

Gender bias in reproductive behaviour in Georgia, Indonesia, and Vietnam: An application of the own-children method

Christophe Z. Guilmoto

IRD–CEPED, Université Paris Descartes

I present a method for estimating indicators of gender bias in reproductive behaviour, using microdata based on the own-children method. The method is first tested on a large sample from India with both birth history and household records. I then apply the method to Georgia, Indonesia, and Vietnam. My estimates demonstrate that the proportion of Georgian couples expressing a preference for sons in their fertility behaviour closely corresponds to the proportion resorting to sex selection at high parities. I show how individual Indonesian provinces provide examples of both son and daughter preference. The method also allows me to date the onset of sex imbalances at birth in Vietnam. The approach based on the own-children method therefore provides a unique tool for estimating the diversity and intensity of gender bias in reproductive behaviour.

Keywords: Vietnam; Georgia; Indonesia; India; fertility; parity progression ratio; own-children method; sex ratio at birth; gender bias

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Introduction

Prenatal sex selection has changed the demography of many countries, from Eastern Europe to South and East Asia, by causing a gradual masculinization of their age pyramids. The effect of this will be felt throughout the twenty-first century (UNFPA 2012). The study of sex selection has been based chiefly on examination of the sex ratio at birth (SRB), but it also requires analysis of the prevalence of son preference, which is at the root of sex imbalances at birth.

This rise of the SRB in many countries has led to an intensive scrutiny of trends in birth masculinity, as well as of indicators of gender preference. Nevertheless, there are serious shortcomings in the estimation of gender bias, because of the absence of proper indicators or usable data. In this paper, I examine the potential of a new method for exploring the two major dimensions of discriminatory behaviour:

- The preference for one sex over the other as manifested in parents' childbearing behaviour, in particular, progression to the next birth.

- The SRB and its relationship with birth order and sex composition of previous children.

This new method is derived directly from the own-children method (OCM), which was designed initially for estimating fertility levels. I apply it here to estimate the intensity of gender preference and of sex imbalances at birth (for a first application, see Guilmoto 2011, 2012).

The paper aims to provide a systematic description of the method. It starts by discussing available indicators of gender-biased reproductive behaviour and birth masculinity, along with their limitations. The second section presents the application of the OCM framework to the analysis of gender preference and discrimination, and notes its potential limitations. It introduces a new indicator called the 'sibling progression ratio' (SPR), which serves as a proxy for the usual parity progression ratio (PPR). This second section ends with an illustration of the quality of these estimates based on India, which has the largest sample available, with both household composition and birth history records. The third section uses the OCM to answer key questions on

the prevalence and intensity of gender bias in three very different countries: Georgia, Indonesia, and Vietnam. I also compare some of the empirical results with findings from other existing sources. Towards the end, I summarize the results and discuss the potential uses and limitations of a more systematic application of the OCM method to large data sets.

Gender bias in reproductive behaviour

Demographic data can reveal many forms of gender discrimination, relating to nuptiality, fertility, health behaviour, survival, and migratory behaviour. I focus here on the preference for children of a particular sex and its potential impact on birth outcomes, as manifested by fertility behaviour and sex imbalances at birth, respectively.

Gender preferences in fertility

Gender preferences can be measured by a variety of indicators. A first type of indicator is based on preferences stated by prospective parents during surveys; for example, preferences for the ideal gender composition of the family, as canvassed during Demographic and Health Surveys (DHS) (Arnold 1997). Similarly, the desire expressed by parents for a new child, according to the size and gender composition of the family, can serve as an indirect indicator of any gender bias. These indicators may, however, be far from reliable for a variety of reasons. One issue, examined later in the paper, relates to the size of the samples available for disaggregated analysis.

Yet, the main issue is that these variables capture stated intentions rather than observed behaviour and may therefore be misleading because of social conformism, variations across respondents by sex and family situation, or *ex post* rationalization (Bongaarts 2013; Robitaille 2013). There is often a large gap between individuals' perceptions, public acknowledgement, and actual implementation of social norms (Bicchieri 2005). For example, people may over-report a balanced desire for 'one boy and one girl'. Using DHS data on ideal family size, Fuse (2010) shows that more than 80 per cent of the populations of Indonesia and Vietnam support a mixed-sex composition or profess no gender preference. However, a closer inspection of actual fertility behaviour, illustrated later in this paper, demonstrates that this is not the case. While Indonesia is indeed characterized by an equal preference for boys and girls, the

bias in favour of sons in Vietnam turns out to be very pronounced. Norling (2016) and Flatø (2016) have recently offered a systematic critique of indicators on stated preferences.

A second type of indicator of gender preference relies on more direct measurement of the effective childbearing strategy of parents, according to the number and gender composition of their prior children. This can be assessed, for example, through contraceptive behaviour by parity and sex composition (Khan and Khanum 2000; Arokiasamy 2002; Leone et al. 2003). But the most direct type of measurement relates to actual fertility choices and to differential stopping behaviour (Filmer et al. 2009; Bongaarts 2013). The conditional probability of an additional birth—measured using PPRs—is in fact the most robust indicator of 'revealed gender preferences' (Beshears et al. 2008). As long as parents have access to contraception, PPRs can show how the sex composition of previous children may influence subsequent reproductive behaviour (Chaudhuri 2012). Like prenatal sex selection, fertility behaviour reflects the gendered objectives of couples directly and is a better indicator of actual preferences than statements influenced by prevailing public representations of what family norms ought to be.

The major issue with this second type of fertility-based indicator is that such measures are usually derived from surveys with limited sample sizes. If we wanted, for instance, to examine whether or not the birth of two successive daughters influences the probability of a third birth after five years, we would have to rely on a rather small fraction of sample births. As a result, any attempt at regional and socio-economic decomposition would be fraught with serious estimation issues. At the same time, larger-scale data sets based on census samples or birth registrations cannot be used for this purpose, since they never record the detailed information needed on birth histories (year of birth, birth order, and sex of mothers' previous births).

Sex imbalances at birth

Ideally, sex imbalances at birth would be identified using SRBs based on birth registration data, but such statistics are often missing or incomplete. To start with, there are only a few countries with elevated SRBs that benefit from the reliable and accessible birth registration data found in industrialized countries. Most of them are in Eastern Europe, where civil registration is reliable on the whole, thanks to the strong statistical tradition introduced

during the socialist period. Yet, most of these countries do not publish birth statistics regularly and seldom publish births by sex or mother's parity. Civil registration data from these countries are usually not accessible for further re-analysis by individual researchers. As for the sex composition of the family—the most crucial variable for understanding the logic of sex selection—no civil registration system collects such detailed data.

The largest countries affected by sex imbalances at birth—China, India, and Vietnam—have no reliable civil registration systems publishing regular statistics. SRB estimates for these countries are based on sample registration or sample surveys and are therefore not robust: keep in mind that the 95 per cent confidence interval of a sex ratio of 105 male births per 100 female births computed over 10,000 births is as large as 101–109. For this reason, India's Sample Registration System provides SRB estimates averaged over three-year periods. In China and Vietnam, SRB estimates are limited to national figures and are either unavailable or unreliable for individual regions. For similar reasons, none of these countries provides SRB estimates by birth order.

The age and sex distribution from a census can be used for retrospective estimation of the SRB, after correction for sex differentials in mortality. Yet, this provides no information on birth order or sex composition for these sex ratios. The usual demographic surveys could in theory be used for SRB estimates, but once again, samples are often too small to provide reliable figures. As a result, it is usually impossible to compute robust sex ratios at birth by birth order or by region using sample data, because of the size of the confidence interval.

In summary, the distribution of children by sex and age across families is a direct reflection of sex preferences (Basu and de Jong 2010). Yet, adequate data to decompose the mechanisms of gender bias are usually unavailable. Both the SRB and PPRs by sex composition of previous children are almost invariably estimated from limited sample data. The size of these samples prevents most demographic or regional disaggregation.

Own-children method and census samples

There are alternative ways to estimate most of these indicators of gender preference and sex imbalances at birth. The method presented here is directly inspired by the own-children method (OCM), a classical technique of indirect reverse fertility estimation

using kin reconstruction. It was first developed to compute fertility differentials from census data (Cho et al. 1986; Timæus and Moultrie 2013) when birth history data were not available. It has been applied to various types of sample data in a variety of countries (Childs 2004; Dubuc 2009; Davie and Mazuy 2010; Retherford et al. 2010). Avery et al. (2013) have recently provided a detailed reappraisal of the method by comparing OCM estimates with total fertility rate (TFR) estimates from DHS samples in 56 countries and conclude that the OCM provides fertility estimates 'at least as accurate' (p. 181) as TFRs computed from birth histories.

Method

The principle of the OCM framework is to use the child population as a reflection of the past fertility behaviour of adult members of the household. Past births are estimated from surviving children. Children of the household head are reclassified as siblings to each other and can be ranked by birth order. The same process is repeated for grandchildren of the household head. The OCM method also draws its value from the growing number of census samples available; for example, IPUMS International (www.ipums.org) provides a collection of censuses and surveys from 82 countries.

Censuses collect the following information on individuals within a given household systematically: relationship to the household head, sex, age, date of birth, and marital status. In some cases, they also provide a specific variable linking children to their individual mother when present in the household. But when censuses and surveys do not collect any information on the parents of children found in the household, we need to reconstruct kinship structures. While IPUMS provides reconstructed variables on family interrelationships (Sobek and Kennedy 2009), I preferred to use the original variables. I started by identifying individuals classified as children of the household head, thus obtaining a first set of putative siblings. In countries where intergenerational co-residence is common, I also retained individuals classified as grandchildren of the household head, which constituted a second set of siblings. Since these grandchildren might have been born from different married children of the household head, I decided that the analysis should be restricted to households where there is not more than one ever-married child present in the household, in order to avoid confusing first cousins for real siblings. It was not possible to use the rest of the child population

—classified as nieces/nephews, brothers/sisters, or others—since they may be affected by various measurement biases. Fortunately, children left out of the kin reconstruction procedure account for a very small share of the child population (less than 6 per cent, in the examples given later). The subsets of children and grandchildren were consolidated into a single data set of siblings from which I derived birth order (in fact, ‘sibling rank’) and gender composition of the family, by ranking siblings by date of birth and sex. In order to obtain SRBs for the years preceding the survey, the child population was converted into birth cohorts by applying life tables by sex to correct for mortality.

Limitations

The OCM requires a large sample with data on children by age, sex, and parentage, and it relies on the quality of these figures, especially for the age data used to compute birth intervals. But there are three additional types of potential bias to the OCM when applied to the estimation of the magnitude of gender bias, as outlined next.

Subsample bias. As indicated earlier, it is preferable to discard the child population not classified as children or grandchildren of the household head because of the risk of bias. Furthermore, in settings with more complex family systems, such as families with unmarried parents, polygynous unions, or fostered or adopted children, kin reclassification may be impossible unless the mothers of individual children can be identified. This may be the case for many countries in sub-Saharan Africa or in the Caribbean. The reconstruction is also impossible when IPUMS census samples do not provide crucial information such as the detailed relationship with the household head (e.g., China 1990 and Pakistan 1998) or single years of age (e.g., all censuses from Israel and the Occupied Palestinian Territories).

Even without these issues, the subsample of children and grandchildren of the household head may not adequately reflect recent birth history. Children may not be the biological children of both the head and his/her spouse (if present). Family recomposition after separation, widowhood, or remarriage may add to the confusion. However, it is not clear in which, if any, direction the rather small proportion of children missed would impinge on measurements of gender bias.

Mortality or migration bias. Children who died or who migrated without their parents before the survey will be missing from the household and this situation may skew estimates of subsequent birth order or sex composition of previous children and inflate birth intervals. While OCM-based fertility estimates can be adjusted easily for mortality using survival ratios by sex, there is no straightforward method for adjusting birth order in this way. In the case of migration, and especially of marriage-related migration among young women, it is safer to restrict the final analyses to the child population aged below 15 (although older children are, of course, included in the original ranking procedure). The death of some children may, however, lead to an underestimation of the birth order of younger children. PPRs computed from surviving children correspond in fact to what I call here sibling progression ratios rather than the usual parity progression ratios derived from full birth histories.

I consider this mortality/migration bias to be of limited consequence for this analysis. Using sibling rank as a proxy for birth order may, in fact, represent an advantage for this analysis, since subsequent fertility decisions are more related to surviving children than to the total number of previous births. Parents often have another child to compensate for the death of a previous child. Using the observed sibling rank rather than actual birth order may reflect the fertility strategy pursued by parents better.

Parity and mortality bias. As noted earlier, the child population by sex was converted into birth cohorts with the help of corresponding life tables, in order to obtain the SRB in the years preceding each survey or census. Yet, infant and child mortality may in some cases themselves be influenced by parity and the gender composition of families: for instance, mortality rates in India are higher for girls born into families with no sons than for girls born into families with at least one son (Rosenblum 2013). Ideally in such cases survival ratios would be modified to take account of these differences, but the likely impact on estimated sex ratios is quite modest.

Illustration: India, 2005–06

I now illustrate this method with India’s latest National Family and Health Survey (NFHS-3), for 2005–06. This is the DHS sample with the largest number of households in the world and it includes both a household roster and detailed birth history

data. This survey has already been used to assess the strength of gender bias in India (Clark 2000; Chamarbagwala and Ranger 2010; Chaudhuri 2012). From this sample, I calculated estimates of gender bias derived from the household population aged from birth to ten years (using the PR: household roster file) constructed using the OCM. These estimates were compared with those based on births during the last ten years derived from birth histories (using the BR: birth file). The births sample was slightly smaller than the reconstructed household population, as birth histories were not collected from all eligible women in the sample.

The first step in my reconstruction consisted of converting the child population into siblings. For this purpose, I only retained household members classified as children or grandchildren of the household head and removed all others (mostly nieces and nephews, accounting for less than 6 per cent of the population below age 15). Sibship was established by an identical mother (identified in DHS surveys through mother's household number). I also discarded births born to mothers absent from the household to avoid mortality or migration bias. Siblings were then ranked by age and sex in order to compute sibling rank and sex composition of previous children. I computed SPRs and sex ratios at birth from these data. Using birth history records classified by year, sex, and birth order, I then computed the same indicators based on births during the last ten years. Progression ratios were computed using the Kaplan–Meier method and correspond to the probability of a younger sibling being born before the survey date. PPRs are often computed with the Kaplan–Meier estimator (Ahn 1994; D'Addato et al. 2008; Billingsley and Duntava 2015; Jiang et al. 2016) and can also be computed for periods rather than cohorts (Spoorenberg and Dommaraju 2012).

The results show a very close correspondence between the two series of estimates, even though most differences are statistically significant (Table 1). Using either method, SPRs decline sharply from sibling rank one to two, and more slowly thereafter. The gender gap—the difference between progression ratios for families without a previous male child and those with one—increases significantly as sibling rank increases. Remarkably, the gender gap in fertility progression, which is most relevant for the estimation of gender bias, is almost identical over the two series. A closer examination shows that the largest difference between the series relates to progression ratios for sibling rank one: the figure based on kin reconstruction corresponds to an underestimation of actual fertility progression (83.9 per cent progressing to a second child against 87.7 per cent from the birth history data). As expected, this disparity can be attributed to cases where the younger sibling is missing from the household file because of mortality: 7.4 per cent of children in India died before reaching age five during the study period. Differences between the two series for progression at higher parities are two percentage points or less.

I also computed the distribution of births by sex and sibling rank according to both the kin reconstruction and birth history data sets. Table 2 displays the derived sex ratios at birth by sibling rank for births in India during the ten years before the survey. The two series of SRB estimates appear extremely close, with statistically insignificant differences in sex ratios that do not exceed 1 per 100. The SRB among first births, at below 103, appears rather low according to both types of NFHS-3 data, but that issue is beyond the scope of the study described in this paper.

In conclusion, the Indian illustration shows that the OCM method can yield very good indirect

Table 1 Fertility progression and gender gaps in fertility progression by sibling rank: a comparison of kin reconstruction (OCM) and birth history methods, India, 1995–2005

Indicator	Method used	Sibling rank 1 Per cent	Sibling rank 2 Per cent	Sibling rank 3 Per cent	Sibling rank 4+ Per cent
Sibling progression ratio (SPR)	Kin reconstruction	83.9	62.1	55.6	52.2
	Birth history	87.7 ¹	60.4 ¹	55.6	54.2 ¹
Gender gap in SPR	Kin reconstruction	2.4	19.8	24.4	27.8
	Birth history	3.2	19.4	23.8	25.6

¹Statistically different at the 5 per cent level from the kin reconstruction figures (standard error computed on unweighted figures).

Notes: The kin reconstruction (OCM) method is described in the text. The SPR at sibling rank 1 is the percentage of families going to have a second child, and so on. The gender gap is defined as the difference between progression ratios for families without a prior male birth and those with one.

Source: Computed from National Family and Health Survey (NFHS-3) files, 2005–06.

Table 2 Sex ratio at birth by sibling rank: a comparison of kin reconstruction (OCM) and birth history methods, India, 1995–2005

Method used	Sibling rank 1	Sibling rank 2	Sibling rank 3	Sibling rank 4+	All births	<i>N</i>
Kin reconstruction	102.3	109.4	111.7	109.7	107.5	105,355
Birth history	102.9	108.6	111.1	110.7	107.9	100,903

Notes: The sex ratio at birth is the number of males per 100 females born. Sex ratio estimates from the two methods are not statistically different at the 5 per cent level.

Source: As for Table 1.

estimates of fertility progression and of birth masculinity. It should provide a reliable method for estimating the forms and intensity of gender bias from larger census samples in other countries.

Gender bias in Georgia, Indonesia, and Vietnam

In this section I present results of the analysis for three countries (Georgia, Indonesia, and Vietnam) that display various forms of gender bias. At the outset, it is worth underlining that these three countries are characterized by extremely diverse social and political conditions. Georgia, Indonesia, and Vietnam exhibit distinct religious traditions (Christianity, Islam, and Buddhism, respectively), levels of socio-economic development, political systems, and overall fertility levels (from low fertility in Georgia to above replacement level in Indonesia). Therefore, we should expect different levels of fertility progression in these three countries, as well as various forms of gender bias.

Data and methods

For each country, I had a sizeable census sample dating from 2002 to 2010 on which to apply the OCM. Available census data are described in Table 3. The data sets from Indonesia and Vietnam are available from the IPUMS collection and constitute some of the largest census samples in the world. Georgia's 'sample' pertains to the entire 2002 population of Georgia and was kindly made available by their Statistical Office (Geostat). Table 3 indicates that the kin reconstruction procedures cover between 96 and 99 per cent of the entire child population aged under ten. The lowest percentage (96.1 per cent) relates to Georgia, where there is a comparatively lower proportion of nuclear households. There is, however, no reason to believe that the child population left out of this analysis would significantly bias the empirical results. Table 3 also

describes the smaller survey samples used later in this analysis for comparative purposes: the 2005 Reproductive and Health Survey (RHS) of Georgia, the 2012 DHS for Indonesia, and the 2002 DHS for Vietnam.

I followed the OCM method presented in the previous section. Based on the distribution of siblings by sex and year of birth, I computed fertility progression ratios for mothers of children aged under ten years. The Kaplan–Meier estimator was used to measure the cumulative probability of a new birth (i.e., a younger sibling) over a right-censored interval and the resulting progression ratios relate therefore to the decade preceding each census. Sex ratios derived from the census population were corrected for sex differentials in mortality using survival rates by age and sex derived from World Health Organization life tables (apps.who.int/gho/data). With child mortality in these three countries being two to three times lower than in India, the aforementioned risk of bias in indirect parity estimation is rather limited.

Georgia

Along with Armenia and Azerbaijan, Georgia figures among the three countries in the South Caucasus region that are affected by sex imbalances at birth (Duthé et al. 2012; Michael et al. 2013). It is probably the least studied of the three because of the deficiencies in its birth statistics. Civil registration in Georgia deteriorated seriously during the 1990s, after independence. Notably, the introduction of a fee for registering vital events was responsible for a growing under-reporting of births and deaths, which severely reduced the quality of vital statistics. Birth data by sex are missing for the late 1990s and no statistics by birth order are available before 2005 (UNFPA 2015). Census figures are therefore the only source for exploring trends in gender bias in Georgia during the first ten years of independence.

The 2002 Census may help to shed light on two crucial unanswered questions about gender bias

Table 3 Population samples used for Georgia, Indonesia, and Vietnam

Country	Data set	Date	Number of women aged 15–49 years	Proportion of children aged under ten covered by the OCM Per cent
Georgia	Census	2002	1,171,476	96.1
	RHS	2005	6,376	–
Indonesia	Census sample	2010	6,471,560	97.3
	DHS	2012	45,607	–
Vietnam	Census sample	2009	4,021,751	98.6
	DHS	2002	5,665	–

Notes: RHS, Reproductive and Health Survey; DHS, Demographic and Health Survey.
Source: Computed from IPUMS and Geostat samples.

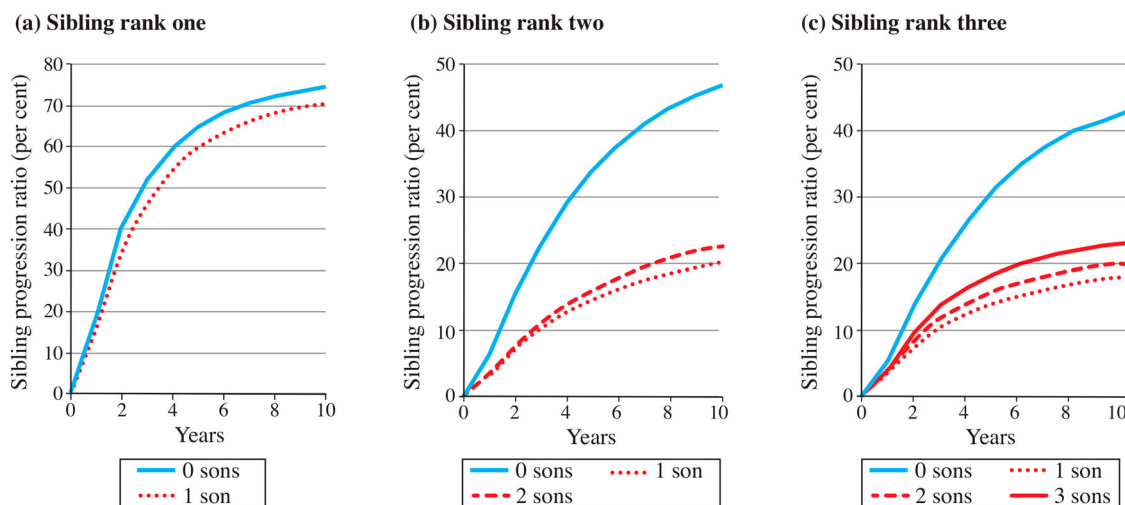
and the rising SRB in Georgia. First, is there any trace of son preference in childbearing during the 1990s, after 70 years of a communist regime that promoted gender equity? Second, can we confirm the high SRB following Georgian independence and relate it to son preference?

Progression ratios. Fertility progression ratios in Georgia were particularly low during the 1990s: at parity one, the probability of having a second child lies below 75 per cent and the probability of a subsequent child falls below 30 per cent for higher parities, according to calculations from the 2002 Census data. Such figures reflect primarily the dramatic fertility decline observed after the dismantling of the Soviet Union in 1991. Total fertility reached its lowest ever level of 1.4 children per woman in 2000–05.

SPR computations can demonstrate the influence of gender preferences on fertility progression.

Figure 1 shows fertility progression over the ten years preceding the 2002 Census, as measured by the SPR. Figure 1(a) shows that the sex of the first child has only a minor, although statistically significant, impact on the probability of a second birth, with the proportion of parents having had another child within ten years being four percentage points lower after a male firstborn than a female firstborn. But this gap widens at the next birth order, as Figure 1(b) illustrates. Parents without any boys have a probability of having a third child that is more than twice that of parents with at least one boy (47 vs. 21 per cent). A disparity of a similar extent can be seen at sibling rank three (Figure 1(c)): parents with no male offspring have an SPR of 43 per cent after ten years, as against 18–23 per cent for other parents. Starting from sibling rank two, parents with a mixed-sex progeny always have the lowest risk of having an additional child.

Our data therefore confirm the strength of son preference in Georgia during the 1990s, suggesting that

**Figure 1** Sibling progression ratios by sibling rank according to number of sons, Georgia, 1992–2002

Notes: Progression ratios measured over ten years since the birth of a child in 1992–2002. Measurements are right-censored at 2002. Source: Computed from 2002 Census, Georgia.

parents without sons are twice as likely to have a third or higher-order child as parents with a son. The next section discusses whether this selective childbearing in favour of sons also translates into measurable prenatal discrimination through sex selection.

Birth masculinity. From overall SRB estimates based on the OCM (results not shown here), a regular increase in the proportion of male births can be seen in Georgia from 1991 onwards, reaching 110 male births per 100 female births in 1996. This increase reflects the high SRB orders three and higher. The rise is almost identical to that observed in neighbouring Armenia and Azerbaijan (Duthé et al. 2012). The data derived using the OCM allowed me to restrict the analysis here to a small sample consisting of children of sibling rank three and higher. I then further subdivided this sample according to the presence or not of an elder brother in the family, in order to identify the subpopulation most vulnerable to subsequent sex selection: those where the family has no previous male child.

Results plotted in Figure 2 show the SRB since 1990 in these two groups. Among families who already had a son, the sex ratio of third and subsequent births hovers around 105. Observed fluctuations from 102 to 107 can be attributed to random variations resulting from sample size. However, these annual fluctuations are totally dwarfed in the figure by the trend observed for the remaining high-order children. In the absence of a male child in the family, the sex ratio of subsequent children at

sibling ranks three and higher exhibits a dramatic increase after 1992, reaching 150 in 1995, over 200 in 1997, and 235 on the eve of the 2002 Census. Such unparalleled SRB levels (above 200) suggest that parents who had failed to have a boy after two births may have aborted half of the subsequent female foetuses.

This record proportion of parents apparently avoiding female births should not come as a surprise in view of the progression ratios examined in Figure 1. At birth orders two and above, the progression ratios are twice as large among parents without a boy, which suggests that half of them decided to have another birth in the quest for a son. The sex ratio data show that about the same proportion of parents without any sons have probably resorted to sex-selective abortions. Thus, the gender bias revealed by fertility preferences biased in favour of sons is directly converted into active prenatal sex selection of female foetuses. In conclusion, this analysis demonstrates that not only is the birth of a third child conditional on the absence of a previous boy, as the SPR estimates show, but that subsequent pregnancies are also subject to a rigorous prenatal screening that leads to a systematic sex selection of almost half of them in the absence of a previous son.

Indonesia

Fertility in Indonesia is still commonly estimated using the OCM method (Hull 2016), for want of adequate civil registration statistics. Most of the country is reputed to have a balanced bilateral kinship

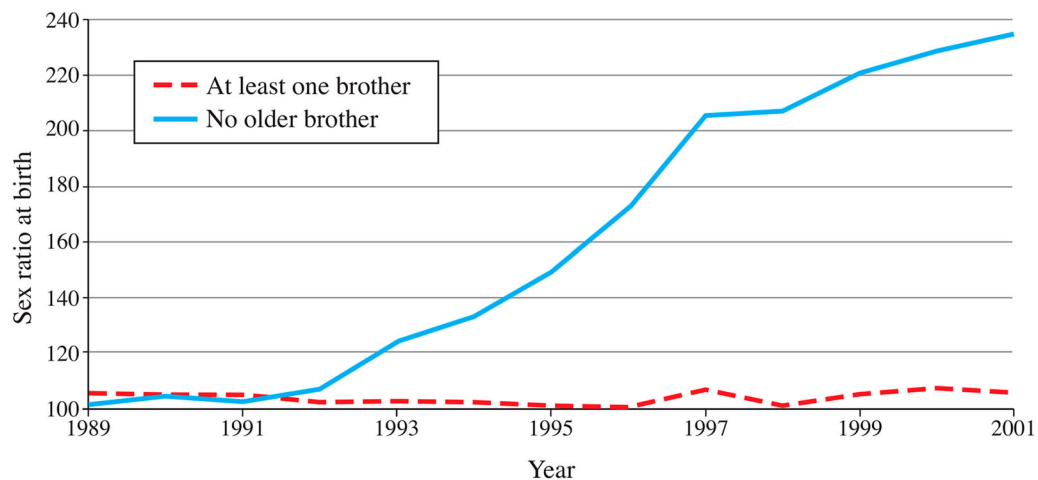


Figure 2 Sex ratios at birth at sibling ranks three and higher, according to the presence of an older brother, Georgia, 1989–2001

Note: Sex ratios corrected for mortality by sex and age.

Source: Computed from 2002 Census, Georgia.

system, in which the male and female lines play similar roles, and hence we would not expect to see pronounced forms of gender bias (Kevane and Levine 2000). Yet, we do not know much about any selective fertility strategies used by parents. National demographic surveys are not representative at the regional level; the sample of the latest 2012 DHS survey was 800 households in each province. In addition, microdata from the regular National Socio-Economic Surveys (SUSENAS)—from which annual vital rates are estimated—are not available for reanalysis. The 2010 Census sample is therefore the only source providing disaggregated information on gender preferences. I examine two questions here: (1) does Indonesia’s mostly bilateral kinship translate into a lack of gender bias in childbearing? and (2) does this apparent gender indifference hold true in all provinces of the country? No computation of birth masculinity is attempted here because of the absence of pronounced sex imbalances at birth in Indonesia as a whole (Guilmoto 2015).

Progression ratios. Using findings based on the OCM, I now re-examine the hypothesis of gender equity in the light of progression ratios by sibling rank and sex composition of previous children (see also Guilmoto 2015). As Figure 3(a) shows, having a son or daughter at first birth has absolutely no impact on progression to second birth in Indonesia, as both curves are identical at sibling rank one. After two births (Figure 3(b)), some minor variations can be seen in the behaviour of parents according to the gender composition of the family. But contrary to what can be seen in patriarchal countries, the presence of a son does

not determine subsequent fertility. Here, it is the lack of mixed offspring (i.e., at least one son and one daughter) that increases fertility progression by five percentage points after ten years. The difference remains modest. At sibling rank three (Figure 3(c)), the probability of having another child falls slightly, but once again, gender composition plays a minor role. Higher proportions of parents without a boy do go on to have an additional child, but the gap between them and parents with a mixed-sex family composition is once again quite modest (six percentage points).

Unlike in patrilineal settings, where married sons stay with their parents, post-marital co-residence in Indonesia is equally likely to occur with the husband’s or the wife’s parents. This feature is reflected in rather gender-indifferent fertility strategies, as illustrated by the national SPRs. To explore this further, I also wanted to examine the presence of regional variations. I identified two provinces in Indonesia with unorthodox kinship systems. On the one hand, West Sumatra (known as Sumatera Barat or Sumbar) is well known for the distinctly matrilineal and matrilocal system followed by its main ethnic groups, the Minangs (Blackwood 2000). The Minangs (or Minangkabau) are considered one of the largest matrilineal populations in the world. On the other hand, the population of the eastern island of Bali is Hindu and characterized by a high degree of patrilineality (Parker 2003). Balinese constitute the largest patrilineal population in Indonesia, but other smaller groups such as Bataks and Melanesian populations in the Eastern islands also follow a patrilineal system. Bali and West Sumatra correspond, respectively, to the largest concentrations of

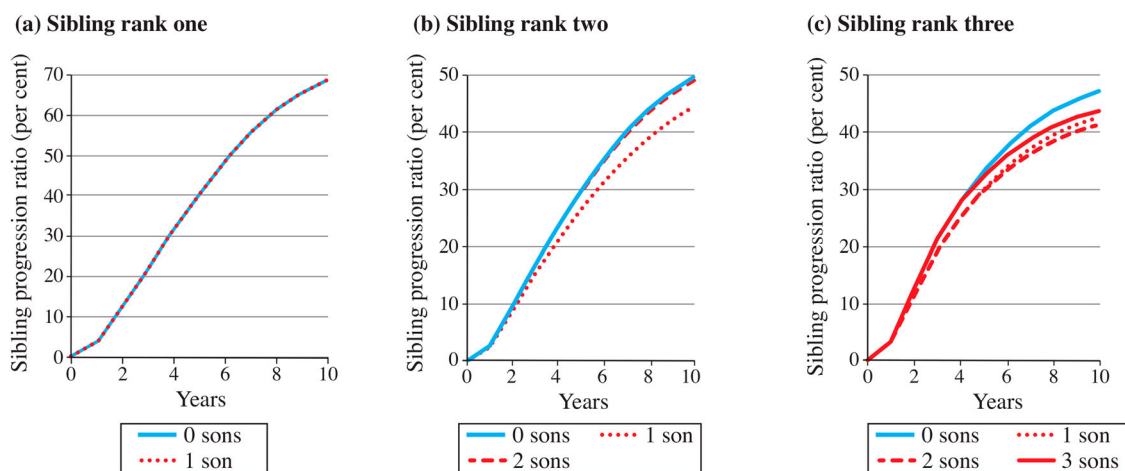


Figure 3 Sibling progression ratio by birth order according to the number of sons, Indonesia, 2000–10

Notes: Progression ratios measured over ten years since the birth of a child in 2000–10. Measurements are right-censored at 2010. *Source:* Computed from 2010 Census sample, Indonesia.

Table 4 Fertility progression by sex composition of previous children, 2000–10, Indonesia and two provinces

	Sibling progression ratios							
	Sibling rank 1		Sibling rank 2			Sibling rank 3+		
	Sex composition		Sex composition			Sex composition		
	One girl Per cent	One boy Per cent	Two girls Per cent	Mixed Per cent	Two boys Per cent	Only girls Per cent	Mixed Per cent	Only boys Per cent
West Sumatra	80.8 ¹	82.5	62.3 ¹	59.0 ¹	69.0	54.1 ¹	47.2 ¹	57.5
Bali	80.0 ¹	72.6	59.4 ¹	32.7	30.7	50.8 ¹	26.2	27.6
Indonesia	68.5 ¹	68.6	49.7 ¹	44.5 ¹	49.0	47.3 ¹	42.3 ¹	44.4

¹Statistically different at the 5 per cent level according to the log-rank test ('only boys' is the reference category).

Source: Computed from 2010 Census sample in Indonesia.

patrilineal and matrilineal populations found in Indonesia. I repeated the fertility progression analysis, focusing on these two regions, in order to explore potential variations in gender preferences.

The results are summarized in Table 4. For each province, I have computed the progression ratios after ten years based on the Kaplan–Meier estimator. Results are displayed by sibling rank (1, 2, and 3+) and further disaggregated by the sex composition of the family. Because of the large sample size, most differences in fertility progression across gender compositions are statistically significant. As shown in Figure 3, the numerical results for Indonesia as a whole reflect relative gender indifference after one child (very similar progression ratios) and a slight preference for a mixed composition after two or more children (lowest progression ratios).

However, the role of sex composition on fertility progression appears rather heterogeneous in Indonesia as the case of the two provinces under study demonstrates. In general, progression ratios are much lower in Bali than in West Sumatra because of differences in overall levels of fertility. The more striking feature is the variation related to gender composition: we see, for instance, that after the birth of a firstborn girl, Balinese have a higher probability of having a second child during the following ten years than after a boy. This eight percentage point difference widens considerably at sibling rank two, with parents of two girls having almost twice as much risk of progressing to a third child than parents who have a mixed-sex family composition (59 vs. 33 per cent). The same feature is visible at the higher birth orders (51 vs. 26 per cent) and demonstrates the force of son preference among the Balinese. The absence of a daughter in Bali plays almost no role in fertility progression, suggesting that the Indonesian principle of preferred mixed composition is absent on the island.

In comparison with Bali, the situation in West Sumatra appears diametrically different. In this province, the birth of a first boy triggers a slightly higher probability of progressing to a second birth than the birth of a first girl. This inclination becomes more visible at higher sibling ranks and the absence of a female child is always associated with significantly higher subsequent fertility. While differences in fertility behaviour between couples with or without girls are modest (two to ten percentage points), they are statistically significant and provide a rare case of distinct preference for daughters. This childbearing behaviour stems primarily from the dominance of the ethnic Minangs, who account for 87 per cent of the provincial population of West Sumatra. In conclusion, the OCM results demonstrate that, while Indonesia overall is characterized by a preference for mixed offspring, the 2010 Census sample also shows that the national figures conceal a great deal of local and ethnic diversity, exemplified here by the cases of Bali and West Sumatra.

Vietnam

Despite many similarities with China (rapid economic development, kinship systems, son preference, family planning regulations, and Confucian traditions), the SRB in Vietnam has long been normal (Bélanger et al. 2003). However, a more recent study has demonstrated the presence of distinct son preference according to available sample data (UNFPA 2009), and the 2009 Census provided stronger evidence of sex imbalances at birth (Guilmoto et al. 2009). In the absence of adequate survey data and reliable birth registration estimates, the 2009 Census sample is the main source allowing an examination of two related aspects of gender bias in Vietnam: (1) is son preference present in Vietnam?

Table 5 Fertility progression by sex composition of previous children, computed from census and demographic survey data, Georgia, Indonesia, and Vietnam

Country	Data set	Year	Progression ratios (PPR/SPR)					
			Sibling rank 1		Sibling rank 2		Sibling rank 3	
			One girl Per cent	One boy Per cent	Only girls Per cent	At least one boy Per cent	Only girls Per cent	At least one boy Per cent
Georgia	Census	2002	74.5	70.4	46.9	21.0	42.9	19.6
	RHS	2005	77.7	72.0	54.7	18.4	41.7	16.4
Indonesia	Census	2010	68.5	68.6	49.7	46.1	47.3	42.4
	DHS	2012	70.7	74.5 ¹	50.7	44.3	43.6	39.1 ¹
Vietnam	Census	2009	82.7	78.3	54.4	26.8	54.9	29.2
	DHS	2002	84.9	84.5 ¹	62.7 ¹	34.5 ¹	53.8	28.9

¹Survey-based estimates statistically different at the 5 per cent level from the Census-based estimates according to the log-rank test (standard error of DHS estimates computed on unweighted figures).

Notes: PPRs (parity progression ratios) are computed from survey data and SPRs (sibling progression ratios) from census data. Both are computed over the ten years preceding the date of data collection. RHS, Reproductive and Health Survey; DHS, Demographic and Health Survey.

Source: Computed from census and survey sample data (described in Table 3).

and (2) can the rise in the SRB after 2000 be dated more precisely?

Progression ratios. Total fertility in Vietnam has gradually declined over the last three decades and reached replacement level by the time of the 2009 Census. The role of son preference in determining fertility behaviour was first noticed by Haughton and Haughton (1995), while Becquet (2015) provides a more detailed analysis. The penultimate row of Table 5 shows SPRs for Vietnam calculated from 2009 Census data. Since there is often no significant difference in fertility progression between parents with one or more boys, I have simplified the gender composition in Table 5 to parents with only girls or with at least one boy.

As the disaggregated SPR figures based on 2009 Census data illustrate (Table 5), the fertility strategy of Vietnamese couples depends closely on the gender composition of their offspring. After one birth, the tendency to favour male births is almost negligible. Compared with parents without a boy, those with a boy are only four percentage points less likely to have a second child within the next ten years. This gender gap widens considerably at sibling rank two, since 27 per cent with at least one boy go on to have a third child, as against 54 per cent of the parents with no sons. The progression ratio, therefore, is twice as large in the absence of a previous male child, a similar finding to that observed in Georgia. The gap diminishes only marginally at the next birth order: parents without a son still have a 25 percentage point

higher probability of having a fourth child than other parents. In a separate analysis, Becquet (2015) demonstrated that there is no difference in progression ratios between parents with two boys and those who have one boy and one girl. This shows that, contrary to what can be observed in Indonesia, there is still no distinct desire for a girl in Vietnam after the birth of two boys.

Birth masculinity. Figure 4 aims to answer the second question, by presenting the evolution of annual SRB estimates to date the onset of prenatal sex selection in Vietnam at the national level. The population data derived from the 2009 Census were converted into sex ratios at birth, after correcting for mortality by sex and age. Instead of plotting the annual SRB estimate for all births, I decomposed the births sample into three groups according to birth order and sex composition of older siblings, distinguishing firstborns from higher-order children born with or without an elder brother. The sex ratio of children born after the birth of a boy appears to stay fairly stable at around 105 during the entire period, notwithstanding yearly fluctuations. The sex ratio of children of sibling rank two or higher without a brother is slightly elevated around 106–108 up to 2003, but the rise after that year is spectacular. The SRB of this sub-population reaches 115 within a few years. The role of son preference in the rise of the overall SRB in Vietnam is therefore clear.

Also of interest is the trend relating to firstborns. Although less pronounced than for higher-order births, we can observe a slight increase during the four years preceding the census, with a SRB close

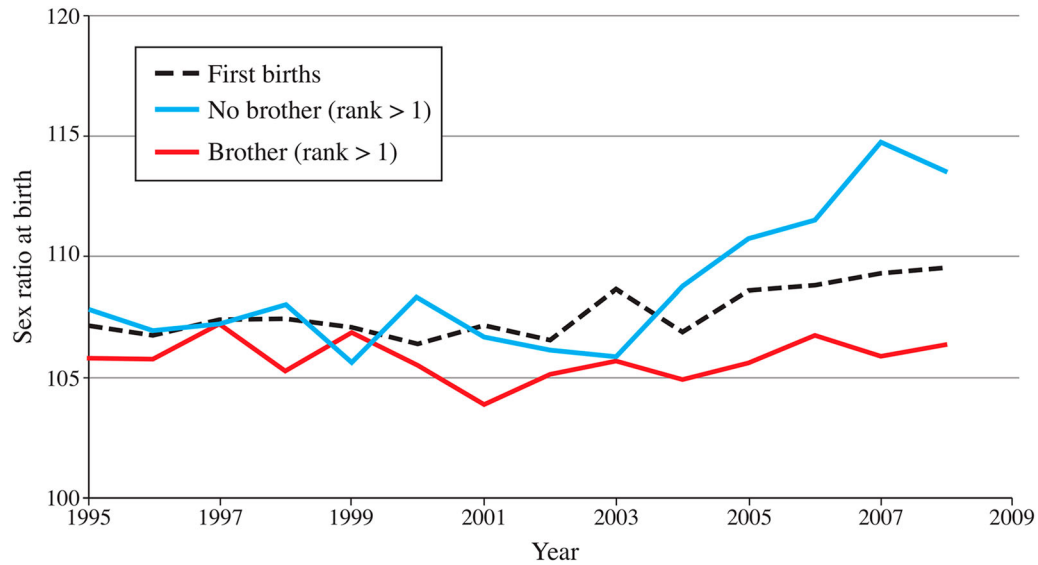


Figure 4 Sex ratio at birth for first births and for later births (rank > 1) according to presence of an older brother, Vietnam, 1995–2008

Note: Sex ratios corrected for mortality by sex and age.

Source: Computed from 2009 Census sample, Vietnam.

to 110 in 2008. This relatively high SRB among first births is in fact a specific feature of sex selection in Vietnam and was already detectable from demographic survey data (UNFPA 2009). Figure 4 shows that it started rising in 2005, just after the SRB for higher-order births did.

Comparison with DHS estimates

To compare the census-based results with those from survey sources, I performed similar computations based on the closest DHS/RHS samples existing for the three countries used in this paper (see Table 3). The results, shown in Table 5, are based on simplified gender composition (families with only girls or at least one boy) and are restricted to fertility progression ratios for the first three birth orders. We cannot compare SRB estimates from the two sources, as sample-based figures are affected by large random variations resulting from the small number of births.

Results are very similar overall and there is a strong linear association between the census estimates and those derived from sample surveys. A regression analysis of the 18 sample-based figures against census figures yields a very high correlation coefficient (with $r^2 = 0.97$) between the two series, despite potential disparities arising from variations in the time period analysed.

Census-based estimates of fertility progression are often lower than sample-based figures and this is

probably because of the number of deceased or absent siblings missed in censuses. In other cases, census figures are above DHS estimates. Yet, the gaps between the series are significant at the 5 per cent level for less than a third of the Census–survey comparisons and may simply arise from the time gap or the limitations of survey samples for disaggregated analysis.

Conclusion

This paper aimed to show the advantages of applying the OCM (Avery et al. 2013) to assess the presence and the intensity of gender bias in reproductive behaviour. The justification for the method arose from the lack of either large-scale surveys with birth history data or usable civil registration estimates, combined with the availability of large census samples. The OCM procedure relied on the classification of the household population according to their relationship to the household head. Individuals identified as children or grandchildren of the head of the household were used to reconstruct sibship, with siblings subsequently classified by year of birth and sex. In some cases, census data also identified the biological mother of children present in the household.

I computed the birth order and sex composition of previous children for all births. The interplay between these two variables proved to be a powerful predictor of gender preferences in reproductive

behaviour. In the case of gender bias, the absence of a child of a given sex may result subsequently in increased fertility or a skewed SRB. The reliability of the method was first illustrated with data from a large sample from India: the OCM estimates for both fertility progression and birth masculinity proved almost identical to figures drawn from detailed birth records. The comparison also showed how high child mortality might affect the quality of estimates for progression to second birth slightly.

I further illustrated the potential use of the method with three different census samples from Georgia, Indonesia, and Vietnam. The share of children that could not be properly included in the OCM analysis turned out to be negligible in each country. Using my procedure, I estimated fertility progression and sex ratios, as well as differentials by birth order, gender composition of previous children, and region. Until now, studies based on vital statistics or demographic surveys could not yield such disaggregated estimates. The findings confirmed for instance the strong preference for sons in Georgia and the related increase in birth masculinity after 1991. The results also showed the overall absence of sex preference in Indonesia as a whole, which masked the presence of clear preferences for either daughters or sons in at least two provinces. Finally, the analysis illustrated the intensity of son preference in Vietnam and showed how the rise in the SRB emerged only after 2003. A more sociological analysis of gender bias in these countries can be found elsewhere (Guilmoto 2012, 2015; UNFPA 2015; Becquet 2016).

The OCM method has some limitations, as it requires a large household roster with high-quality data on age, sex, and family relationships. In addition, complex family structures and high mortality may bias the results. Yet, as a method it has considerable strengths. First, the systematic examination of variations in fertility progression according to the previous sex composition of the family provides a robust tool for testing the presence of gender bias in fertility behaviour. This measurement provides a better indicator of observed gender preferences than ideal family composition, intended fertility, or contraceptive behaviour. Second, the SRB by sibling rank can be computed easily for previous birth cohorts after correcting for mortality. This method can provide robust estimates for countries where vital statistics are unavailable, unreliable, or fragmentary. Third, the SRB can also be computed according to the sex composition of previous children, whereas this cannot be done from vital statistics that record only birth order. This conditional sex ratio is the best indicator of the presence of

deliberate gender-biased sex selection in a population. Finally, both fertility progression and birth masculinity can be further cross-tabulated by time period or by household characteristics such as geography, ethnicity, or socio-economic status. IPUMS census samples are usually large enough for systematic regional or socio-economic disaggregation. In summary, the OCM method provides further tools with which to explore the complex distribution of gender-biased reproductive behaviour within countries and, thus, potential further applications of this method are considerable.

Notes

- 1 Please direct all correspondence to Christophe Z. Guilmoto, IRD–CEPED, Université Paris Descartes, 45 Rue des Saints-Pères, 75006 Paris, France; or by e-mail: christophe.guilmoto@ird.fr
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