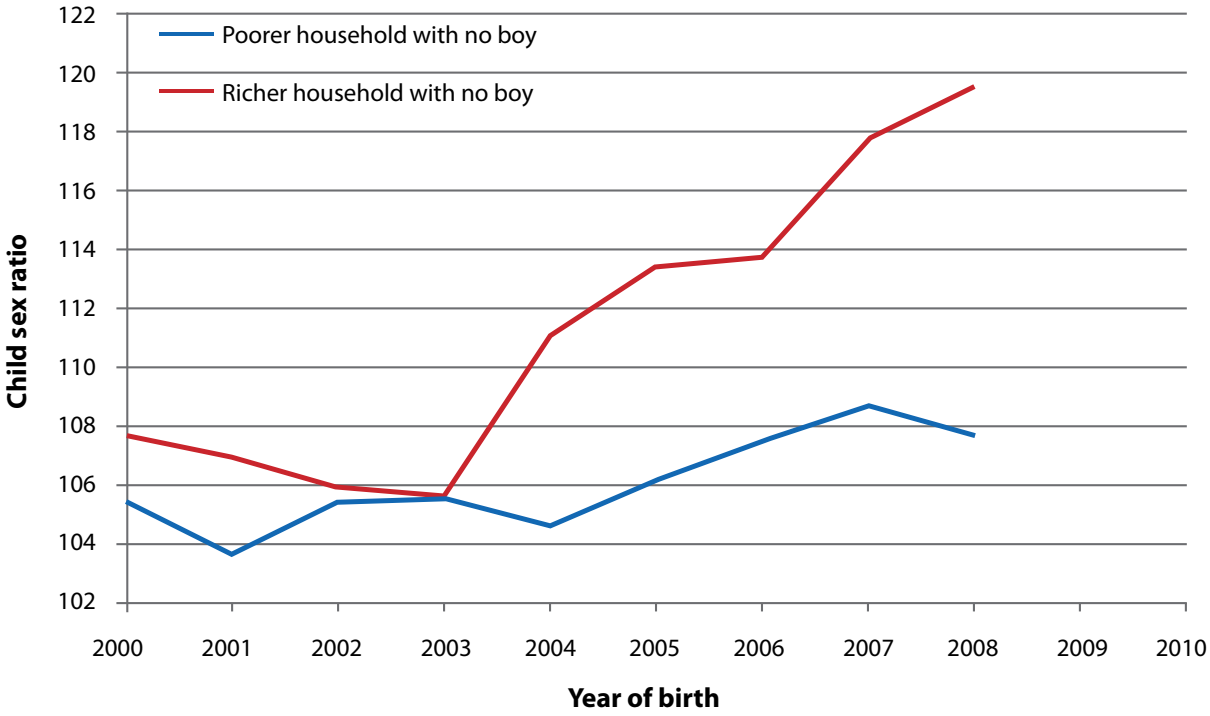
The following figure (Figure 13) is based on the sex ratio of children according to the sex of previous siblings. A distinction is made here between children with or without an older brother, assuming that the absence of a boy in the family is likely to influence the sex of the following child. On the other hand, families who already have a son may be more indifferent to the sex of their later children. The figure indeed shows mere oscillations around 105-106 during the entire period for births that followed a previous male birth. The surge of the SRB observed in the country as a whole after 2004 has obviously not affected families with a son. But in families without sons, the increase is steady after 2003 and leads to a child sex ratio of 115 during the last two years preceding the census.

Figure 13: Child Sex Ratio by presence of an older brother, based on reconstructed sibling population by year of birth



Lastly, figure 14 combines the family sex composition with SES levels. The analysis is restricted to children born in families who have at least one child already, but no son. Furthermore, the sample using the median SES level is divided into two equal-sized categories: poorer and richer households. Among the richer families without a male child, the SRB trend becomes severely male-oriented in 2004 as it jumps from 106 to 111. The rise continues steadily until 2008 when the SRB nears 120. In contrast, no such rise is visible among poorer households before the second half of the decade when the SRB finally reaches 108. As indicated by the previous analysis summarized in Figure 10, the absence of a son is a powerful boost for a third pregnancy across all SES categories. However, this more detailed analysis indicates that poorer households without a son have been distinctly slower to react to the changes observed in the country as a whole after 2003; their SRB of approximately 108 since 2006 remains hardly distinguishable from that of the SRB for families which have a son already.

Figure 14: Sex ratio of children in families without a previous son by socio-economic status, reconstructed sibling population and by year of birth



Changes in demographic behavior are rarely sudden or uniform across society. The current disaggregated analysis demonstrates that among certain groups in Viet Nam the growing demand for sex selection has appeared earlier, in particular among inhabitants of the Red River Delta and more prosperous households. While the upward trend of the SRB estimates becomes only visible in 2005 on a national scale, among these "pioneer" groups, the rise is in fact perceptible in 2004. Moreover, the trend may be far from over.

What is also striking is that the rise in SRB in Viet Nam has been both very recent and sustained over the last six years. In China and South Korea –countries for which annual estimates are available– it probably took more than 10 years to reach such levels. In comparison, the rise has been faster in Viet Nam and resembles the increase observed in the former Soviet republics of South Caucasus in which the observed SRB crossed the 110 line almost five years after the beginning of its rise in the 1990's.

10. DEMOGRAPHIC MASCULINIZATION AND VIET NAM'S DEMOGRAPHIC STRUCTURES

The population pyramid displayed in Figure 15 is based on the current sample data and bears witness to Viet Nam"s demographic history. In particular, the age and sex distribution still reflects the major demographic impacts of the war and demographic recovery that accompanied the end of the conflict: a small proportion of population above 55 years and a relative deficit of men in this age group. However, in 2009 the most salient feature of the age distribution is the substantial shrinking of the population base over the last 15 years which followed the acceleration of the fertility decline. The slight growth in the size of the younger birth cohorts (born between 2004-2009) does not correspond to a larger number of children per woman, but to the echo of the previous baby boom as the majority of the population born after 1975, at the end of the war, is now married and has children.

Figure 15: Population by sex and five-year age group, based on the 15 per cent 2009 census sample data

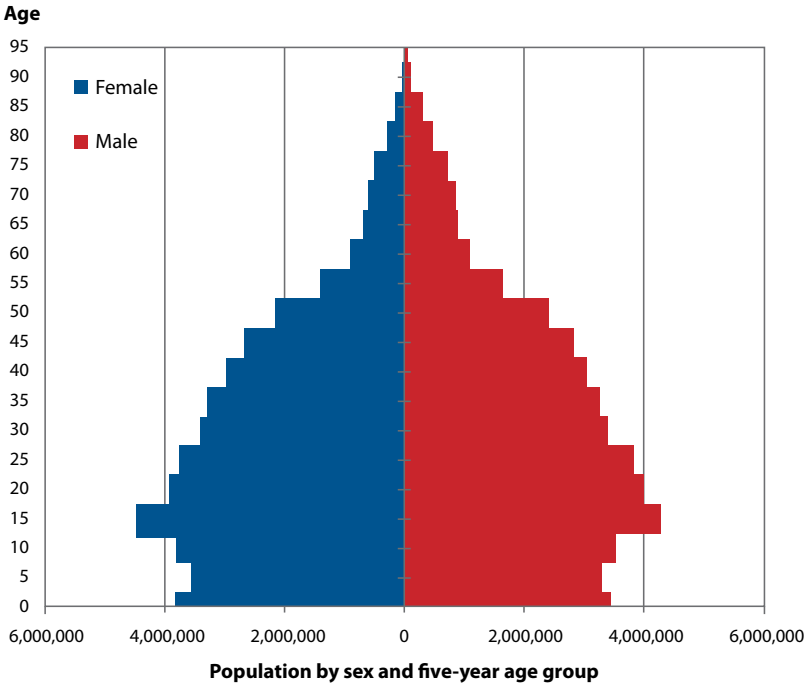
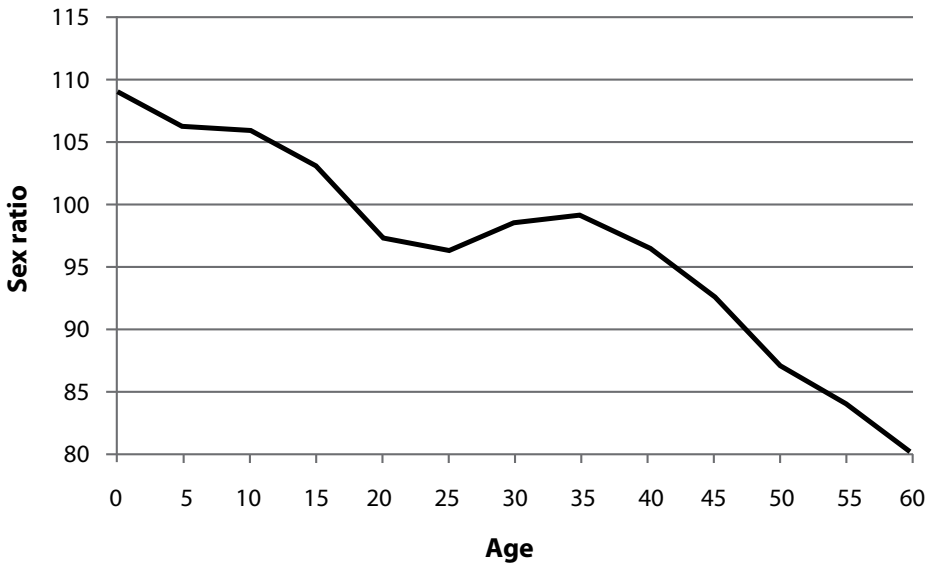


Figure 16 shows the age specific sex ratio computed from the previous age pyramid. As should be expected, the sex ratio declines with age under the influence of higher male mortality compared to female mortality in the same birth cohort. But this downward trend of the sex ratio is made up of different components: the recent increase of the SRB over the last 10 years, an unusual drop of the sex ratio among young adults that can be associated with outmigration, under-enumeration of young men and non-household population, and, finally, the rapid decline of the sex ratio after 45 reflecting the higher mortality rates among men caused by the war.

In view of the SRB trends estimated in the previous section and according to the analysis, the sex ratio of the population aged 5-14 years at 108 seems exaggerated: this level appears higher than the sex ratio at birth of the corresponding 1994-2003 birth cohorts, even though they are expected to be lower because of lower male survival rates. In fact, these sex ratios are most probably inflated by the sex-wise weighting system (Appendix 3). The exhaustive population count of the 100 per cent census data will soon provide a more realistic view of the current age and sex structure.

Figure 16: Sex ratio by five-year age group based on the 15 per cent 2009 census sample data



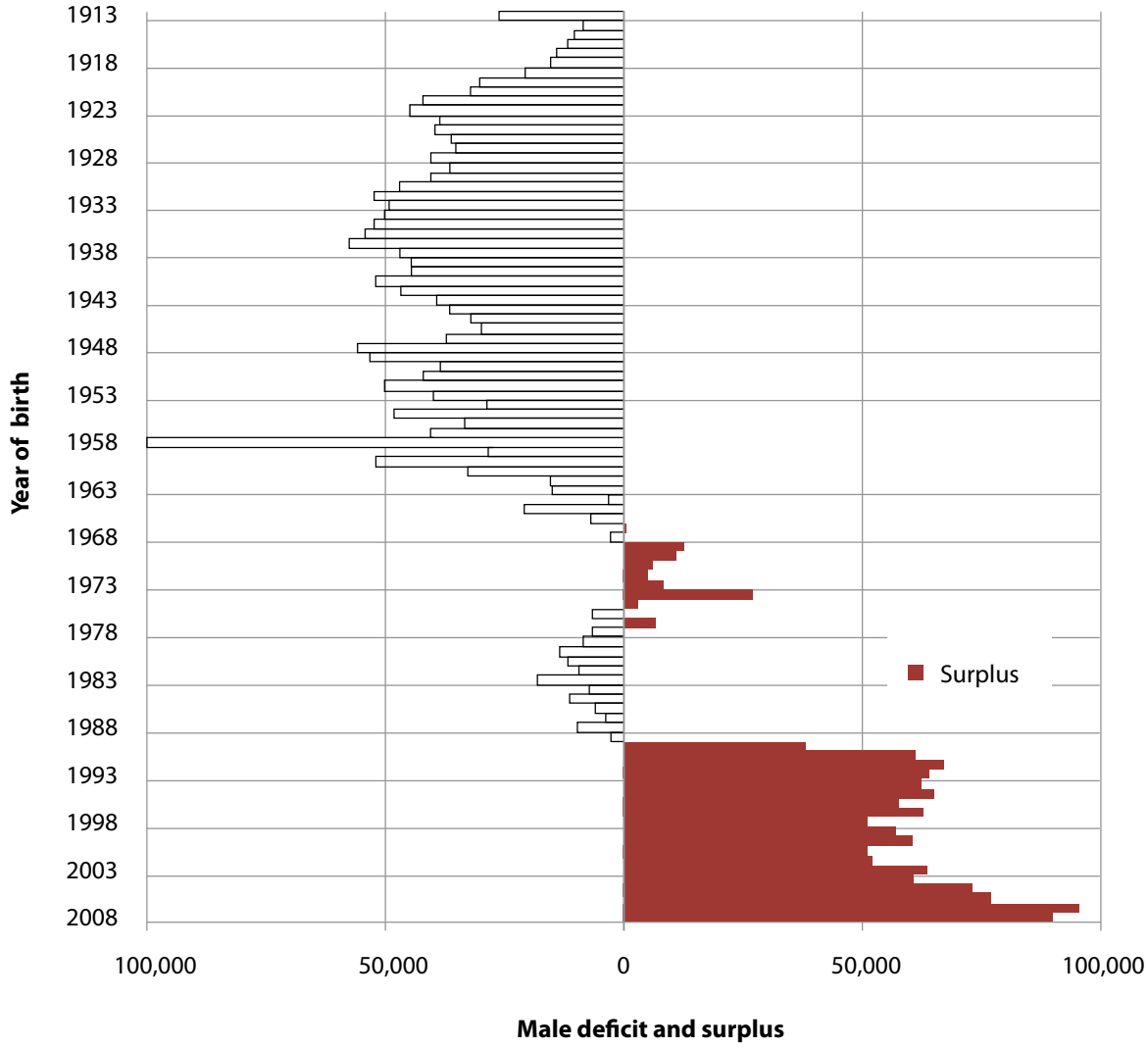
Viet Nam"s population today comprises a majority of women and this has been the case since the 1960"s. The population sex ratio has been continuously increasing since the 1970"s and has now reached 98.1. Figure 17 plots the distribution of the male and female surplus by age in 2009, i.e. the absolute difference between the male and female populations. Male surpluses are shown on the right side of the chart[13], revealing that they are concentrated in the younger generations, while for women there is distinct surplus among older adults for reasons already mentioned above. The current rise of the SRB will amplify the increase of the proportion of men in the total population as the older adult population gradually disappears and the younger male-dominated birth cohorts get older. In the long run, the sex imbalance at birth will inevitably have an impact on the sex distribution of the population, leading to a long-term sex disequilibrium that will reverberate in Viet Nam"s population for more than 50 years.

A set of population projections based on the mortality and birth rates (see Appendix 8 for details regarding the projection methodology) were made for a better evaluation of future demographic trends. The SRB is an important input for these population projections as this ratio will determine the extent of sex imbalances for decades to come[14]. The exact impact of the SRB imbalance depends on two factors: the intensity of the SRB imbalance including its peak, and its duration in years before a return to normalcy (if any).

[13] The extreme deficit for 1958 results from the age heaping at 50, which is more common among women.

[14] See Guilmoto (2010) for a more detailed exercise based on the population of China and India.

Figure 17: Male and female surplus by year of birth



While it seems difficult to foresee exactly how the recent masculinity trend will evolve, there is already evidence to suggest that birth imbalances are likely to affect new social groups and new provinces in the near future, potentially causing a further rise of the proportion of male births at the national level. To overcome predictive uncertainty, three demographic projections based on future SRB trends are set out below. While this exercise is more a demographic simulation than a population forecast, it is based on three plausible scenarios of future change of birth masculinity derived from previous considerations regarding socio-economic and regional differentials and from the SRB trend observed since 2003.

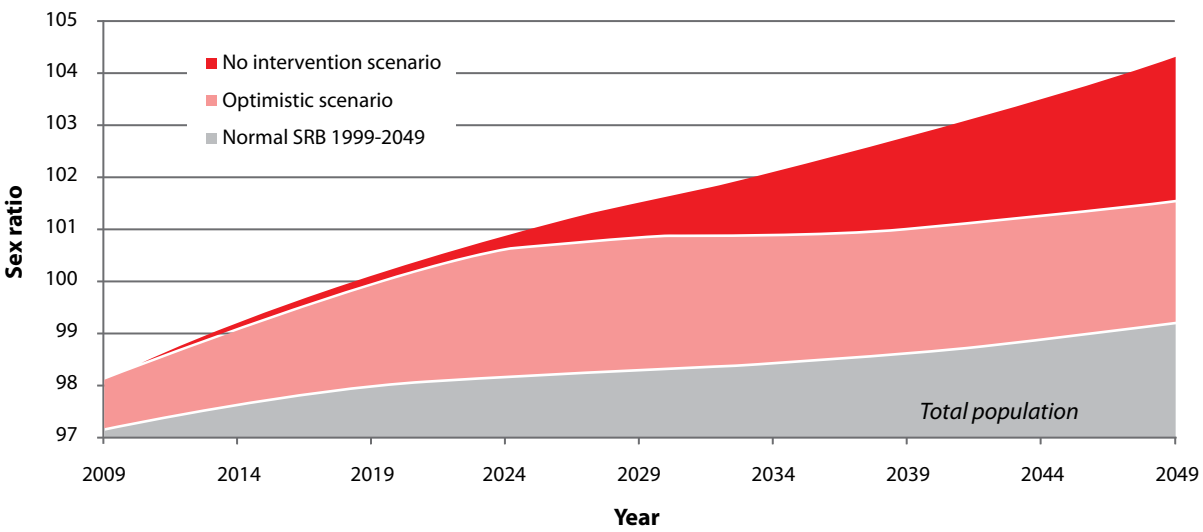
- First, according to the "no-intervention scenario", the SRB is predicted to rise to 115 by 2015, a level close to that observed in China in the 1990"s and already observed in the Red River Delta. In this scenario, the SRB will stay at this high level even beyond 2015. This is a rather pessimistic scenario, in which high birth masculinity is supposed to become a permanent feature of Viet Nam"s demography within a few years. The simulated long-term SRB level however remains below that estimated for China today.

- In contrast, the second, more optimistic scenario presupposes a slower rise of the SRB to 115 by 2020, followed by a gradual return to normal (105) by 2030. The latter scenario suggests that social change and public policy initiatives will first slow the growth of the SRB down and then accelerate the downturn, thus preventing Viet Nam from treading the same path as several regions of China and India. The two scenarios should serve as the upper and lower limits of Viet Nam"s forthcoming sex ratio imbalances.

- The third simulation is based on the assumption of achieving a steady and normal SRB (105) during the entire period 1999-2049. This simulation presupposes in particular that the 2009 population under 10 years was never affected by SRB imbalances. In this context the 2009 sex distribution was corrected by removing the surplus of young boys due to abnormal sex ratios at birth.

According to the different sets of parameters, all three scenarios described above converge on the fact that in Viet Nam the sex ratio of the entire population will continue to grow slowly (Figure 18). According to both the optimistic and the pessimistic scenarios the male population will exceed the female population in numbers from 2020 onward. However, in the high SRB scenario, the imbalance of the overall population sex ratio will rise indefinitely, reaching 104 in 2049, if not subject to interventions which reduce prenatal sex selection. In the second scenario in which the SRB is allowed to gradually decrease after 2020, the population sex ratio will remain almost stable with only a marginal predominance of men over women. In comparison, the third set of simulations corresponds to a much slower increase. In fact, with normal SRB levels throughout the period, Viet Nam"s population would continue to be predominantly female for at least the first half of the century.

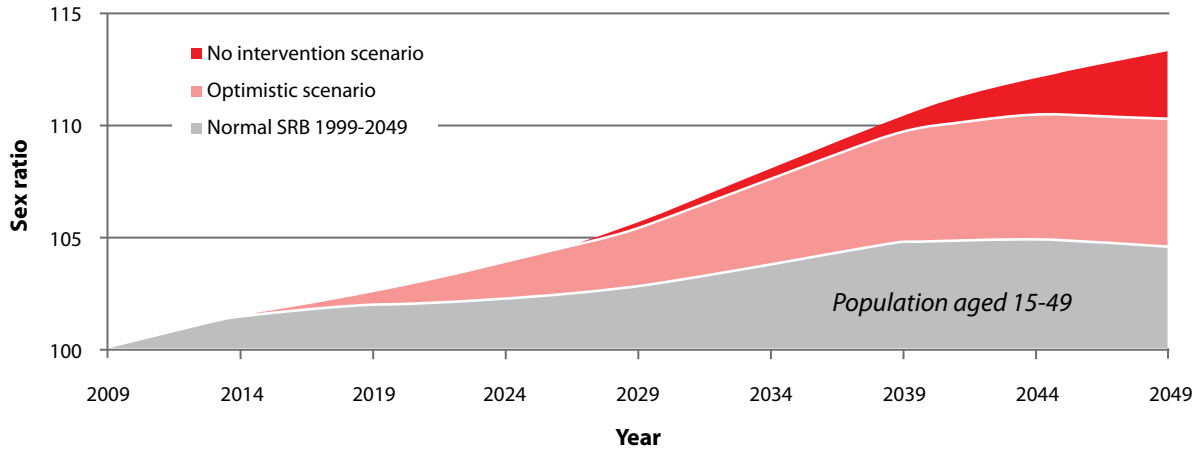
Figure 18: Sex ratio of the total population according to three simulation scenarios



Of all possible consequences of a distorted SRB on Viet Nam"s future demographic structure, the imbalance will probably be felt most by young adults. The so-called "marriage market" is based on a steady and balanced inflow of young men and women, but the recent rise of the SRB is bound to distort past trends, with potentially a decreased male capacity to find a female partner. This in turn will exert pressure on women and could lead to the increasing occurrence of gender abuse: gender violence, female trafficking, etc[15]. In order to reflect the intensity of sex imbalances among the adult population aged 15-49, Figure 19 indicates that the adult population will experience faster and more significant changes in sex ratio levels than the overall population of Figure 18.

In the years following 2009, the sex ratio of adults of marriageable age will grow from today"s 100 to 105 in 2029, independent of any changes in SRB levels. Thereafter, based on a no-intervention scenario, the sex ratio will increase to 113 by 2049. This level corresponds to a potential structural surplus of men of approximately 12 per cent among adults of 50 years of age and below. Such a proportional excess of men will lead to serious changes of gender relations in society, with implications of crisis in the marriage market (the so-called "marriage squeeze"). According to the second set of projections, the rise of the adult sex ratio would level at 110 in 2044 and decline thereafter. Here the large gap between the year when the SRB starts decreasing (2020) and the years during which the impact of this decline becomes visible (2049), is displayed as well. The third scenario indicates the projected adult sex ratio in the absence of an unbalanced SRB, resulting in a slow rise towards levels below 105 and corresponding to an entirely different society in which the predominance of adult men remains marginal (and can probably be corrected by delayed marriage).

Figure 19: Sex ratio of the adult population aged 15-49 years according to three simulation scenarios



[15] In the context of this report it is not possible to discuss all complex processes that might be generated by the rising numerical predominance of men and all ways in which this may affect households and society. In short, gender imbalances will primarily affect male behaviors and the family formation process.

From the no-intervention scenario, it is estimated that the SRB would rise to 115, with no periods of decline, yielding an average excess of 58,000 male births per year during the 2009-2049 period[16]. This number of additional men is attributed to the abnormal SRB levels used as parameters for our simulation. These additional male births, accumulating at such a rate during one or several decades, would lead to significant numbers of excess men in a country like Viet Nam.

The birth imbalances observed in Viet Nam today is one component likely to influence the marriage system in the future. Another factor which is likely to exert further pressure on the marriage market is e.g. the possible rise of female age at marriage, which at present remains very low - 22.8 years - in comparison with more developed Asian nations. Migration patterns may also disturb the equilibrium between prospective brides and grooms. Predicting the future disturbances in the marriage system as generated by high SRB"s and possible responses to the male squeeze – such as delayed marriage, increased out-migration or singlehood among men – therefore remains a hazardous exercise, even if the impact of today"s excess male births on Viet Nam"s demographic structures appears unavoidable.

[16] This figure is estimated as the difference between the projected surplus of male births and the male surplus resulting from a standard 105 SRB.

11. FUTURE SRB CHANGE FROM A POLICY PERSPECTIVE

The numbers displayed in our prospective analysis of the impact of a high SRB on future population structures demonstrate some of the risks associated with a laissez-faire attitude of no-intervention when addressing an imbalanced SRB. An additional decade of unbalanced SRB will inevitably translate into tens of thousands of excess boys being born, thus distorting the sex ratio among prospective spouses twenty years later. As a matter of fact, any successful effort towards the reduction of excess male births today through targeted interventions and advocacy campaigns will lead to a parallel decrease of the number of men condemned to delayed marriage or singlehood in the future. Male singlehood is a rather paradoxical outcome of the current trends: it would potentially lead to a severe disruption of the functioning of the patriarchal structures that rely on men to perpetuate the family line. The quest for sons through modern sex selection might indeed endanger the very system that gave rise to it.

It is important to envisage the future change in SRB trends and especially to consider the possible effects of various interventions on demographic trends. It should indeed be noted that the rise of SRB levels is not at all irreversible. The long-standing preference for sons stemming from traditional patriarchal societies is far from invariant. Modern societies in East Asia have in fact witnessed a gradual decline of gender inequity during the last decades. For instance, in spite of persisting gaps between men and women in many social and economic domains, the conditions for women in Japan improved gradually over the last fifty years by means of progress in education and employment opportunities. This has also been the case in South Korea, a country especially important from this perspective given the rapid deterioration of its SRB during the 1980"s. During that decade, birth masculinity there started to rise exactly as in China when prenatal sex identification technology became available and allowed women to opt for abortion of unwanted female fetuses. The SRB in South Korea even reached levels close to 115 during the early 1990"s. What is striking in South Korea"s case however is the subsequent decline of SRB levels observed since the mid 1990"s: a gradual reduction of birth masculinity has been recorded over the years while the SRB has by now reached a normal level of 106. It is the only case thus far of sustained decline of an SRB and therefore offers a number of lessons about the potential role of public policy and social intervention to stabilize SRB imbalances (Chun and Das Gupta, 2007).

Several factors have been suggested to explain the downturn initiated in South Korea during the 1990"s, a period particularly characterized by rapid economic growth and political change. In the first place, the government made sex selective abortions illegal. It subsequently applied severe pressure on the medical community to ensure its respect of the newly introduced prohibition. Secondly, a series of new family and employment laws to promote gender equity were introduced simultaneously from the late 1980"s onward. Thirdly, the gradual erosion of gender bias in South Korean society was reinforced by the rising proportions of women gaining access to higher education, better jobs and higher incomes. As a result, women started to marry significantly later until at present a rising proportion of the female population may even decide to forego marriage for good. The respective contribution of these three different processes on changes in sex selection practices is not yet clear from

the available research into these issues, but it seems obvious that both targeted government interventions together with the structural processes of social change played a major role with regard to the turnaround of both attitudes and mentalities. Many other policy experiences have been described for China and India, but the recent changes observed in SRB trends in these countries point only to interrupted increase and signs of slight decline in some areas. Evidence of the specific impact of various social interventions on social behavior is therefore limited here.

In view of the limited success of Asian countries - apart from South Korea - with regard to generating a SRB decline, the challenge which lies ahead therefore consists of finding the most effective ways to redress current son preference and prenatal sex selection practices in Viet Nam. Policy tools and potential domains for intervention are numerous, but of many of them, tested outside Viet Nam, the effectiveness in terms of SRB reduction is unknown. To start with, the statistical situation with regard to SRB remains poorly known and except for decennial census data, the statistical materials available are of limited use to assess trends or differentials. Hence, it is indispensible to collect regular statistical information regarding SRB trends. The SRB rises cannot be properly assessed without access to quality statistical data sets and birth registration information which provide annual and regional details and are by far the most appropriate for monitoring trends.

Several of the approaches implemented thus far rely on the control or the prohibition of sex selection, a now generalized phenomenon in most Asian countries[17]. However, these measures remain poorly enforced for logistical and other reasons. For example, it is almost impossible to detect an abortion caused by sex selection considerations. Similarly, the prohibition of prenatal sex identification is often unfeasible, especially when a growing private health sector caters to the needs of pregnant women. Not only are these approaches difficult to implement, they also run the risk of increasing the number of unsafe pregnancy terminations. Furthermore, newly emerging techniques (sex identification based on fetal blood, pre-implantation method etc.) may even generate additional difficulties with regard to the monitoring of sex selection in the future.

The abovementioned intervention methods tackle the "supply side" of the sex selection framework, by targeting the feasibility of sex selective abortions. However, many other responses to abnormal SRB levels address, on the contrary, the demand components of the sex selection equation, i.e. the strong need for a son perceived by families. This son preference itself is caused by various considerations in Viet Nam, ranging from strictly religious ones related to the role of sons in family rituals to the very concrete need for male labour in peasant families. The key dimension underlying all these aspects of gender preference is the patriarchal system revolving around male descendants, in which sons are indispensable for the perpetuation of the family. Its multifarious manifestations can be religious, psychological, social, political or economic, yet all relate to the lesser importance attached to daughters vis-à-vis their brothers within Viet Namese households. As Bélanger (2002) writes, gender bias

[17] Sex selection is forbidden in Viet Nam (2003 Population Ordinance). This prohibition has been strengthened by a decree issued in 0ctober 2006 and by more recent regulations. Little is known about the actual implementation of these measures and it remains difficult to monitor the behavioural practices of the medical community.

has persisted in Viet Nam for many different reasons that tend to reinforce each other. But census data also demonstrates the existence of sizeable regional disparities in the intensity of son preference within the country, a feature probably closely related to variations in kinship systems and traditions (see Appendix 9 for a detailed analysis).

Possible policy initiatives to redress the imbalances produced by the traditional preference for sons are therefore diverse and often complementary. A first approach focuses on the legal environment and many governments have introduced new legislation to ensure the effective protection of the rights of daughters and women through laws. Altering the legal system by introducing women-friendly laws and providing more effective implementation and monitoring are essential to ensure gender equity. The legal domains to be covered mostly concern the family (marriage, inheritance, etc.), education, employment and political representation. Unequal inheritance practices constitute a case in point, since depriving daughters from their share of the family"s property and assets, including household-held land rights, reinforces their economic marginalization and undervaluation in society. Specific incentives (scholarships, bonuses, allowances, reservations in schools, etc.) have been devised to correct existing gender biases, to offset the extra costs often associated to girls, and to encourage parents to view the births of female children with the same positive attitudes as those of males. Such measures of positive discrimination are potentially costly and therefore need to be adequately targeted toward the right population - such as parents in low-fertility areas who only have girl children.

Another type of approach consists of active campaigning for gender equality combined with other advocacy activities. These campaigns may in particular target specific attitudes which are inherited from the past and are linked to traditional practices (marriage systems, rituals, religious and other beliefs, etc.). Long standing gender discrimination has in fact often given birth to "spontaneous" gender bias which is e.g. illustrated by sayings and proverbs that get carried through the generations, even when women"s conditions have meanwhile vastly improved. Some campaigns may also target specific sections of the population only (health personnel, political leaders, educated households, families without sons, etc.). It goes without saying that such campaign and advocacy efforts are unlikely to bear fruits immediately or to alter mentalities and prejudices overnight. But they do constitute a necessary component to accelerate transformations in the gender system of any society and do contribute to the creation of a new environment in which women"s roles in society are better valued than in the past.

These initiatives[18] should target both deep-rooted attitudes towards women and discriminatory practices without losing sight of the importance of the necessary transformations in the social, economic and political environment that indirectly affect gender relations and gender biases. Political participation is a case in point, because women are more likely to get involved with the fight against gender prejudices. The pension system is another such example, due to the close connection between the need for male children and the old age support system. Civil society organizations and administrative bodies at different levels of governance will play a decisive role in these future changes.

[18] The various initiatives and projects recently launched by the Ministry of Health as well as aspects such as families with girls, school benefits for girls, old age support, awareness campaigns, etc., are beyond the context of this paper.

12. CONCLUSION AND RECOMMENDATIONS

The true extent and the nature of geographical disparities arising from an imbalanced SRB in Viet Nam have remained ambiguous for years. Results from the latest census have now dispelled doubts regarding these issues by providing extensive and detailed quantitative evidence of the sex imbalances at birth associated with sex selection practices, and their wider spread ramifications within Viet Namese society. It can now be confirmed that, following the introduction of modern, good quality ultrasonography, the proportion of male births has increased during the last decade, especially from 2003 onwards[19].

At 110.6, the current SRB in Viet Nam appears moderately elevated compared to other regions, yet is already comparable to the SRB in India, where the rise in birth masculinity started more than 20 years ago and where signs of stagnation have already been observed (UNFPA India)[20]. Viet Nam"s recent SRB rise is, in fact, of serious concern for several reasons. In the first place, none of the neighboring countries in South-East Asia such as Cambodia, Thailand and Indonesia, all of which are comparable to Viet Nam in terms of demographic and socio-economic levels, have experienced any detectable rise of the SRB in recent decades. Viet Nam stands out as the only country in this region where gender preferences have so distinctly been translated into demographic imbalances. Secondly, the rise of the SRB in the countries mentioned in Table 1 started relatively early - during the 1980"s or the 1990"s - whereas the rise of SRB levels in Viet Nam is relatively recent and has proceeded at a rapid pace since 2003-04. Based on the experience of other countries, predictions are that the SRB trend in Viet Nam will continue to rise for some years to come.

Moreover, our analysis has shown that, partly due to economic and demographic conditions linked to poverty, low urbanization, high fertility and lower education rates, several sections of the population as well as entire regions have been unaffected thus far. It is most likely that these conditions will change in the near future. Accordingly, the SRB in the entire country may soon increase to 113 for the richer population quintile or even to 115 in the Red River Delta region. The demographic simulation described above has documented the implications of such an unchecked rise in birth masculinity and suggests that the delayed effect on the adult sex ratio is likely to have a direct impact on the marriage system.

While the arithmetic of the sex imbalances now provides better insight, little is known still about the social mechanisms accounting for this rise in male births. Viet Nam meets the three initial conditions for a distorted SRB –son preference, lower fertility and access to sex selection technology – but a number of questions remain, most notably about the context

[19] The rapid emergence of prenatal ultrasound has been described by Gammeltoft and Hanh (2007) and Gammeltoft (2007). The recent population survey conducted by the General Statistics Office in 2006 indicates that two thirds of mothers are aware of the sex of their child before its birth (UNFPA 2007).

[20] See also Das Gupta et al. (2009) and Guilmoto (2009) for comments about a possible downturn in SRB rates in other Asian countries.

of son preference and of prenatal sex selection, that cannot be addressed by the evidence of the census data. As documented elsewhere (Institute for Social Development Studies 2007, Bélanger et al., 2009), the most likely cause of the SRB increase is the tendency of parents to opt for a sex selective abortion after learning through prenatal sex diagnosis that the fetus is female. But because prenatal sex selection remains an illegal practice in Viet Nam, information cannot be adequately or accurately gathered through quantitative surveys. Therefore, the prevalence of sex selection remains a hypothesis inferred from the biased SRB and its specific relation to the sex composition of children. Field surveys in particular, will help to document the way health infrastructures satisfy the new demand for "gendered offspring" and manage to circumvent existing legislation.

In addition, surveys with a focus on gender systems in various localities will be indispensible to analyze the various dimensions of the preference for sons observed across most social groups in the country. Some components of this preference are cultural traits transmitted through traditional institutions (the patrilineal family, village communities), while the male bias also depends on more recent social transformations linked to the rapid economic development in the country. These features and their characteristics will determine the levers available to policy-makers to accelerate the shift in gender attitudes by supporting interventions and campaigns that promote changes in attitudes and behaviors". As pointed out above, South Korea"s experience suggests that three types of factors have been effective in the successful SRB downturn observed there during the 1990"s: enforcement of the prohibition of sex selection, thorough changes in the legal environment after the introduction of new employment and family laws, and increased access for women to equal education and employment opportunities.

These observations suggest a careful monitoring of SRB trends in the years to come. Regular statistics on birth masculinity, in-depth qualitative analyses of local gender and family arrangements as well as the review of various local initiatives to curtail the SRB rise will shed more light on prenatal sex selection behavior, the various social and economic contexts underlying the preference for sons and the responses to interventions. These studies will yield important clues for reflections on the intensity and likely social consequences of prenatal sex selection practices. They will also assist policy makers in improving the effectiveness of strategies and interventions designed to tackle the rising SRB imbalances.

13. REFERENCES

Anselin, L., (2003), *GeoDa 0.9 User's Guide*. Spatial Analysis Laboratory (SAL), University of Illinois at Urbana-Champaign.

Attané I, and Guilmoto CZ, editors. (2007), *Watering the Neighbour's Garden. The Growing Demographic Female Deficit in Asia*, CICRED, Paris.

Bang, Nguyen Pham, et al., (2008), "Analysis of socio-political and health practices influencing Sex Ratio at Birth in Viet Nam", *Reproductive Health Matters*, 16, 32, 176-184.

Bélanger, D, et al. (2003), "Are sex ratios increasing in Viet Nam?", *Population*, 2, 231–250

Bélanger, D, et al. (2009), "Second-trimester abortions and sex-selection of children in Ha Noi, Viet Nam", *Population Studies*, 63, 2, 163–171.

Bélanger, Danièle, (2002), "Son Preference in a Rural Village in North Viet Nam", *Studies in Family Planning*, 33, 4, 321-334

Central Population and Housing Census Steering Committee (2009a), *The 2009 Viet Nam Population and Housing Census of 00.00 Hours 1st April 2009: Implementation and Preliminary Results.*

Central Population and Housing Census Steering Committee (2009b),The 2009 Viet Nam Population and Housing Census of 00.00 Hours 1st April 2009: *Expanded Sample Results.*

Central Population and Housing Census Steering Committee (2010), The 2009 Viet Nam Population and Housing Census: *Major Findings.*

Cho, Lee-Jay, et al. (1986), *The Own-Children Method o. Fertility Estimation*, Honolulu, University Press of Hawaii.

Chung, Woojin and Monica Das Gupta, 2007, "The decline of son preference in South Korea: The roles of development and public policy", *Population and Development Review*, 33, 4, 757–783.

Das Gupta, M. et al. (2009), "Evidence of an incipient decline in numbers of missing girls in China and India". *Population and Development Review* 35, 2, pp. 401-415.

Edlund, Lena, *et al.* (2007), "More Men, More Crime: Evidence from China"s One-Child Policy", IZA Discussion Papers, 3214.

Gammeltoft T, Hanh TTN (2007), "The Commodification of Obstetric Ultrasound Scanning in Ha Noi, Viet Nam". *Reproductive Health Matters* 29, 163–171.

Gammeltoft T. (1999), *Women's Bodies, Women's Worries. Health and Family Planning in a Vietnamese Rural Community*, Richmond, Curzon.

Gammeltoft T. M. (2007), "Prenatal Diagnosis in Postwar Viet Nam: Power, Subjectivity, and Citizenship", *American Anthropologist*, 109, 153–163.

Guilmoto, C. Z. (2009), "The sex ratio transition in Asia". *Population and Development Review* 35, 3, pp. 519-549.

Guilmoto, C. Z. et *al.* (2009), "Recent increase in Sex Ratio at Birth in Viet Nam". *PLoS ONE* 4, 2, p. e4624

Guilmoto, Christophe Z. (2010), "Longer-Term Disruptions to Demographic Structures in China and India Resulting From Skewed Sex Ratios At Birth", *Asian Population Studies*, 6, 1, 3-24

Haughton, Jonathan and Dominique Haughton, (1995), "Son Preference in Viet Nam", *Studies in Family Planning*, 26, 6, 325-337

Institute for Social Development Studies (2007), "*New Common Sense": Family-Planning Policy and Sex Ratio in Viet Nam. Findings from a Qualitative Study in Bac Ninh, Ha Tay and Binh Dinh*, UNFPA, Ha Noi.

Kaur, Ravinder (2008), *Missing Women and Brides from Faraway: Social Consequences of the Skewed Sex Ratio in India*, AAS Working Papers in Social Anthropology / ÖAW Arbeitspapiere zur Sozialanthropologie, Vienna.

Le Bach Duong et al. (2007), "Transnational Migration, Marriage and Trafficking at the China-Viet Nam Border", in Attané, I. and Guilmoto, C.Z., eds., 2007, *Watering the Neighbour's Garden. The Growing Demographic Female Deficit in Asia*, CICRED, Paris, 393-425.

Miller, B. (2001), "Female-selective abortion in Asia: patterns, polices, and debates". *American Anthropologist* 103, 4, pp. 1083-1095.

Shakti Vahini (2003), *Female Foeticide, Coerced Marriage & Bonded Labour in Haryana and Punjab. A Situational Report*, Shakti Vahini, Faridabad, Haryana.

UNFPA (2007), *Population Growth in Viet Nam: What the Data from 2006 Can Tell Us, with a Focus on the 'Sex Ratio at Birth'*

UNFPA (2009), *Recent Change in the Sex Ratio at Birth in Viet Nam. A Review of Evidence*, UNFPA, Ha Noi.

UNFPA (2010), *Trends in Sex Ratio at Birth and Estimates of Girls Missing at Birth in India*, New Delhi.

United Nations (2000), *World Population Prospects: the 2008 Revision Population Database* United Nations, Population Division, New York.

Wei, Shang-Jin et al. (2009), The Competitive Saving Motive: Evidence from Rising Sex Ratios and Savings Rates in China, *NBER Working Paper*, w15093.

Werner, Jayne (2009), *Gender, Household and State in Post-Revolutionary Viet Nam*, Routledge, London.

APPENDICES

APPENDIX 1: SRB COMPUTATION AND SAMPLE SIZE

The *Sex Ratio at Birth* (SRB) is the number of male births per 100 female births. The biological standard is usually taken as 105, but statistical data collected around the world suggests that it actually ranges between 104 and 106, with distinct, yet poorly explained historical and inter-country minor variations. When computed for large, unbiased samples in countries with reliable birth registration, some of these deviations in SRB levels remain limited to 1 per centage point. In other words, they cannot account for the magnitude of the biased SRB"s observed in many Asian regions including Viet Nam. But the sensitivity of SRB calculation with regard to small sample size is a well-known issue in sex ratio analysis. Table 6 illustrates this sensitivity by providing the 5 per cent confidence of sex ratio measurements for sample sizes ranging from 1,000 to 100,000 observations. The computation here is based on Viet Nam"s estimated SRB level (110.6). It can be seen for instance that a sex ratio of 110.6 is not significantly different from the normal 105 figure when using a sample of 5,000 observations. Even with 20,000 births, the confidence remains equal to ±3 per 100 (107.6-113.7).

Table 6: 5% Confidence interval for sex ratio estimates by sample size

Sample size	1,000	2,000	5,000	10,000	20,000	50, 000	100,000	200,000	500,000
SRB level	110.6	110.6	110.6	110.6	110.6	110.6	110.6	110.6	110.6
Lower limit	97.7	101.3	104.6	106.3	107.6	108.7	109.2	109.6	110.0
Higher limit	125.3	120.8	116.9	115.0	113.7	112.6	112.0	111.6	111.2

The size of the sample is therefore crucial to ensure the statistical significance of computed SRB"s. Table 7 presents the characteristics of our sample and of the various subsamples extracted for our analysis. While the first column gives the raw number of records, the second column gives the weighted total (decimal figures have been rounded off). The last line corresponds to the number of recent births and illustrates some of the limitations of the sample. The case of province-level estimates is examined in Appendix 4.

Table 7: Samples used for different estimates in the 15% Sample Census data

	Observations	Weighted observations
Number of households Number of individuals	14,177,590 3,692,042	14,177,590 3,692,042
Province: average population Province: largest population Province: smallest population	225,041 663,169 (Ha Noi) 117,367 (Lai Chau)	225,041 1,177,203 (Ho Chi Minh City) 61,168 (Lai Chau)
Urban	3,621,262	4,193,352
Minority population	3,281,357	2,014,438
Population below age 5	1,260,187	1,202,904
Women aged 15-49	4,021,751	4,053,178
Women who gave birth within the last 12 months	260,768	247,632
Births within the last 12 months	262,232	247,603

APPENDIX 2: USING REPORTED BIRTHS TO COMPUTE THE SRB

The SRB is computed here for births reported by women during the 12 months preceding the census. Incidentally, for various reason some recent births may not be included in this count[21]. In addition, it should be stressed that it is not possible to use this indicator to assess recent trends in SRB levels by computing SRB levels for older periods, the reason being that older "last births" tend to be biased in favor of sons as Table 8 eloquently illustrates. The distortion towards higher SRB"s for births which occurred a longer time ago results from an increasing proportion of reported "last births" which in fact correspond to "final births". But since many couples opt to stop child-bearing precisely after the birth of a son, this introduces a sizeable bias towards male births among the final births. For instance, the sex ratio of the "last births" in 2000 is 128.8, a level obviously unrelated to the real SRB level. Selective omission of older female births is another potential factor for this bias. However, there is no bias when computing the SRB for the last 12 months.

Table 8: Sex ratio of the" last births" reported by women classified by year of birth

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
SRB	128.8	123.8	122.2	119.6	117.0	116.3	114.4	112.9	110.4	112.4

The last births reported in the census can be related to various characteristics of the mothers as well as to corresponding household and housing information. But one thing that cannot be easily done is relating the sex of births to the social and demographic characteristics of the father: not only are some mothers living without their husbands (because of migration,

[21] For instance, recent births to women who died or migrated before the census was taken are missing from the sample, but this discrepancy is unlikely to bias our estimate.

divorce, or widowhood), but it is also not always possible to unambiguously identify the spouse of individual mothers and therefore the likely father of births reported by individual women within each household[22].

When the number of last births is too small, we have made use of the *Child Sex Ratio* computed over the population below 5 years. This population is roughly five times bigger than that of the births during the previous year and therefore statistically more robust (confidence intervals for child sex ratios are more than twice as small as for last births). This indicator may however be affected by sex differentials in infant and child mortality (biologically, mortality being slightly higher among male children). Contrary to the measurement based on births reported by mothers, the Child Sex Ratio cannot be related to the mothers" social and demographic characteristics.

APPENDIX 3: WHY IS THE SEX RATIO AT BIRTH DIFFERENT FROM THE SEX RATIO OF CHILDREN BELOW ONE?

The comparison of sex ratio estimates based on the 2009 census indicates the presence of a small gap of 110.6 between the sex ratio during the last 12 months (based on births declared by women) and the sex ratio of the population aged 0-11 months of 112.6. In view of the numbers of observations involved (247,603 births and 251,744 infant children), the difference between these two figures is significant and therefore intriguing. Children below 1 were born during the past 12 months, but have since then been subjected to the influence of biological mortality, which is higher among infant boys than girls. We should therefore expect the sex ratio of children below one year to be slightly lower than that of births, rather than higher as suggested by our estimates. Similarly, the sex ratio for children below 5 years of age (111.5), referring to the population born in 2004-09, is significantly greater than the Sex Ratio at Birth for 2009 [23].

The possibility of underreporting was examined of births during the past 12 months or for children aged less than one by relating children and births within each household. However, the match between reported births and household children was almost perfect and no sex differential whatsoever was observed among missing children. It finally became clear that the source for these differentials between reported births and enumerated infants was inherent in the sex-wise weighting system used for individuals. Original sampling weights were designed for the census enumeration units and strata. But as the census publication explains, they were also further adjusted to match the total population by sex as enumerated in 2009. As a result, weights vary not only by household but also by sex. In fact, weights used for boys are on average higher than weights used for girls, including *within the same sampling unit and within the same household.*

The effect of this adjusted weighting methodology on the sex distribution by age is illustrated in Figure 20, which displays the average weights by sex for children below 15 in the entire

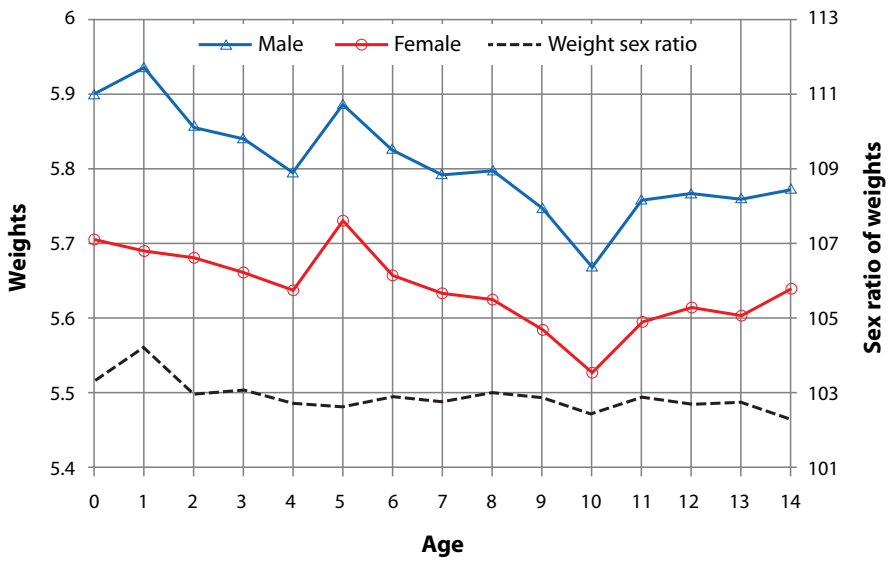
[22] The only case in which such identification sounds feasible corresponds to the simple nuclear family structure in which parents are the "head of the household" and his/her "spouse" (as per the variable "relationship to the head of the family"). Within the current sample, this situation amounts to no more than 57% records of women with a birth during the previous year.

[23] Migration differentials by sex at these ages are taken as negligible.

census sample[24]. As can be seen, male weights appear to systematically be higher than female weights. The sex ratio of these weights shown on the right scale of Figure 20 lies in the range 102-104 and is always greater than 100. In other words, within a given enumeration district or within the same household, boys receive a higher statistical weight than girls. These differentials in weights by sex directly impact the population sex ratio. Moreover, weights change by age as can be seen for age 5 (inflated) or age 10 (deflated). There are also isolated variations as was the case for age 1: whereas the female weights follow a declining trend from age 0 to 4, for the male weights an unexpected increase is recorded for age 1. As a result of this, the weighted sex ratio of the population sample computed for age 1 is unusually high (112.6) and greater than any other sex ratio among children. This impacts any attempt to compute the sex ratio based on age and sex distribution and it explains why the sex ratio of children aged one is unusually high (112.6).

In order to overcome the difficulties related to sex-specific weights, in some cases it may be preferable to apply the household weight–which is not sex-specific– rather than individual weights in order to compute unbiased sex ratios. The household weight is based on the weight of enumeration districts included in the sampling design and therefore corrects the regional imbalances of the sample. With the household weights, the sex ratio for the population below 1 is now 109.7. Given that infant mortality is biologically higher among boys, the ratio for infants was thus corrected for infant mortality, yielding an estimated Sex Ratio at Birth of 110.7 for the children aged less than one year as enumerated by the census[25]. This value is very close to the Sex Ratio at Birth of 110.6 based on recent births reported by mothers and demonstrates the consistency of both SRB measurements. However, only future census tabulations based on the entire population will provide the exact age and sex distribution in the country.

Figure 20: Statistical weights by age and sex, and corresponding sex ratio



[24] These average values are obtained from the entire sample. Apart from reflecting sex-wise weighting differentials, these figures are also affected by the respective age distributions of sampling units.

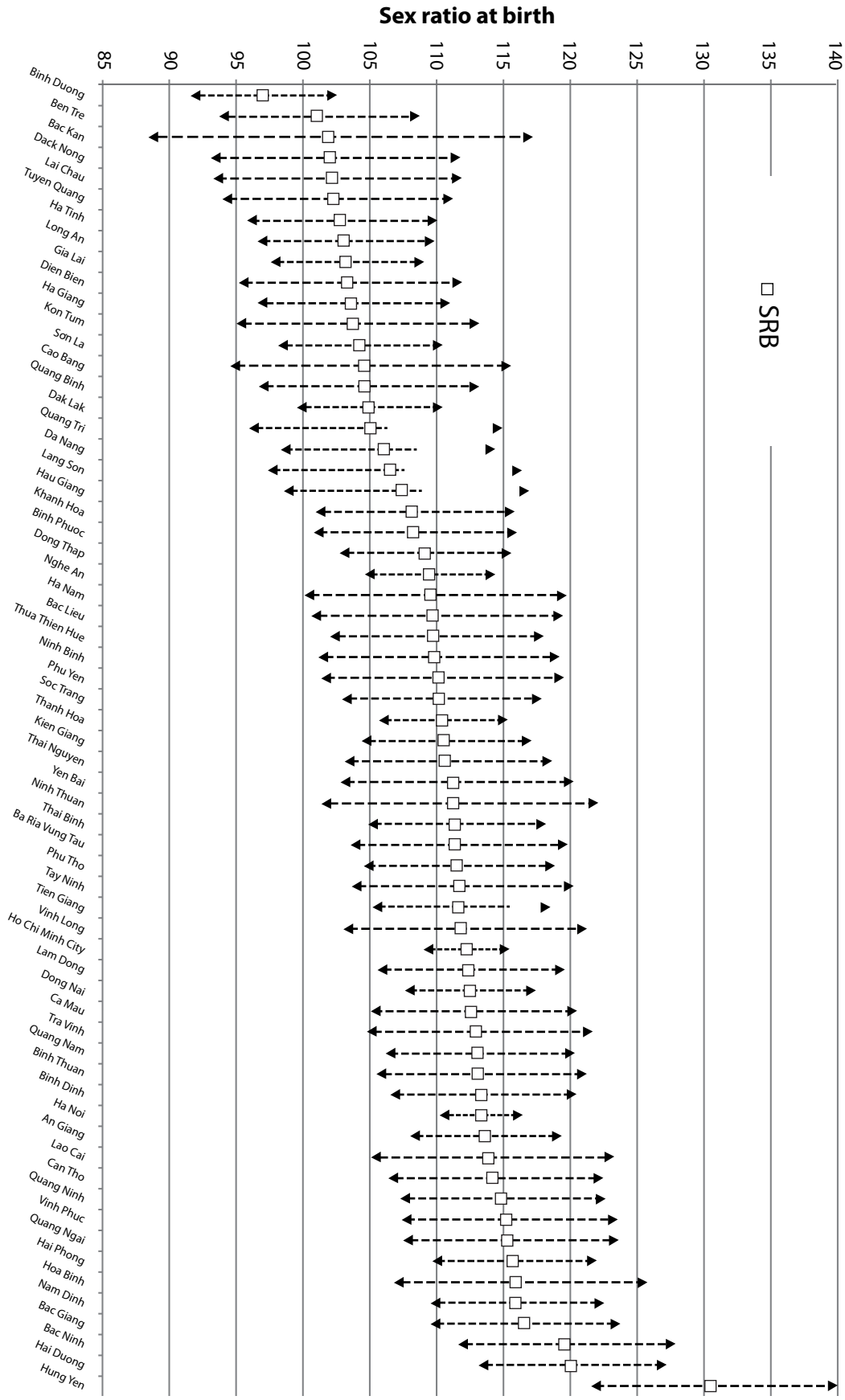
[25] The life tables by sex of the census were used for projections back in time from infancy to birth (Central Population and Housing Census 2010).

APPENDIX 4: THE SEX RATIO AT BIRTH BY PROVINCE

Figure 21 plots the Sex Ratio at Birth based on the births during the 12 months preceding the census as computed for each province. As mentioned before, the number of births in individual provinces is often limited as the sample covers only about 15% of the entire population. Thus, the average number of births during the year preceding the census and by province is 3.900, a sample size likely to create random errors when used for computing the SRB. No less than 54 provinces have fewer than 5,000 recent births in the 15% sample.

In Figure 21 the 5% confidence interval by individual province is inserted as well. As expected, the confidence range is often greater than 15 per 100 because of the small number of births recorded. It has become apparent that in more than half of the provinces, the SRB estimate is in fact not distinguishable from the biological standard of 105. When the various provincial SRB estimates are compared with the national average (110.6), it emerges that only three of them have significantly lower SRB levels than that national average, while only four have higher levels than the national average. These estimates are obviously very vulnerable to random fluctuations and measurement errors.

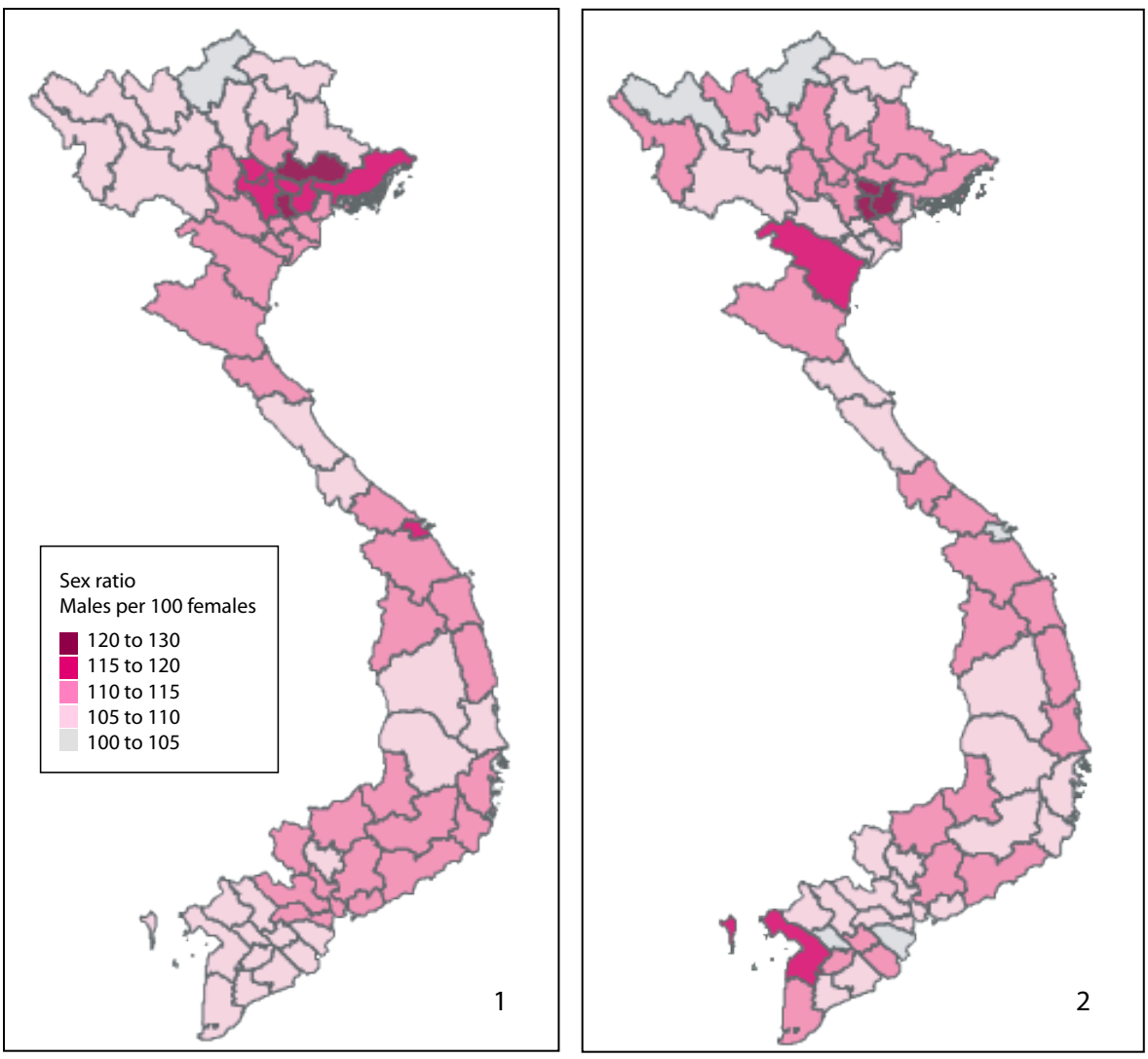
Figure 21: Sex Ratio at Birth by province and 5% confidence interval



APPENDIX 5: SPATIAL ANALYSIS OF SEX RATIO VARIATIONS

This section is devoted to a closer analysis of the spatial patterns of sex ratio variations between the provinces.The province-level maps displayed in Figure 22 are based on different sources: The first map is the Child Sex Ratio (children below 5) from the 2009 census sample while the second map is based on the SRB of the births recorded in health facilities (average 2007-2009). These maps do not tally perfectly (r=0.58) and some of the mismatches are significant (e.g. Hue city and Kien Giang). However, they largely correspond to the same spatial patterns, with a distinct cluster visible in the Red River Delta region, and traces of a high sex ratio also detectable in Central and South-East Viet Nam.

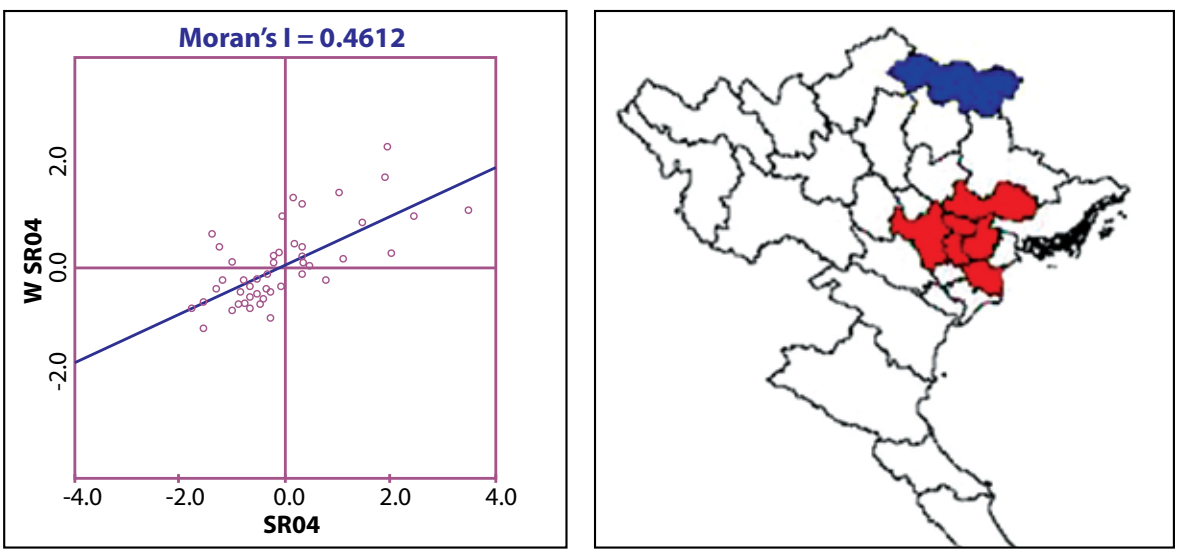
Figure 22: Sex ratio by province: 1. Child sex ratio (0-4 yrs in 2009) and 2. Sex ratio of births (2007-08)



To test the spatial distribution of the sex ratio in Viet Nam, the previous two maps of sex ratio (Child Sex Ratio, Sex Ratio of Births 2007-09) have been used as well as the map of the SRB based on births during the last 12 months. Each map was subjected to a geostatistical analysis in order to evaluate the level of spatial autocorrelation and the spatial clustering of sex ratio indicators. Mapping and computation were done with Geoda software (Anselin 2003).

The Child Sex Ratio map exhibited the strongest spatial dependence as measured with Moran"s I: these results are presented in Figure 23. The first scatterplot (also known as Moran"s scatterplot) displays Child Sex Ratio estimates for the provinces in 2009 against the average Child Sex Ratio for adjacent provinces. The spatial dependence is very pronounced and corresponds to a level of spatial autocorrelation (Moran"s I) of 0.46. The next figure is a map of North Viet Nam showing the Moran cluster of six provinces (in red) with a high sex ratio: Na Noi, Bac Ninh, Hung Yen, Thai Binh, Hai Duong and Bac Giang. These are provinces in which the sex ratio of the province and of its neighbours are significantly above average. As such, they constitute the core area (or hot spot) of gender discrimination in the country and are surrrounded by other provinces (such as Vin Phuc, Hoa Binh, Hai Phong etc.) which constitutes border areas. The significance of this cluster of six provinces ($p<0.01$) is determined by a simulation analysis of the local indicator of spatial association (LISA). The map also indicates that the province of Cao Bang (in blue) along the Chinese border is, on the contrary, the only area which is a low sex ratio cluster (low ratios in the province and its neighbours).

Figure 23: Moran scatterplot of Child Sex Ratio and spatial clusters



APPENDIX 6: THE FAMILY RECONSTITUTION METHODOLOGY

A shortcoming of the analysis presented here is that it does not include information about the influence of the sex of a previous child on the SRB. The reason for this limitation is that the census does not record parity information by sex and therefore only the total number of previous births by a woman is known, but not the sex of her children except for that of the last born. No retrospective estimation is possible from these data because of the bias towards boys with regard to births that occurred a longer time ago. As a result, there is no way to ascertain if a particular birth was preceded by the birth of a male or female child. This is a severe limitation of the present analysis since an essential hypothesis underlying this study of the gender bias framework for sex selection is that mothers without a son are more likely to discriminate against the future births of female children than mothers who have given birth to a boy already.

In order to compensate for this weak link in the analysis the study was enriched by using the "own-child method", a method of family reconstitution originally developed to use the detailed household composition as a way to estimate past births (Cho et al. 1986). This method aims at identifying mothers and children within the same household in order to compute a retrospective estimate of past births by using the amount of children classified by age during the census (after correction for mortality). With this method the already available information on sex, age, marital status, and family status (in terms of relationship to the head of the household) is taken to identify parents and children within each household. Whenever a mother or a father can be linked to certain children, a specific family nucleus can be identified and the children then ranked by age to get a proxy for birth order. The procedure employed here is based on the following configurations with regard to family status:

1. Children are "children of the household head".
2. Children are "grandchildren of the household head" and there is only one married child of the household head in the household (the putative father).
3. In all other cases, identified children may not be siblings and are therefore discarded.

In the first two cases, which correspond to the vast majority of children (95%), this reclassification procedure leads to the identification of sibling groups composed of brothers and sisters. Within each sibling group, information about the dates of birth can then be used to attribute a child order to all children, which is subsequently used as a proxy for birth order. Furthermore, from this "reconstructed sibling population" it can be deduced whether individual children had an older brother when they were born. Other features examined include year of birth, household socio-economic status, or region of residence. The data sets presented focus on the births which occurred during the last ten years (the population born since the previous 1999 census) in order to avoid distortions linked to the absence of older children from the household. In view of the possible biases linked to the weighting system described previously, for this calculation *household sample weights* were used rather than individual sample weights.

[26] The main difference between child order and birth order relates to mortality and migration. In fact, this child order is likely to underestimate the actual birth order and this bias steadily increases with age since a larger proportion of older siblings may not be present in the household during the census due to marriage, migration, or decease.

APPENDIX 7: HOW TO CONSTRUCT A SYNTHETIC INDICATOR FOR SOCIO-ECONOMIC STATUS?

A proper analysis of socio-economic differentials ideally requires either household-level income estimates or a detailed socio-professional classification of the labor force, both of which are missing from the census framework. However, a large array of household information is available that can help to devise an indicator for socio-economic status by acting as a set of proxies.

To start with, a subset of household-level census questions was identified which were deemed related to socio-economic status. These different variables were subjected to a factor analysis in order to compute a preliminary SES index. In this case the procedure used was the *Multiple Correspondence Analysis* (MCA), a factor analysis applicable to the qualitative household and housing variables. For computational reasons only 10 per cent of the entire sample was used. Household observations with missing answers (0.9 per cent) were removed which caused the resulting database to be marginally smaller than the original sample. After a first analysis, variables which poorly correlated to the first factor of our MCA were removed as well.

The first dimension (or component factor) derived from this MCA represents 73.1 per cent of the entire variance (or inertia). This value is obviously considerably high in view of the diversity of the variables retained (see below), but it also corresponds to the existence of a unique SES scale in which all households can be ranked. The first factor, centered at zero, synthesizes the following variables: ownership of seven different goods (TV, phone, computer, washing machine, refrigerator, air conditioner, motorcycle), four types of amenities (type of lighting, type of cooking fuel, source of drinking water, type of toilets), house construction materials (walls and roofing), as well as nature of the dwelling. All these variables were highly correlated – positively or negatively - to this synthetic household-level index. Finally, the living standard index was used to classify births into five quintiles, starting from the poorest 20 per cent of households to the richest 20 per cent[27].

An illustration of the consistency of this indicator is given in Table 9, in which the distribution of women by educational level is computed by quintile. The table demonstrates the close association between female education and our SES indicator. Even if the two indicators are not exactly identical (e.g. some of the richest households contain a significant proportion of uneducated women), female education and household living standards are obviously strongly correlated. Similar tables also illustrate the close association between SES and other variables such as rural/urban residence or ethnicity.

Table 9: Mothers' education by SES quintile of their household

SES Quintile	Primary education	Secondary education	Higher education	Total
Poorest	50.4%	49.2%	0.4%	100.0%
Poor	32.9%	66.0%	1.1%	100.0%
Medium	17.8%	79.5%	2.7%	100.0%
Rich	12.9%	79.9%	7.3%	100.0%
Richest	4.8%	63.6%	31.6%	100.0%
Total	18.5%	70.0%	11.4%	100.0%

[27] Decile classification leads to numbers of births that are too small for a robust statistical analysis.

APPENDIX 8: POPULATIONS PROJECTIONS

Population projections up to 2049 presented in this booklet are simulations based on the demographic parameters (fertility and mortality) of the most recent projections by the Population Division of the United Nations (2009). Age and sex structures from the 2009 census are applied as the baseline. In that sense, these projections are similar to other forecasts, with the only difference that various levels of the SRB have been factored in to simulate their impact on future sex distributions.

Table 10: Projection parameters, 2009-2049

Year	2009	2015	2020	2030	2049
Fertility (TFR)	2.1	1.9	1.9	1.85	1.85
Male mortality (life expectancy)	70.3	71.6	72.6	74.5	79.0
Female mortality (life expectancy)	76.2	77.2	78.0	79.5	83.0
SRB: scenario 1	111	115	115	115	115
SRB: scenario 2	111	113	115	105	105
SRB: scenario 3	105	105	105	105	105
Note: Intermediate values are interpolated					

Starting with an SRB of 111 in 2009, two different scenarios have been developed. The first (no-intervention) scenario of long-term SRB increase posits a rapid rise up to 115 by 2015 followed by stabilization. The second, more optimistic scenario of SRB decline postulates a slower rise up to 115 by 2020, followed by a rapid return to a biologically normal level (105) in 2030. The differential impact of these hypotheses will be reflected in the sex structure of the birth cohorts born after 2009.

The third simulation is based on the hypothesis that the SRB never increased, thus having remained stable at biologically normal levels since 1999. Since abnormal SRB levels have already affected the census figures in 2009, the age and sex structures for 2009 had to be corrected by using Thailand"s child population by age and sex as a reference. Births were then projected for the next forty years by using a normal SRB of 105 throughout. This simulation reflects the predicted Viet Namese age structure in the absence of prenatal sex selection.

APPENDIX 9: SEX IMBALANCES AT BIRTH AND SON PREFERENCE

Sex imbalances as measured by the sex ratio at birth are ultimately linked to a strong preference for a son among couples. In fact, SRB levels can be understood as "revealed preferences": the clear manifestation of desired sex outcomes for the offspring of Viet Namese families. But as mentioned previously, son preference is far from being the only determinant of biased sex ratios. Other factors such as access of sex selection technology, socio-economic levels or fertility constraints also tend to affect the proportion of male births. Assessing the actual intensity of son preference based on demographic data remains, therefore, a thorny issue because of other intervening factors likely to exert an influence on observed SRB levels.

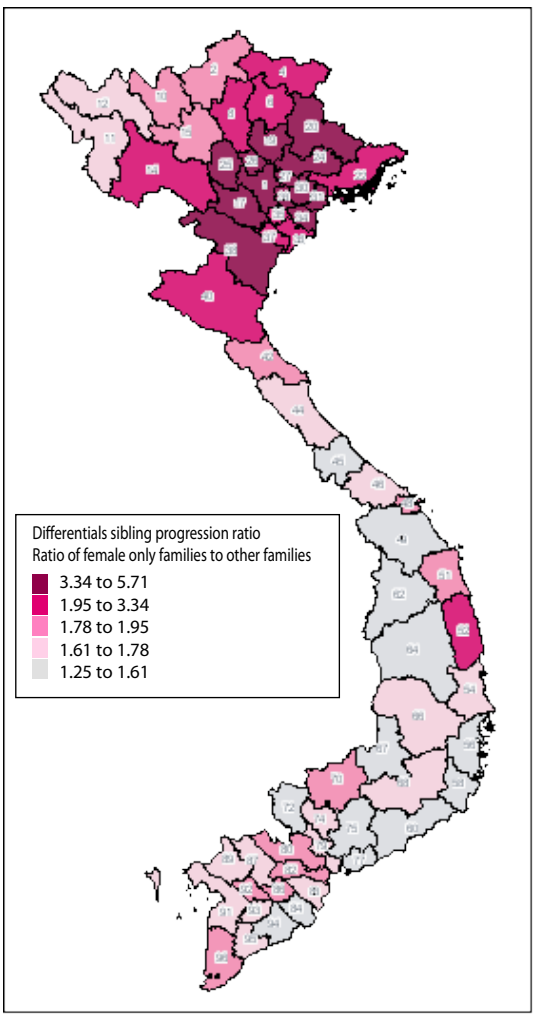
There are, however, indirect indicators of the preference for sons that can be derived from Viet Nam"s census data. One such indicator is related to the inclination of couples to have an additional child according to the sex of the previous births. Using the reconstructed sibling population already computed from the child composition of the sample households, the proportion of families with a third child born during 1999-2009 among families with at least two children in 2009 was calculated. This figure was found to be proportional to the parity progression ratio–probability to go for a third birth – and is crucial in Viet Nam where fertility has been gradually reduced from three to two children over the last fifteen years. In a next step, the ratio of these proportions according to the presence or absence of a boy among the two older siblings was calculated, which should be close to 1 in the absence of sex preference. Unsurprisingly the results obtained indicated that this relative probability (or differential sibling progression ratio) is above 1 everywhere in the country, demonstrating that among third children born to a family, the probability of it being a boy is very high. What was however less predictable is the extent of the observed regional variations in this ratio, which takes values ranging from 1.2 to 5.7 across provinces, as the estimates in Figure 24.1 show.

Another indicator for the preference for sons in the census data is the frequency of patrilineal families, which can be estimated through the presence of male or female married children living with their parents in the same household. In spite of the prevalence of the patriarchal system in the country, it is not unusual for daughters to reside with their parents after marriage, and this feature can be taken as an illustration of a more bilateral kinship system prevailing in some parts of Viet Nam, especially in the central and southern provinces. This indicator is computed as the proportion of multigenerational households with only male married children. The analysis is restricted to households with married children and with a household head aged 40 years or above. The average proportion of extended households with only married sons is 80.5 per cent in Viet Nam. But this high proportion does not mean that the presence of married daughters is rare. There are many provinces where married daughters also reside with their natal families. The province-level estimates plotted in Figure 24.2 illustrate the significant geographical variations prevailing in the country.

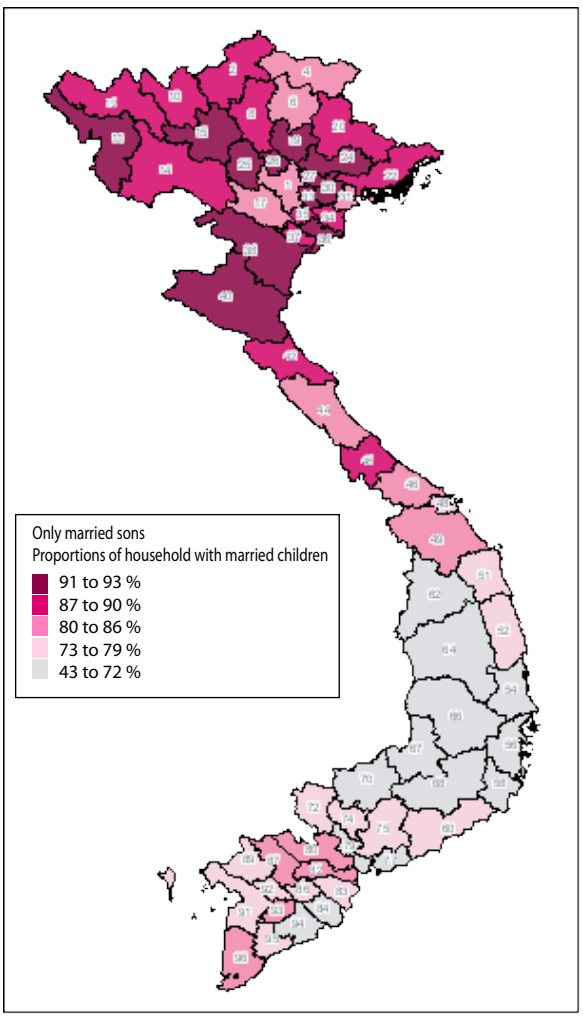
These two indicators reflect different aspects of a preference system for a certain sex. The first one is a direct manifestation of the efforts by couples to ensure the birth of at least one son, and if necessary by having a third child. As depicted in the map, this tendency to have a third child and ensure that it is a boy appears, however, far more accentuated in the Red River Delta region than in other regions. The second indicator, on the contrary, reflects the more balanced multigenerational family arrangements observed in large parts of Viet Nam, suggesting a prevalence of more flexible patriarchal norms in these areas. There is, once again, a distinct regional patterning in which northern Viet Nam emerges as having a stronger patrilineal family system.

The patterning in these two maps generally coincide. The regional prevalence of more bilateral family systems corresponds to lower levels of sex bias in family progression, suggesting that family arrangements and the reliance on male offspring are important determinants of active gender preference expressed by fertility behaviour. It may also be observed that our two maps of son preference in Figure 24 are strongly reminiscent of the map in Figure 3 of child sex ratio. SRB levels tend to be higher where patriarchal family arrangements and the need for a male child are most pronounced. This parallel regional patterning suggests that even if progress in healthcare infrastructures, socio-economic conditions and fertility decline are significant factors behind imbalanced SRB levels, son preference appears to remain the primary driver of sex selection.

Figure 24: Province-level estimates of two indicators of son preference:

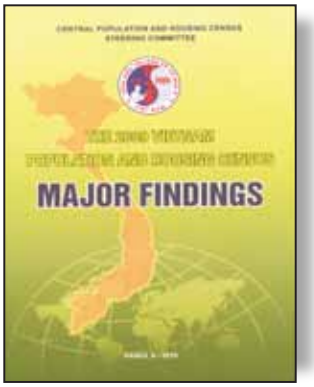


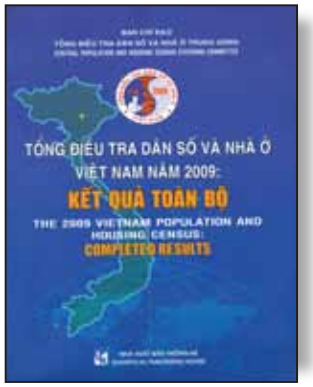
Relative probability to have a third child according to the presence of an older boy.

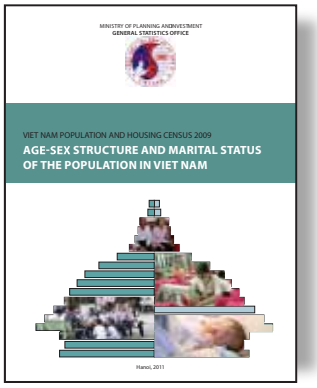


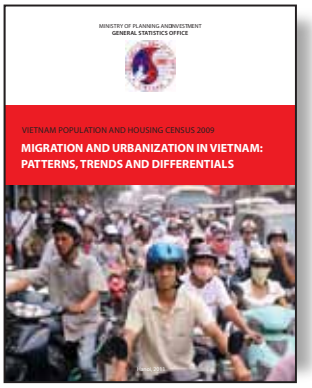
Proportion of households with only married sons among households living with married children.

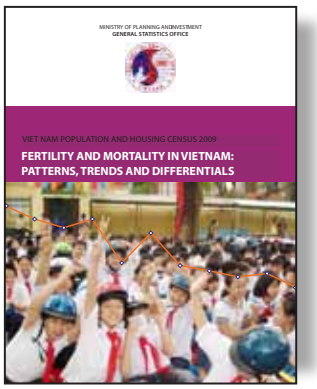
Product for the celebration of the 65th Anniversary of the Vietnam Statistics foundation (06th May 1946 - 06th May 2011)

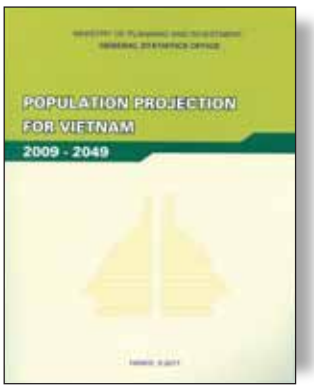












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