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September 2015 • 32

Working Papers du CEPED

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Citation recommandée • Recommended citation

Guilmoto C., « Mapping gender preferences and sex imbalances in Indonesia », *Working Paper du CEPED*, numéro 32, UMR 196 CEPED, Université Paris Descartes, IRD), Paris, septembre 2015.
Available at http://www.ceped.org/wp

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Mapping gender preferences and sex imbalances in Indonesia

Christophe Z. Guilmoto[*]

Abstract
Indonesia is usually viewed as a country free of the acute forms of gender discrimination observed elsewhere in East or South Asia. This situation is often ascribed to Indonesia's bilateral kinship system. This paper aims at re-examining gender differentials by focusing on ethnic and regional variations using new indicators of marriage practices and gender bias derived from 2010 census microdata. To do this, we first analyze the heterogeneous marriage systems across Indonesia and highlight the presence of patrilocal patterns in many parts of the archipelago. We also probe the presence of son preference in fertility behaviour. We finally examine the evidence of excessive child sex ratios and excess female mortality in some areas and show how they are related to son preference and patrilocal residence systems. The paper concludes with a broader regional perspective on female demographic vulnerability, distinguishing bilateral Southeast Asia from more patrilineal Melanesia.

Key words
Indonesia, Southeast Asia, Melanesia, gender discrimination, marriage patterns, sex differentials in mortality, prenatal sex selection, abortion

Acknowledgments
Previous versions of this work have been presented in Singapore, Paris, Kuala Lumpur and Washington. Thanks to Emmanuel Todd for initial inspiration and Gavin Jones for later support. Aris Ananta, Evi Arifin, Nicolas Lainez, Theresa Devasahayam, Barbara Miller, Devanto Pratamo and colleagues at CEPED helped me to sharpen my arguments. This work was supported by an invitation by the J Y Pillay Comparative Asia Research Centre to the National University of Singapore during 2013.

Introduction

Son preference and excess child mortality among girls have been observed in many regions of the world, with countries such as India, China and South Korea featuring prominently over the last decades (Croll 2000; Guilmoto 2012b). The strong regional gradient of sex imbalances at birth has encouraged researchers to focus on South Asia, East Asia, South-east Europe and South Caucasus. While signs of elevated levels of birth masculinity were also found in Southeast Asian countries such as Singapore and Viet Nam, the analysis of North Viet Nam or Singapore's Chinese affected by high sex ratio at birth (SRB) suggest the influence of East Asian Confucian values systems on gender behaviour. This suggests

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that Southeast Asia–from Myanmar to Indonesia–may remain a region immune to prenatal sex selection compared to other parts of Asia (Wongboonsin and Ruffolo 1995).

Yet Indonesia appears rather heterogeneous in terms of family systems and previous studies suggest kinship structures in Asia may be at the root of several forms of gender bias (Dyson and Moore 1983; Dube 1997; Guilmoto 2012a). This paper aims therefore at re-examining the case of Indonesia in the light of variations in family arrangements to assess whether the country is indeed free of forms of gender preference and distorted sex ratios as suggested by Kevane and Levine (2000). To do this, we will summarize in the first section the main factors behind the rise in sex ratio at birth. This will help us to argue that Indonesia meets the conditions of potential prenatal or postnatal bias and may well be worth a revisit from a theoretical standpoint. We then describe our rich census-based dataset and describe some new indicators of reproductive and residential practices. The following section presents three sets of results: the heterogeneous marriage systems across Indonesia ranging from matrilocal to strict patrilocal arrangements, variations in gender preference patterns visible across regions and ethnicities, and traces of elevated child sex ratios and excess mortality among girls in various provinces. We probe in particular the links between family structures, fertility behaviour and prenatal or postnatal sex imbalances. We conclude with a discussion of how Indonesia's anthropological and linguistic diversity may be related to the variety of gender systems that distinguish in particular regions east of Java from the rest of the country.

The context of sex selection and Indonesia's situation

The main factors associated to prenatal sex selection

The conditions of emergence of prenatal sex selection are now better understood and three distinct supply, demand and fertility factors can be distinguished (Guilmoto 2009). The supply component refers to the fact that sex selection was first made possible by a rapid progress in reproductive health technology over the last fifty years, involving successively modern contraception, abortion and prenatal diagnosis. Contraception first allowed parents to stop child-bearing once they had reached the number of children desired, and in regions characterized by uneven gender preferences, it resulted in the fertility differentials linked to the sex composition of the family as illustrated for instance by Viet Nam (Haughton and Haughton 1995; Pham 2012). Later on, prenatal diagnosis through amniocentesis and ultrasonography, coupled with access to pregnancy termination, led many parents to use sex-selective abortion to attain their gendered fertility objectives. Today, access to sex selection technology is no more a serious obstacle in Asia, except where abortion is severely restricted (e.g. Philippines) or where the private healthcare system remains undeveloped (e.g. Afghanistan).

There are, however, two other mediating factors for explaining the rise of sex selection. One is low fertility. In a high-fertility regime, parents may be able to reach their fertility objectives through repeated births and applying the stopping rule. But in a low-fertility regime, parents will be adverse to go for an additional pregnancy in order to reach the desired sex composition because of the marginal costs attached to an additional birth and the uncertainty of the sex of the future child. When fertility declines, the probability to end up without a son is for instance bound to swiftly increase: it is 12% with three children and rises to 24% with two children. Another factor–son preference–is undoubtedly the most important precondition of sex selection and corresponds to the existence of an entrenched gender bias. Son preference is the "demand variable" at the core of skewed sex ratios at birth and it can be attributed to the prevalence of unequal gender relations and to the gendered division of caring for elderly parents.

Its social interpretation is probably complicated, as we observe for instance no obvious relationship between son preference and many other well-documented dimensions of gender inequality–such as sex differentials in education, access to employment, political and religious rights, or even domestic violence. Son preference is probably a somewhat unique dimension of gender inequity, irreducible to other features of gender-based inequalities.

Son preference and kinship systems

Son preference may prove hard to measure in spite of the apparent simplicity of the notion. Field surveys document the presence of "patriarchal" norms and their influence on family formation, including the need for a male progeny (Croll 2000). But such surveys cover only specific localities and never provide a systematic mapping of variations in gender preference systems across a country. Moreover, while they attest the local presence of gender bias, they cannot provide any reliable measurement of its relative magnitude. They may at best offer a qualitative indication, without assessing the comparative intensity of son preference.

When expressed in quantitative indicators, son preference is often equated indirectly with its demographic outcomes, such as the sex ratio of the last birth in a family or the overall sex ratio at birth (Bongaarts 2013). Another source for understanding son preference relates to the information collected on women's or couples' preference by sample surveys such as DHS rounds (Fuse 2010). This information is based on stated preferences (e.g. desire for an additional child in the absence of a son) and at times on indirect behaviour (e.g. contraceptive behaviour in the absence of a son). But attitudes and statements may not reflect the actual fertility behaviour. Moreover, such data are collected during surveys and do not allow a detailed examination of variations in gender preference systems because of the limited size of the samples.

To overcome this gap, we will use an indicator based on conditional fertility behaviour as described further below. We will also follow hints derived from anthropological analysis of gender systems and focus on ethnic groups and local marriage patterns to identify vulnerable populations. Gender norms are strongly anchored in local traditions and structured along ethnic lines. Groups displaying the most accentuated form of bias towards sons are expediently labelled "patriarchal" (Greenhalgh 2013), but they are better identified in terms of patrilineal or agnatic descent (family identity transmitted along the male line) and of patrilocal or virilocal residence (preferred residence of married couples with or close to the residence of the husband's family). Coresidence is in fact a central dimension of family systems as it determines where new married couples will live. Most importantly, patrilocal arrangements often translate into long-term support to the parents and mean that married women will lose their close connection with their native family as they are assumed to support their husband's family in priority (Das Gupta et al. 2003; Grogan 2013a). In contrast, bilateral family systems ignore differences between husband's and wife's families and tend to lead to more symmetrical patterns of coresidence, which are classified as bilocal (ambilocal). Uxorilocal (matrilocal) systems are even observed when new couples tend to reside more often with the bride's parents than with the groom's.

Why Indonesia?

At first sight, Indonesia does not seem particularly suited for a study of son preference and distorted sex ratio. In keeping with the theoretical framework presented above, more than a few reasons seem to militate against an in-depth study of Indonesia. To start with, abortion is legally restricted in Indonesia and women could therefore find it difficult to use it as a way to adjust their gender preference (Sedgh

and Ball 2008). To which we may add that fertility is not low as in East Asian or East European countries and may even have recently rebounded (Hull 2014). In addition, son preference–the crucial demand factor itself–may be weak, especially since Indonesia is not characterized by patrilineal and patrilocal systems typical of regions affected by sex imbalances in East or South Asia. Confirming the absence of the main three preconditions we have briefly reviewed, we may finally add that the sex ratio at birth in Indonesia appears to have always remained at a normal level of the recent decades close to 105 male births per 100 female births. Consequently, it should come as no surprise that previous studies have reported the absence of pronounced son preference and sex imbalances in Indonesia (Kevane and Levine 2000; Fuse 2010; Bongaarts 2013).

A closer look at Indonesia's situation suggests, however, that this preliminary overview requires some qualification. Adopting a broader regional perspective, we note that instances of inordinate sex ratio at birth in Southeast Asia have already been observed in Viet Nam (Guilmoto 2012b). Some specific communities in Southeast Asia also exhibit high SRB levels and the case of Chinese in Singapore and Malaysia in the past has been already described (Graham 2007; Sia Po Chua 2014). Recent statistics confirm that the sex ratio at birth among ethnic Chinese was 108.1 male births per 100 female births in Singapore, and 107.4 in Malaysia in 2009-2012. Such levels, though moderate, are significantly higher than the natural sex ratio at birth assumed to lie close to 105 (vital statistics from the national statistical offices). In Indonesia, evidence of sex imbalances at birth appears limited, but the only demographic study of sex ratio in the country conducted in 2005 has underlined the gradual masculinization of Indonesia's population (Sigan and Dasvarma 2005). The overall sex ratio has gradually risen over the last thirty years, peaking at 101.2 males per 100 females in 2010. This pioneer study attributed this rise in male migration, but also mentioned excess female mortality and the sex ratio at birth as potential explanations. Its authors noted that the sex ratio of the population below one may have been slightly higher than usual in 2000, a feature confirmed by more recent figures from the 2010 census (see further below). We may also observe that the most recent estimation of the impact of gender discrimination points to Indonesia as one of the countries in the world with more than one million missing women in 2010 (Bongaarts and Guilmoto, 2015).

We need also to reconsider Indonesia's context in more detail by reviewing the three preconditions of sex selection. To begin with, access to new reproductive technologies such as ultrasound is easy and cheap in Indonesia and there is in particular no law preventing doctors from telling the sex of the foetus. While abortion is officially banned in Indonesia (except to save the life of the mother or in cases of rape), abortion is rather common and takes place notably under the alternative appellation of menstrual regulations (Sedgh and Ball 2008). It is estimated that several million abortions are performed every year–2.4 million in 2012 according to the National Population and Family Planning Agency (see also Hull and Widyantoro 2010). While these numbers are probably exaggerated, we may conclude that at least in theory, Indonesians do have access to sex selection technologies by combining access to legal and illegal facilities. Turning our attention to fertility, we may point out that fertility rates lower than replacement level are not a prerequisite of prenatal discrimination. After all, sex selection appeared in Indian regions in the late 1980s, when the overall fertility level was still above 3 children per women (Booth et al. 1994). While fertility decline in Indonesia may have indeed stalled during the previous decade, the average fertility is already rather low at 2.3 children per women (Hull 2014). At such a level, the probability of having no boy would affect 19% of the families. In addition, many provinces and regencies in Indonesia have already fertility rates well below two children per woman (BPS 2011; BKKPN 2013).

The key demand factor of the sex selection equation is, however, the most problematic for Indonesia, where son preference seems to be almost non-existent (Wongboonsin and Ruffolo 1995). Reid (1988) set

the tone for the entire Southeast Asian region by stressing the relative advantageous position of women in a historical perspective. There are numerous studies documenting forms of gender inequity in the country in the context of the recent rise of political Islamization (Robinson 2009, Blackburn 2004), but very little to suggest that men are generally preferred to women in society. Studies relying information on stated preference towards boys or girls do not confirm the presence of any specific gender bias (Fuse 2010). Similarly, the work by Levine and Kevane (2003) fails to identify any bias against women, including in patrilocal areas. The typically Southeast Asian anthropological setting encountered in Indonesia suggests indeed that bilateral kinship systems predominate and are more balanced and cannot be regarded as similar to the patriarchal environment of China and India (Devasahayam 2009; Dube 1997).

In this paper, we will however re-examine some of these tenets in the light of the archipelago's anthropological diversity and test the linkages between on one side family systems and ethnic distribution, and gender discrimination on the other side. We want to avoid equating Indonesia's population with its most populous groups–such as the Javanese or the Malays–and posit on the contrary that anthropological diversity may lead to a great diversity in gender systems, with potential implications on sex selective behaviour (Rammohan and Johar 2009; Carranza 2012). Using parity progression ratios, Filmer et al. (2009) observe a modest, but significant son preference in Indonesia and Palloni (2014) shows the impact of prior gender preference in health outcome of births. We will first use recent census data to map the gender aspect of residential arrangements and of reproductive behaviour in Indonesia. We consider in particular that gender preferences should be firstly assessed through actual behaviour than on attitudes or local norms (*adat*). We will use this information to examine in detail two typical manifestations of gender discrimination: sex imbalances among children and sex differentials in mortality. Following the patterns observed elsewhere in Asia, we will then test if there is a link between family systems and gender bias in reproductive behaviour or in mortality. This will lead us to draw up a more complex map of gender differentials in Indonesia in the last section of this paper.

Data used and methods

In order to cover the entire country adequately, we use the large IPUMS (Integrated Public Use Microdata Series) dataset derived from the 2010 census. This 10% sample includes a total of 23.6 million individuals drawn from 6.1 million households. The considerable size of this sample ensures the possibility to analyze specific subpopulations, which we illustrate in the section on progression ratios with the case of small ethnic groups. Variables and indicators used are presented further below.

Coresidence systems

We use here households as defined during the census. Their contour may be affected by the very process of enumeration–when interviewers decide to count separately or not related households that share in a common compound–, but we have no way to correct for such potential bias. More precisely, we focus on married individuals classified as "children" of the household head. This population of married children in itself is rather large in the census sample and corresponds exactly to children coresiding with their parents. We also add married "grand-children" and "adopted children" to this total of married "children" to compute coresidence indices. For simplicity's sake, we will call this aggregate population "married children." The proportion of males and females among coresiding married children provides a simple and valuable index of patrilocality. This computation is limited to coresiding married children below 50 years. About 10% of the married population in this age group is classified as

child or grandchild of the head of the household out of a maximum proportion of 50% (since both spouses cannot be simultaneously classified as "children"). This percentage rises to 24% among married individuals aged less than 30 years. Other patterns of postmarital coresidence–such married household heads living with at least one older parent or parent-in-law– cannot be analyzed with the census data.

It is necessary to stress at the outset that marriage is often neolocal in Indonesia and that the newlywed may only live briefly with parents. Since the 2010 census supplies no information on age at marriage, we cannot compute the frequency of coresidence by marriage duration. The proportion of couples coresiding with parents declines with age, from 52% below 20 and 37% among the 20-24 to less than 3% above age 40. The same percentage for men decreases from 57% among the 20-24 to less than 4% above 40. But we are not interested here in the actual frequency of postnuptial coresidence and its implications on family solidarity (see Kreager and Schröder-Butterfill 2008; Schröder-Butterfill 2006). In the following analysis, we only use the proportion of men among coresiding married children as an indicator of the relative intensity of patrilocality, even if coresidence is brief and less common than in other Asian countries. Our approach of kinship is therefore essentially pragmatic and based on observed household arrangements, which may correspond only imperfectly to normative systems as reflected by *adat* customs. *Adat* refers to the set of customary laws regulating local society and covering in particular marriage arrangements (Koning 2000; Buttenheim and Nobles 2009). Surveys that have attempted to map gender bias are only based on a few thousands observations or the classification derived from Murdock's *Ethnographic Atlas*. As such, they provide a rather simplified view of the country's level of diversity compared to what computations based on the census data can tell on household structures and gender preferences. The 2010 sample provides indeed a total of 881,000 married children aged less than 50 and living with their parents, which is large enough for further ethnic and regional disaggregation.

Birth history, son preference and sibling progression ratio

Son preference will be here measured through revealed fertility preferences: we use the parity progression ratios (PPRs) according to the presence of sons and daughters as a reflection of the intensity of gender preferences. The computation of such PPRs requires a large size sample since we need to identify children by individual rank and by previous gender composition. For instance, children of parity 3 account for 12.6% of our sample. Among them, children with no older brother–an indicator used to measure the influence of the previous gender composition–represents only 2.7% of all children in our sample. Such computations are therefore not feasible when using small sample surveys, but the large size of the census microdata provides figures large enough for further regional or ethnic disaggregation.

The major challenge consists in reconstructing birth history. We borrow here from a technique based on the own-children method developed by Cho et al. (1986) to estimate past fertility based on family composition and already used in various countries for family reconstruction. The method consists of using the detailed variable describing the relation to the household head to identify two basic family nuclei. In the case of two-generational nuclear households, we simply identify "children" of the head of household. In the second case, we have married "children" of the head of household along with their own children, classified as "grandchildren" of the head of the household. In such situations, we keep "grandchildren" of the household head when there is one and only one "married child" in the family, assumed to be the parent. We exclude households comprising more than one "married child" because of the risk of confusing real siblings and cousins who are all classified as "grand-children." These two

family configurations of "children" and "grandchildren" cover 94% of the sample population below 15 years, which indicates that our method covers almost the entire child population.

Once siblings are adequately identified, we can then rank them by age and obtain a ranking similar to birth parity and compute progression ratios. We call these ratios *sibling progression ratios* (SPR) to underline their close similarity with parity progression ratios. They are computed as the probability of finding a younger sibling in the household. The ranking of siblings is not identical to birth order since absent and deceased children are missing from the household listing. As a result, child ranks underestimate parity. Yet, as far as mortality is concerned, this child rank provides a better indicator process since it factors in the impact of child mortality on family formation. Family-building strategies are indeed more closely related to surviving children than simply to births. Older absent children due to family, marriage, study, or labour reasons may, however, distort the ranking of siblings.

Since our measurement of sibling progression is based on right-censored by the census date, we will use the Kaplan-Meier estimator to measure the cumulative proportion of children who have had a younger brother or sister before the 2010 census. The computation is restricted to children born since 2000 in order to focus on one single decade and to avoid distortions due to older children missing for other reasons. Once again, the subsample used here (4.3 million children aged 0-9) is large enough for further subdivision.

The quality of SPR estimates–and their similarity with PPRs–is illustrated by the use of sibling progression ratios to compute fertility. We can apply to sibling progression ratios the classical formula linking parity progression ratios to fertility rates (Preston et al. 2001):

$$TFR' = \sum_{i=0}^{n} \prod_{j=0}^{i} SPR_j$$

where SPR_j is the sibling progression ratio at rank j (probability of child of rank i to have a younger sibling in the household), SPR_0 is the proportion of women aged 40-49 with at least one child and TFR' the initial estimate of past fertility (to be corrected for child mortality).

We use here the Kaplan-Meier procedure to compute the SPR_i over a 15-year period. The crude TFR' thus estimated from sibling progression ratios is 2.37 children per woman. Once corrected by a survival factor of 0.95 for 1995-2010 mortality, we obtain a net TFR estimate of 2.49 children, which compares very well with the United Nations TFR estimate of 2.51 children per woman for the same period. This suggests that family reconstruction captures satisfactorily fertility behaviour and that surviving children absent from the household do not significantly distort our computations.

Other social and economic variables

The regional analysis follows the administrative division into 33 provinces and into rural and urban parts. The size of provinces is rather unequal as they vary from Central Java (32.4 million inhabitants) to Papua Barat (0.7 million inhabitants). In some cases, we even disaggregate data for some of the 482 regencies (*kabupaten*), although sample constraints prevent a more systematic analysis at this scale.

The linguistic and ethnic divide according to census data is more complex. According to the IPUMS sample used here, there are in Indonesia 830 different languages recorded by the census and 964 ethnic groups, with respectively 86 and 107 of them comprising more than 100,000 persons. Thanks to the recent work by Ananta et al (2014), we now have a less prolific classification based on 119 major ethnic groups (see also the official classification in BPS 2011c). This reclassification is especially useful to club

together groups such as the Bataks, Malays and Dayaks, which are subdivided into further smaller groups by the census. We have adapted our data to this new classification. There is, however, no comparable effort to reclassify linguistic returns.

Results

Mapping coresidence systems

This section presents results on postmarital coresidence in order to identify kinship patterns. The departure point is that Indonesia is usually presented as a country of bilateral kinship and bilocal postmarital residence for centuries. Biological data present a more complex picture, by stressing that uxorilocal practices have been an "ancestral" feature of Austronesian societies in the past (Jordan et al 2009). The Austronesian language families include in particular Indonesian and Malay, as well as Polynesian languages. Non-Austronesian languages spoken in Indonesia comprise principally Papuan languages and Chinese. However, there are also many bilocal or patrilocal societies in the region–especially in the south-eastern part of Southeast Asia and Melanesia. Since there has never any systematic mapping of marriage systems in Indonesia so far, our use of 2010 census data to investigate postmarital residence can be taken as the first attempt at a quantitative assessment of the situation. Our computations offer indeed a strong confirmation of the bilateral character of Indonesia's marriage systems: the share of men (sons) and women (daughters) among married children coresiding with their parents is exactly 50.5% and 49.5% respectively. In other terms, children may reside with their parents after marriage irrespective of their sex.

Another striking finding of our analysis is that this average picture conceals considerable variations within the country depicted by province-level results plotted on **Figure 1** (see also **Table 1**). The perfect bilocal pattern reflected from the national average is in fact the product of pronounced regional differentials. Indonesia is in fact made of regions where coresidence patterns vary widely, ranging from typical matrilocal arrangements (taken here to correspond to less than 40% of sons among married children) to entrenched patrilocal regions (more than 60% of sons). The map of postmarital arrangements delineates in particular an entire area to the East of the Archipelago where patrilocal arrangements predominate. This starts to the East of Java with Bali and continues with the chain of eastern islands from Lombok and Flores to West Timor. It also encompasses all islands to the Northeast from the Maluku archipelago (Moluccas) to the Papuan provinces of Western New Guinea. Patrilocal systems prevail also in two provinces of Sumatra: North Sumatra, a province dominated by Batak ethnic groups and patrilineal groups living in the Nias archipelago, and Lampung. In several of these provinces, the percentage of men among coresiding married children is above 70%, but the highest proportion is clearly observed in Bali where it reaches 84%. At a lower scale, patrilocality levels can even be higher, with values close to 80% or 90% found in several adjacent regencies of Papua, West Papua, and Bali as well as in Sumba.

Variations in uxorilocal postnuptial residence are less marked than for patrilateral residence. In several provinces of Sulawesi Island (Celebes) as well as West Sumatra, around 60% of postmarital coresidence is matrilocal. High levels of uxorilocal practices observed in West Sumatra inevitably point to the presence of the Minangs (Minangkabau), a Muslim ethnic group which may be one of the largest matrilineal populations in the world (Blackwood 2000). Coresidence of married daughters with their mother is logically the preferred system among them and its frequency reaches indeed a record 85% in the south of the province (against 15% of patrilocal coresidence).

Interestingly, bilocal marriage practices, ethnicity and language only partly intersect in Java (see also Table 2). Patrilocal residence is more common to the West of the island and this corresponds largely to the Sundanese-speaking areas, with Sundanese and Bantenese as dominant regional groups. Yet, as we move toward East, the share of uxorilocality tends gradually to rise and exceeds 60% in East Java and the same is true if we restrict the analysis to the Javanese population. Very high proportions of women among coresiding married children are also observed on Madura Island to the east of Java. While the frequency in patrilocal arrangements declines regularly in Java from west to east, it suddenly from 40% to 80% when we cross the 2-km Bali Strait separating Java from Bali.

However, most of the largest ethnic groups–Javanese, Sundanese, Betawi, Malay, Bantenese and Bugis–along with the Acehnese, the Banjarese, and the Makassarese, practice typical bilocal customs. This also applies to the Dayak populations found in Kalimantan. The demographic share of these ethnic groups explains why the overall figure for Indonesia is close to 50%.

Yet, the existing literature tells us also that more patrilocal arrangements exist in Indonesia. Chinese Indonesians–who account for 2.8 million people according to the 2010 census–constitute for instance a traditionally patrilineal population. But apart from ethnic Chinese, many exogamous patrilineal clans–such as the *Dadia* among Balinese, the *Marga* among Bataks, the *Kanaf* among the Atoni, the *Waja* among the Endenese, or the *Mado* among the Nias–are also prominent features of local societies found across the Indonesian archipelago. (West 2009; Hockings/Levinson 1993; Dube 1997; Todd 2011; Koentjaraningrat 1967; Koning 2000; Jordan et al. 2009).

Our results confirm these observations and we find for instance that patrilocal residence is very common among Balinese (86%) and among the Lampungese (76%), societies that could easily be equated with patriarchal societies found in East or South Asia (Parker 2003). Patrilocality is also above 60% among ethnic Chinese, Bataks and smaller ethnic groups such as the Sasak, the Toraja, The Ambon and the Mangarrai found in the "Outer Islands"–a notion that commonly refers today to smaller and less developed islands east of Bali.

There is an obvious increasing gradient of patrilocal practices as we move east towards Papua. The two largest groups (*Ekagi* and *Dani*) of Papuan provinces have both patrilocal indices above 90%, pointing to the complete absence of any uxorilocal postnuptial residence. Both groups speak Papuan languages. Overall, patrilineal and patrilocal societies tend to predominate in Melanesia (on Papua New Guinea, see Lederman 1986 and Pouwer 2010). The anthropological diversity found in Papuan provinces, however, prevents a more disaggregated analysis.

In contrast, distinct uxorilocal traits with a patrilocal index close to 40% are associated in Indonesia to specific ethnic clustering such as the aforementioned Minangs of Sumatra and the Gorontaloans of Sulawesi. Residence in the bride's family appears to be most pronounced among the Madurese of East Java, a society with ancient matrilineal traits. Their influence is visible on the ethnic Javanese of East Java, who are distinctly more uxorilocal than the rest of Java. This may point to the potential ethnic blending of Madurese and Javanese, with the former influencing or absorbed into the latter.

Mapping gender preference

We now turn our attention towards gender preference, using fertility behaviour as an indirect indicator of potential gender bias. Conditional progression ratios point to the desire of parents for an additional child according to their current family composition determined by the number, sex and date of previous children (Ahn 1994; Graham et al. 1998). The data shown are "sibling progression ratios" (SPRs), which are analogous to the more usual parity progression ratios used to measure fertility strategies. The Kaplan-Meier curves are limited to child intervals of ten years or less in order to focus on the decade

2000-2010. Disaggregated SPR computations displayed here correspond only to three typical ethnic groups, viz. the Balinese, the Batak and the Minangs (see Table 2 for other groups). The presentation of the results is broken up by child ranks, but combined for all ranks equal or greater than 3. Figure 2 brings together different charts by child rank (R1 for rank 1, R2 for rank 2 and R3+ for rank 3 and higher) for Indonesia and selected ethnic groups. On each chart, we distinguish progression ratios according to previous sex compositions: only boys, only girls and mixed composition. The latter category is applicable only to children of rank 2 or higher who may have both one male and female older sib. The upper series of SPRs corresponds to the first birth interval. In a country where average fertility is above two, these progression ratios at rank 1 are usually above 70%. The likelihood of the presence of a second sibling in the family is apparently not affected by the sex of the first surviving child and both Kaplan-Meier curves are identical in Indonesia. But data for the Balinese point to a significant variation after a first birth: parents with a girl tend to have a second child earlier and in larger proportions. The sibling progression ratio after 10 years is 10% higher among parents of a first girl. The difference between the curves is almost imperceptible among Bataks. Among Minangs, births following the birth of a first boy tend to occur slightly faster than after a female birth. The difference in sibling progression ratios is only 2% after ten years, but is statistically significant according to the log-rank test.

Variations in fertility behaviour become more visible for higher child ranks. The data for Indonesia clearly shows that the mixed gender composition is preferred. This principle echoes the famous Indonesian family planning slogan: "two children are enough, boy or girl makes no difference" (*Dua anak cukup, laki-laki perempuan sama saja*). In other words, the progressing ratio is at its lowest among parents with both a boy and a girl. But after the births of two girls or of two boys, it is respectively 12% and 10% higher than for a mixed gender composition. For siblings of higher rank, the absence of a male offspring still results in a fertility progression ratio 12% higher than for a mixed composition, while the absence of a daughter causes a smaller increase of 5%.

Among the three other minority groups, gaps in sibling progression ratios between gender composition tend to widen even further. The desire for sons becomes much stronger among Balinese after the first two births. The probability to have another child increases much faster among sonless parents than among other Balinese. After ten years, fertility in the absence of a son is 82% higher than with a son among third births and this gap reaches 94% among higher-order births. This tremendous difference points to the desire for a male offspring among the Balinese. Interestingly, there is no perceptible difference in fertility behaviour between parents with only boys and those with at least a son and a daughter. In other words, the absence of a daughter makes no difference in fertility behaviour and family balancing is not a cause for additional fertility. Bataks present a somewhat less pronounced scenario of son preference. After two births, the absence of a son causes an increase of 12% in the sibling progression ratio, while that of a daughter causes an increase of 6%. These differences double respectively to 29% and 12% for higher-order births. Obviously, a pronounced son preference coexists among Bataks with a complementary preference for a mixed gender composition.

The Minangkabau population exhibits a rather different situation. The mixed gender composition remains the preferred one as elsewhere in Indonesia and is associated with the lowest progression ratios for children of higher rank. What is most unusual is that the impact of the absence of daughters is twice larger than that of boys. Among Minangs, having no daughter tends to raise the probability of having a younger child. The overall effect after ten years is +20% for parity 2, and +26% for parity 3 and higher. The absence of a boy also exacerbates fertility, but in smaller measure: +5% for parity 2 and +13% for parity 3 and higher. Similar cases of deliberate preference for daughters are almost non-existent in Indonesia, with the exception of traces of daughter bias among the Gorontaloans in Sulawesi.

It may be useful at this juncture to make a more technical detour in order to explore how far these trends computed on small subpopulations are statistically significant. To avoid a systematic discussion of

confidence intervals, we may focus on the progression ratios among Minangs after three births of the same sex. This refers clearly to a small group, but it is discussed in detail in this paper (see above). Kaplan Meier estimates of the progression ratios at ten years are based on 3426 observations (only girls) and 5152 observations (only boys). The 5% confidence intervals of these estimates in these two cases are respectively of ±3% and ±2%. The standard log-rank test confirms that these differences across gender compositions are significant at 1%. It may be added that differences across progression ratios that are larger (Balinese) or observed among bigger ethnic groups (Bataks) are equally significant. This amply demonstrates the considerable advantages of census samples over other survey samples. In contrast, the recent 2007 and 2012 DHS surveys of Indonesia have not collected any information on ethnicity and provide therefore no comparable data.

In conclusion, this comparative analysis suggests the presence of three intersecting gender preference rules within Indonesia: preference for sons, preference for daughters, and preference for mixed gender composition. These principles overlap since a similar preference for boys and girls correspond in fact to a preference for a mixed gender composition. Among Acehnese of North Sumatra, the absence of a son increases for instance subsequent fertility by 23% while that of a daughter increases it by 21% (figure for progression ratios after 10 years for parties above one). In other words, parents who do not have at least one boy and one daughter have a higher probability of having an additional child. This pattern is very common in Indonesia and signals a strong preference for a balanced offspring. More formally, we may even decompose further the gender preference system. Keeping the aforementioned example of Acehnese, we would say that the preference for mixed sex composition causes a fertility increase of 21%, with an additional 2% increase (23% - 21%) attributable only to sons. Table 2 summarizes our findings on the largest ethnic groups in Indonesia. Most ethnic groups in the country are characterized by a strong preference for mixed gender composition. In particular, this is true for two of the most important groups, the Javanese and the Malays, among whom the absence of a child of any sex significantly raises subsequent fertility. The pressure for mixed sex composition is also quite high among the Acehnese and the Betawi. On the contrary, it is weak or almost non-existent among other groups living on Java and Madura islands such as the Sundanese and the Madurese. Indicators of son or daughter preference among the latter are the lowest, making Madurese the most gender-indifferent population found in Indonesia. In contrast, Bali provides the most extreme case of son preference and Balinese are unique in this respect, but such levels of son preference are observed in parts of Viet Nam (Guilmoto 2012a). A few other patrilineal groups also display a significant though far less pronounced level of son preference, in particular to the Batak of Sumatra, the Chinese, the Minahasa in Northern Sulawesi, and the Sasak in Lombok. Among them, the absence of a son has a 10% higher impact than the absence of a girl in the family. But contrary to Bali, higher fertility in the absence of a female child also confirms the presence of an underlying longing for a mixed gender composition of the children among these patrilineal groups. It is interesting to observe that Indonesian Chinese have lost some of the staunch patriarchal features of their ancestral country, compared to the intensity of son preference in China. In fact, we also observe among ethnic Chinese a desire for girls in family with only boys. This bilateral feature, unusual among populations of Chinese origin, probably illustrates the growing influence of the local Southeast-Asian *Peranakan* culture on Indonesian Chinese over the traditions of foreign-born *Totok* immigrants (Dawis 2009).

The same analysis can be repeated with provincial estimates (**Table 1**). We observe that son preference does correspond to patrilocal groups and regions. The need for sons stems partly from their primary role in household arrangements as they cohabit with their parents more often after marriage than daughters do. The only surprising feature is that uxorilocal residence does not lead to a preference for

daughters, with the exception of Minangs where families with no girl tend to have a higher fertility than other families.

Sex imbalances among children

The previous analysis has demonstrated the presence of pronounced variations across regions and ethnic groups in Indonesia in terms of gender preference. But we still do not know whether this may result in measurable sex imbalances. We will now examine child sex ratios as well as factors that may account for variations observed.

Child sex ratios

There are no published civil registration series for monitoring the sex ratio at birth over the last two decades or for computing infant and child mortality rates by sex. Birth registration is highly deficient in Indonesia and a recent survey estimated that 57% of children below 1 had no birth certificate, a proportion rising to 71% among the poor (AIPJ 2014). Most demographic estimates for Indonesia mostly derive from annual surveys such as the National Social and Economic Survey (SUSENAS) and the occasional Indonesian Demographic and Health Surveys, but these sources do not provide adequate SRB estimates due to small size of their samples. The latest DHS round estimated the sex ratio at birth at 101.7 male births per 100 female births over 2007-12 as against 107.9 from the previous DHS of 2007. These fluctuations are, however, attributable to the size of the birth sample (about 15,000 births). The SUSENAS surveys provide no estimate of birth masculinity.

The 2010 census did not collect information on the sex of recent births. We are therefore compelled to use the age distribution to reconstruct the sex ratio at birth prior to the census year. The resulting sex ratio by age is displayed in **Figure 3** for the population below 16. As the sex ratio by age is affected by random fluctuations, the series have been smoothed over five years. These figures provide the closest estimate we have of the sex ratio at birth as well as of postnatal mortality. But age-specific sex ratios are also affected by registration issues. We notice in particular that the sex ratio tends to decline regularly from age 12 onwards, a trend likely caused by specific male under-reporting common among young adults. Below 12, the sex ratio among children tends to fluctuate around 106, a level higher than the normal level after correction for male excess mortality. The work by Siagian and Dasvarma (2005) had already underscored that the sex ratio among children at the time of the 2000 census was higher than expected.

This chart also includes the sex ratios of three specific populations. Based on the previous analysis of post-marital residence patterns, we have distinguished provinces and major ethnic groups with higher levels of patrilocality (above 60%) from the rest of the population where ambilocal and uxorilocal predominates. This patrilocal block is itself divided into two components. The West segment is made of the Balinese, the Bataks and the Chinese–three ethnic groups mostly concentrated on the western islands of Sumatra, Kalimantan, Java and Bali. The East segment of the patrilocal block comprises six "Outer provinces" selected for dominant patrilocality: West and East Nusa Tenggara, North and main Maluku, West and main Papua. The East segment comprises all islands east of Bali with the exception of the Sulawesi. The entire patrilocal block represents 12.9% of Indonesia's total population. As **Figure 3** indicates, the child sex ratio of this patrilocal population is quite distinct from that of the rest of Indonesia. The sex ratio below 1–the best proxy for the sex ratio at birth–is already higher than in the rest of Indonesia. But the gap between patrilocal and other populations increases with age, reaching 1 boy per 100 girls by age 3 and exceeds 2 per 100 by age 8. Western patrilocal populations are characterized by a slightly higher sex ratio below 1, but the gap with the all-Indonesia figure remains

lesser than 2 per 100. Short of enumeration issues, the only explanation for a sex ratio increasing with age would be the cumulative impact of excess female mortality. On the contrary, the sex ratio of Eastern patrilocal populations increases faster with age and reaches 110 at age 10.

The difference between patrilocal Indonesia and the rest of the country is summarized in

Table 3 3. Estimates indicate that the patrilocal regions and ethnic groups do have a sex ratio slightly, but significantly above the upper limit (106) of the biological average for both the 0-4 and the 5-9 populations. The differences are more pronounced when we distinguish the Western from the Eastern patrilocal groups. The especially high child sex ratio among the eastern patrilocal populations may also be compared with the situation in two nearby countries, viz. Papua New Guinea and Timor-Leste. Both share a common history with Indonesia's eastern Islands and have similar Austronesian and Melanesian populations.

We use here census data and United Nations figures for Papua New Guinea and Timor-Leste in 2010 (see also Dasvarma 2012). Like Indonesia, they are characterized by an overall masculine sex ratio (104 in 2010) of their population, but interestingly, disaggregated census data from both countries also point to a sex ratio above 106 among the child population. Their child sex ratio is at its highest around age 10-12 years exactly as is also observed in East Indonesia (**Figure 3**). The sex ratio at birth in Papua New Guinea is also estimated at the unusually high level of 108 by the United Nations (United Nations 2012). The same patterns of elevated child sex ratios are also observed in the more distant Melanesian countries of Solomon Islands, Vanuatu and Fiji based on the age and sex data derived from the 2009 and 2007 censuses in these countries. In other words, Eastern Indonesian high sex ratios fall within a larger subregional pattern of high demographic masculinity. In contrast to primarily bilateral Southeast Asia, it may be noted that patrilineal systems tend to predominate in Melanesia, from Papua New Guinea to Fiji.

We can also use our reconstructed household data to probe the impact of birth order and family composition on the sex ratio. The gender composition prior to the birth of a next child serves as the test for gender bias: in the absence of sex selection, it should be unrelated to the sex ratio of subsequent births. Sex ratio estimates shown in are based on the distribution of children below 10 for patrilocal and other populations of Indonesia. The third column of **Table 4** provides the sex ratio of all Indonesian children, which is slightly higher than expected at 106 boys per 100 girls. Even if the first births appears slightly more masculine (106.7), variations across birth orders are by and large not significant in Indonesia. Even when we factor in the previous gender composition of the family, we fail to notice any significant impact on the child sex ratio. For instance, the sex of children who had only female siblings at birth remains almost similar to the sex ratio of other children, including after two successive female births. The minor differences observed by birth order and gender composition completely disappear when we restrict the analysis to the non-patrilocal regions in the second column. Among bilocal or matrilocal populations, the child sex ratio fluctuates within a narrow range from 104.9 to 106.4 and none of these sex ratios deviates significantly from the biological level of 104-106. This suggests that the substantial differences in fertility behaviour spotted in **Figure 2** do not convert in distorted sex distributions. In other words, whereas the absence of boys (or girls) in a family may accelerate the birth of another child as measured in fertility progression ratios, it has no tangible consequence on the sex of this subsequent child

The analysis of conditional sex ratios leads to different results when we focus on patrilocal groups in the first column of **Table 4**. In fact, the child population of the patrilocal subset reports an average sex ratio of 107.6 boys per 100 girls, a level distinctly above the normal sex ratio and that of the rest of Indonesia's population. With respect to parity, the sex ratio of first births is 109 boys per 100 girls and significantly higher than the sex ratio of the rest of the population. When considering children of parity 2, we notice a sizeable difference according to previous gender composition. In the absence of an older brother, the sex ratio among patrilocal populations rises from 105.2 to 108.9. Among higher-order births, populations of patrilocal tradition display again a clear grading of sex ratio according to the family situation: the sex ratio rises from a low 103.3 with only previous boys to 107.1 in families with previous

siblings of both sexes, and to 109.9 in sonless families. The highest value is once again observed among sonless families.

These results are not so easy to interpret since high sex ratios are restricted to a small part of Indonesia's population. Moreover, even if significantly higher than the biological standard, sex ratios among patrilocal groups remain moderate and we do not distinguish the usual rise in SRB with parity as is common in countries with high birth masculinity (Guilmoto 2012b). Yet, the main lesson concerns conditional sex ratio at birth in Indonesia and our figures strongly suggests that previous gender composition among patrilocal groups does influence the sex ratio of subsequent children. This is perceptible at all birth orders and it suggests that these populations find a way to masculinize their offspring in the absence of male children.

We can replicate the same analysis at province level. We distinguish families by gender composition in order to probe the presence of discriminatory behaviour. But the protocol used in the previous analysis is simplified in order to preserve large sample sizes and we exclude in particular first children–in order to focus on children with or without an older brother. The figures presented here are a province-level sex ratio of children below 10. Some results are shown I **Figure 4** and more detailed figures are found in **Table 1**.

Each observation on these charts in **Figure 4** corresponds to one of the 33 provinces, with patrilocality levels on the x-axis and child sex ratios on the y-axis. We are using a bubble chart in order to highlight the relative size of each province since child populations vary by a factor ranging from 1 in West Papua to 48 in West Java. The upper chart is restricted to children born to families with no boy (including first births) while the lower chart corresponds to children from families with already at least one boy. As can be seen on the upper chart, there are sizeable variations in child sex ratio across provinces among families without sons, with regional averages ranging from 103 to 121. In addition, there is a significant and positive correlation between degree of patrilocality and child sex ratio (r^2=0.34). This association is very weak among non-patrilocal provinces and there is, for instance, no difference between matrilocal and bilocal provinces–where the child sex ratio is close to 106. But sex ratio rises with patrilocality on the right part of this chart and the most patrilocal provinces have also the largest proportion of boys below 10. Overall, more than a third of observed differences in sex ratio can be related to variations in marriage systems.

There is, on the contrary, no such association detectable on the lower chart of **Figure 4**. Among families with already a son, variations in child sex ratio across provinces are not only minimal, ranging from 104 and 109, but they also appear completely unrelated to differences in patrilocality. In other words, patrilocal regions tend to respond to the absence of a previous male birth by making subsequent births more masculine. Elsewhere, province-level sex distributions fluctuate randomly around the biological average. The overall impact due to patrilocality is also perceptible on aggregated sex ratio data. There is a similar significant and positive correlation between patrilocality and the overall child sex ratio below 10 (r^2=0.38).

Child mortality differentials

There is no reported excess of female mortality in Indonesia and the last two DHS results point to the absence of recognizable excess female mortality in Indonesia. The census-based monograph on mortality shows similarly that female infant mortality is lower than male mortality by about 15%, and regional estimates from the same sources confirm the absence of any higher than expected female mortality across the country (BPS 2011a).

While original census variables on deaths in the household are not available as IPUMS microdata for a more systematic reanalysis of these results, we can use data on child survival collected from Indonesian mothers. The 2010 census provides the sex and number of born and surviving children of woman aged 15 and more, which allows for the computation of survival rates of children by sex and province. This proportion of children surviving may also be used for estimating mortality rates prior to the census, but our analysis is limited to sex differentials. We simply compute the sex ratio of mortality rates till birth. Figures shown in **Table 1** refer to children born to women aged 40-49 and correspond therefore to the probability of dying before age 15-19. This sex ratio of mortality should be close to 120 in view of the excess mortality of male children (United Nations 2011) and this is what we observe for Indonesia as a whole (117.5). The sex ratio of mortality rates in patrilineal Bali appears to be even slightly above the national figure, pointing to the absence of excess female mortality on the island. Yet, these figures also highlight the presence of excess female mortality in several eastern provinces, which tends to contradict the census-based mortality estimates referred to previously (BPS 2011). Female death rates turn out in particular to be higher than male rates in both Papuan provinces. The sex ratio of mortality rates is also below 110 in the Moluccas, two patrilocal provinces also characterized by a child sex ratio distinctly above average. It remains difficult to assess how far these values may also be affected by small population sizes or data quality.

When considered for the 33 provinces, the correlation between excess female mortality (i.e. lower mortality sex ratio) and high child sex ratio is quite strong (r^2=0.57) when computed on the child population below 10, and even stronger (r^2=0.84) for children born in sonless families. This correlation is primarily driven by the singularity of the Eastern patrilocal provinces where relative female mortality appears surprisingly high and sex ratios above normal values. Elsewhere in Indonesia, values of both mortality differentials and child sex ratios do not deviate significantly from the national average. Results are almost identical when we use other age groups–such as mothers aged 20-29 or 30-39 years–, which confirms the strong association between apparent excess female mortality in the East of the Archipelago with higher child sex ratios. In this connection, we may observe once again a link with neighbouring patrilocal societies of Papua New Guinea and Timor-Leste, where existing demographic estimates also point to an unusually high level of female child mortality. This is illustrated by child mortality estimates derived from the WHO life tables for 2000, 2010 and 2012 (see also NSD 2008). While these regional estimates of excess female mortality appear to contradict previous province-level estimates, they seem to be closely associated with our sex ratio figures, suggesting a possible link between mortality differentials and child sex ratio.

Discussion and conclusion

This paper has attempted to revisit the question of gender imbalances in the largest Southeast Asian country. We have used different types of indicators–marriage systems, fertility behaviour, child sex ratios and mortality ratios–to probe the existence of potential preference for male or female children. In many regions of Indonesia, where the postmarital residence is chiefly bilocal, child sex ratios are close to biological levels and the preference for a balanced gender composition of the family seems well-entrenched. We detected only isolated traces of preference for girls in a specific matrilocal society. The major evidence about a significant departure from the Southeast Asian model of relative gender equity concerns, however, the presence of son preference in several parts of the country. Regions identified often combine patrilocal marriage patterns, increased fertility in the absence of male offspring, and higher than expected proportions of boys among the child population as has been observed elsewhere (Grogan 2013a, 2013b).

These distortions in sex ratio appear rather modest in comparison to levels above 110 or 115 male births per 100 female births observed elsewhere in Asia (Guilmoto 2012b). Yet, convergent anthropological and demographic indicators point to the link between kinship systems and forms of gender bias–expressed in fertility behaviour, mortality differentials and sex ratio outcomes. Family reconstitution based on census data helps in particular to demonstrate that the number and gender of children tends not only to affect the probability of a subsequent birth, but also its sex. Such variations unquestionably signal the presence of gender bias in family building strategies. The analysis has also highlighted that the connection between elevated sex ratios and ethnic composition is not spurious: patrilocal practices encourage the presence of sons in families and are associated with the highest proportions of boys in the child population.

Our findings also remind us that family systems, which lay at the core of many aspects of gender bias, are far from uniform within countries affected by sex imbalances at birth. In smaller countries, from South Korea to Albania, there is a hypothesis of relative anthropological homogeneity, but in countries such as Viet Nam, China and India, the complex spatial patterning of sex ratio variations remains largely unexplained (Guilmoto and Oliveau 2007; Cai and Lavely 2007; Chakraborty and Kim 2010; Kim and Song 2007; Guilmoto 2012b). The study of Indonesia confirms the need for disaggregated analyses to investigate the presence of local pockets of sex imbalances that would be otherwise missed from studies based on national averages.

Another lesson of our study relates to the geography of gender bias in Southeast Asia. The preference for a balanced gender composition is the main feature of the reproductive behaviour of Indonesian couples. This is a feature at odds with what is observed in China, North India or North Viet Nam and it confirms the overall impact of patrilineal vs. bilateral kinship on gender preference and ultimately on discrimination towards girls or boys as long hypothesized by anthropological research (Dube 1997; Miller 2001; Croll 2000). It suggests in particular that similar processes may be at work in bilateral countries of Southeast Asia such as Thailand, Laos or the Philippines where no trace of sex selection has ever been detected. But in countries that are more diverse in terms of kinship systems, such as Indonesia, Viet Nam or Myanmar, we may indeed observe a significant degree of variations in the intensity of gender bias across regions or ethnicities.

A final lesson of this study also relates to gender geography of insular Southeast Asia. As we saw, the few regions of the country affected by adverse sex ratios happen to be mostly inhabited by non-Muslim minorities, ranging from Hindus (Balinese) to Christians (Bataks, Papuans) and Buddhists (Chinese). This group also includes Indonesians living east of Java and many Melanesian populations. In linguistic terms, we find Papuan-speaking groups as well as speakers of a specific branch of Austronesian languages (viz. Central–Eastern Malayo-Polynesian). The geographical distribution almost coincides with the well-known ecological Wallace Line falling between Bali and Lombok, dividing the western part of the Indonesian Archipelago from its eastern part. The line can also be interpreted in linguistic terms (Blust 2013; Pawley 2002). The unifying factor between these populations is again the link with other manifestations of gender preference and discrimination–ultimately related to patrilineal kinship systems and postmarital arrangements. In western islands like Bali, patrilocal practices coincide with a strong son preference clearly expressed in fertility strategies, but also with a moderate rise in child sex ratio and no trace of post-natal discrimination. In the eastern part beyond the Wallace Line, patrilocal regions with high child sex ratio are apparently characterized by excess female mortality, but without clear expression of son preference in fertility behaviour. These eastern regions follow a more typically Melanesian regime found in countries east of Indonesia, characterized by a surprisingly high proportion of boys among children below 15 and higher than usual female mortality in childhood. Further research employing both field surveys and demographic analysis would help to better document many of the

issues raised here and ultimately to delineate more precisely the geography of gender to distinguish ambilocal Southeast Asian patterns from a more patrilocal Melanesian system extending to Fiji.

This is, however, the first study of this kind devoted to Indonesia and there remain several unsolved issues. The first one relates to our analysis of fertility behaviour. We have been able to detect the presence of the gender preference systems across Indonesia and to quantify its relative intensity. The instruments used here–the conditionality of fertility progression–lead to a fine monitoring of preferential gender composition and largely confirm the preference for a mixed offspring, with occasional daughter preference. Yet, results also point to the presence of considerable son preference in Bali and fail to capture similar imbalances in other patrilocal regions. Unlike in Viet Nam, son preference in fertility is not a perfect predictor of unbalanced sex ratios in regions such as Papua and Maluku. In patrilineal Bali, where son preference tends to double fertility levels in the absence of male offspring, the overall impact on the sex ratio at birth appears on the contrary modest.

The second issue relates more precisely to the prenatal or postnatal factors causing higher sex ratios. Regarding prenatal discrimination, the presence in parts of Indonesia of high sex ratio among children below 1 suggests the presence of sex selection, but we have no corroborating evidence from reliable birth registration statistics and from field studies. Traces of excess female mortality clearly emerge from our analysis, but mostly in eastern islands. Our findings point indeed to the need of new quantitative and qualitative research on gender discrimination, from prenatal sex selection to female excess mortality. The discussion of the mechanisms contributing to the observed rise in child sex ratio in parts of Indonesia as well as in Melanesia remains therefore largely open.

A third issue relates to the somewhat atemporal perspective adopted in this study based on 2010 cross-sectional data and on the ethnic mosaic. As a first in-depth study of the complex geographies of gender inequity in the archipelago, it has not fully taken into account the gradually changing state gender ideology and its impact on marriage and family formation. The transition from the patriarchal and patrimonial New Order to the post-1998 democratic period has seen the emergence of religion as a national project (Robinson 2009). The full consequences of these transformations on demographic behaviour–through early marriage, polygyny, or higher fertility–are only partly understood today, but they are also likely to affect the gender strategies of Indonesian couples.

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Tables

Table 1: Selected demographic characteristics of provinces, Indonesia, 2010

	2010 popu-lation in millions	Patri-locality	Difference in fertility progression		Sex ratio below 10 by rank and presence of a previous brother				Male excess mortality
					No brother		Older brother	All children	
			Son preference	Daughter preference	Rank>1	Rank>2	Rank>1		
Aceh	4.5	52.7%	125%	120%	103.9	103.9	103.9	104.2	116.3%
North Sumatra	12.9	58.4%	125%	118%	107.6	108.4	104.8	106.5	114.9%
West Sumatra	4.8	40.0%	118%	127%	108.0	110.7	107.4	107.2	117.8%
Riau	5.5	43.1%	123%	123%	107.6	108.2	103.8	105.7	114.2%
Jambi	3.1	47.0%	120%	128%	104.0	100.4	105.7	105.9	117.7%
South Sumatra	7.4	51.3%	131%	122%	105.3	106.0	105.6	106.3	111.1%
Bengkulu	1.7	42.3%	127%	126%	100.6	103.4	106.9	105.8	122.4%
Lampung	7.6	69.9%	128%	113%	105.3	103.0	106.0	106.2	123.1%
Bangka Belitung	1.2	41.5%	125%	113%	106.7	116.1	104.2	105.3	136.9%
Riau Islands	1.7	54.0%	128%	133%	103.4	94.7	104.1	105.3	125.3%
Jakarta	9.3	57.2%	125%	128%	104.9	103.7	106.6	105.9	132.9%
West Java	42.7	49.9%	113%	109%	106.0	106.6	105.6	105.9	113.8%
Central Java	32.3	50.4%	114%	113%	103.9	103.6	105.8	105.7	126.3%
Yogyakarta	3.4	43.5%	118%	112%	103.2	105.1	104.0	105.7	127.8%
East Java	37.2	36.2%	112%	113%	104.3	103.0	104.8	105.1	118.0%
Banten	10.5	51.5%	115%	114%	104.8	101.5	105.2	106.0	106.1%
Bali	3.8	84.0%	190%	102%	108.8	107.4	104.8	107.5	121.1%
West Nusa Tenggara	4.5	63.3%	125%	115%	103.4	104.3	106.5	105.9	115.3%
East Nusa Tenggara	4.7	66.1%	116%	110%	108.5	110.0	106.6	106.7	117.5%
West Kalimantan	4.4	50.3%	120%	117%	102.7	101.1	105.7	105.3	128.2%
Central Kalimantan	2.2	46.1%	118%	114%	106.2	107.4	105.1	106.2	117.0%
South Kalimantan	3.6	45.4%	115%	106%	108.8	107.5	105.7	107.0	118.9%
East Kalimantan	3.5	58.6%	110%	114%	105.0	113.7	104.2	106.5	125.9%
North Sulawesi	2.3	47.4%	128%	124%	105.8	105.7	105.0	106.5	124.5%
Central Sulawesi	2.6	51.3%	118%	112%	107.2	109.7	109.1	108.1	124.0%
South Sulawesi	8.0	54.0%	114%	116%	105.9	105.3	106.0	105.9	120.6%
Southeast Sulawesi	2.2	38.7%	115%	112%	106.9	102.4	105.5	105.2	116.2%
Gorontalo	1.0	39.6%	117%	122%	102.3	98.0	105.7	104.3	123.7%
West Sulawesi	1.2	40.4%	110%	112%	104.0	102.3	107.1	106.8	119.4%
Maluku	1.5	74.7%	116%	111%	108.8	106.0	108.7	108.2	106.3%

	2010 popu-lation in millions	Patri-locality	Difference in fertility progression		Sex ratio below 10 by rank and presence of a previous brother				Male excess mortality
					No brother		Older brother	All children	
			Son preference	Daughter preference	Rank>1	Rank>2	Rank>1		
North Maluku	1.0	60.0%	115%	115%	113.9	124.1	103.7	105.8	101.7%
West Papua	0.8	66.5%	118%	111%	122.5	124.1	106.4	109.8	99.4%
Papua	2.8	77.2%	117%	109%	121.8	120.8	106.1	113.4	91.7%
Indonesia	**236.0**	**50.5%**	**114%**	**110%**	**105.7**	**105.9**	**105.5**	**106.0**	117.5%

Patrilocality is computed as the percentage of males among coresiding married children
SPRs are computed over 2000-10 for rank 2 and higher by previous gender composition: only girls, only boys, mixed composition (reference category)
Son preference is the ratio of the SPR for only girls over the SPR for mixed sex composition
Daughter preference is the ratio of the SPR for only boys over the SPR for mixed sex composition
Male excess mortality is the ratio of male to female mortality since birth computed on children of mothers aged 40-49.
Source: computed by the author from the 2010 census sample

Table 2: Patrilocality and gender preference in fertility behavior for the largest ethnic groups, Indonesia, 2010

Ethnicity	Patrilocality	Difference in fertility progression		Gender preference
		Son preference	Daughter preference	
Acehnese	51%	123%	121%	Mixed
Balinese	86%	191%	97%	Son
Banjarese	49%	114%	110%	Mixed
Bantenese	50%	112%	108%	Mixed
Batak	61%	128%	117%	Son and Mixed
Betawi	54%	122%	123%	Mixed
Bugis	51%	111%	113%	Mixed
Chinese	63%	142%	125%	Son and Mixed
Cirebon	49%	114%	114%	Mixed
Dayak	48%	119%	115%	Mixed
Gorontalo	41%	116%	121%	Daughter and Mixed
Javanese	48%	114%	114%	Mixed
Madurese	33%	106%	108%	None
Makassarese	48%	118%	120%	Mixed
Malay	46%	122%	124%	Mixed
Minahasa	53%	126%	116%	Son and Mixed
Minangkabau	42%	117%	131%	Daughter and Mixed
Sasak	61%	124%	109%	Son
Sundanese	51%	111%	107%	Mixed

Patrilocality is computed as the percentage of males among coresiding married children
Sibling progression rates (SPRs) are computed over 2000-10 for rank 2 and higher by previous gender composition: only girls, only boys, mixed composition (reference category)
Son preference is the ratio of the SPR for only girls over the SPR for mixed sex composition
Daughter preference is the ratio of the SPR for only boys over the SPR for mixed sex composition
Source: same as for Table 1

Table 3: Sex ratio of the population below 10 with confidence interval, Indonesia, 2010

	0-4 year		5-9 year	
	Sex ratio	**5% CI**	**Sex ratio**	**5% CI**
Patrilocal population	106.8*	106.1-107.5	108.1*	107.4-108.9
West segment	106.8	105.8-107.9	107.6*	106.5-108.7
East segment	106.8	105.8-107.8	108.5*	107.5-109.5
Indonesia	**105.8**	**105.6-106.1**	**106.2**	**105.9-106.4**

Sex ratio as males per 100 females
CI: 5% confidence interval (*: values significantly above the 104-106 range)
See text for definition of patrilocal populations and their West and East segments
Source: same as for Table 1

Table 4: Sex ratio of the children below 10 by child rank and gender composition, Indonesia, 2010

		Sex ratio of children aged 0-9		
Birth order	**Previous gender composition**	**Patrilocal groups**	**Rest of the country**	**Total**
		(1)	(2)	(3)
First births		109.0*	106.4	106.7*
Second births	One girl	108.9*	105.2	105.7
	One boy	105.2	105.8	105.7
	Total	107.0*	105.5	105.7
Third and later births	Only girls	109.9*	105.0	105.9
	Mixed composition	107.1	105.4	105.7
	Only boys	103.3	104.9	104.7
	Total	106.8	105.2	105.5
All births		107.6*	105.8	106.0

Sex ratio as male children per 100 female children
*: sex ratios different from 104-106 (5% confidence interval)
See text for description of patrilocal groups
Previous gender composition computed through sibling reconstruction (see text for detail)
Source: same as for Table 1

Figures

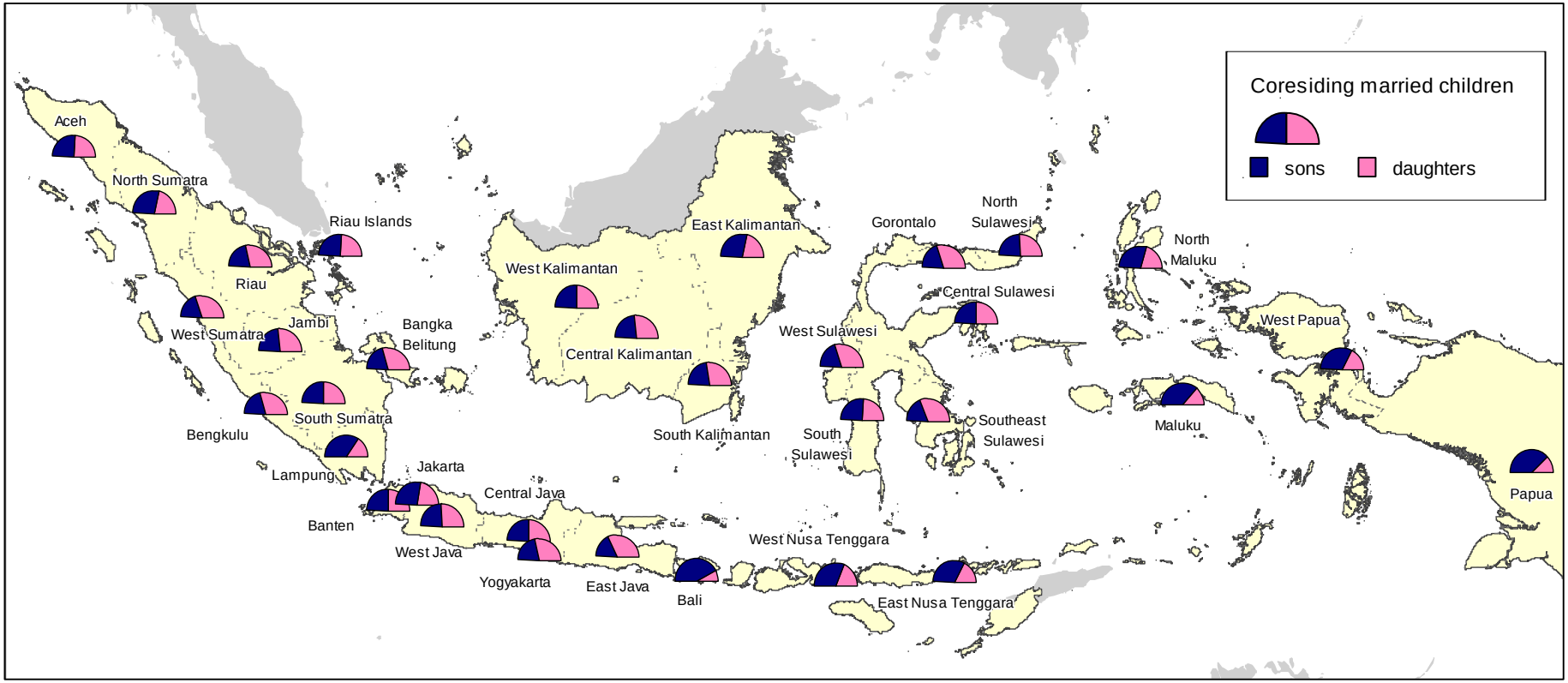

Figure 1: Distribution by sex of coresiding married children below 50, Indonesian provinces, 2010.

Source: computed by the author from the 2010 census sample

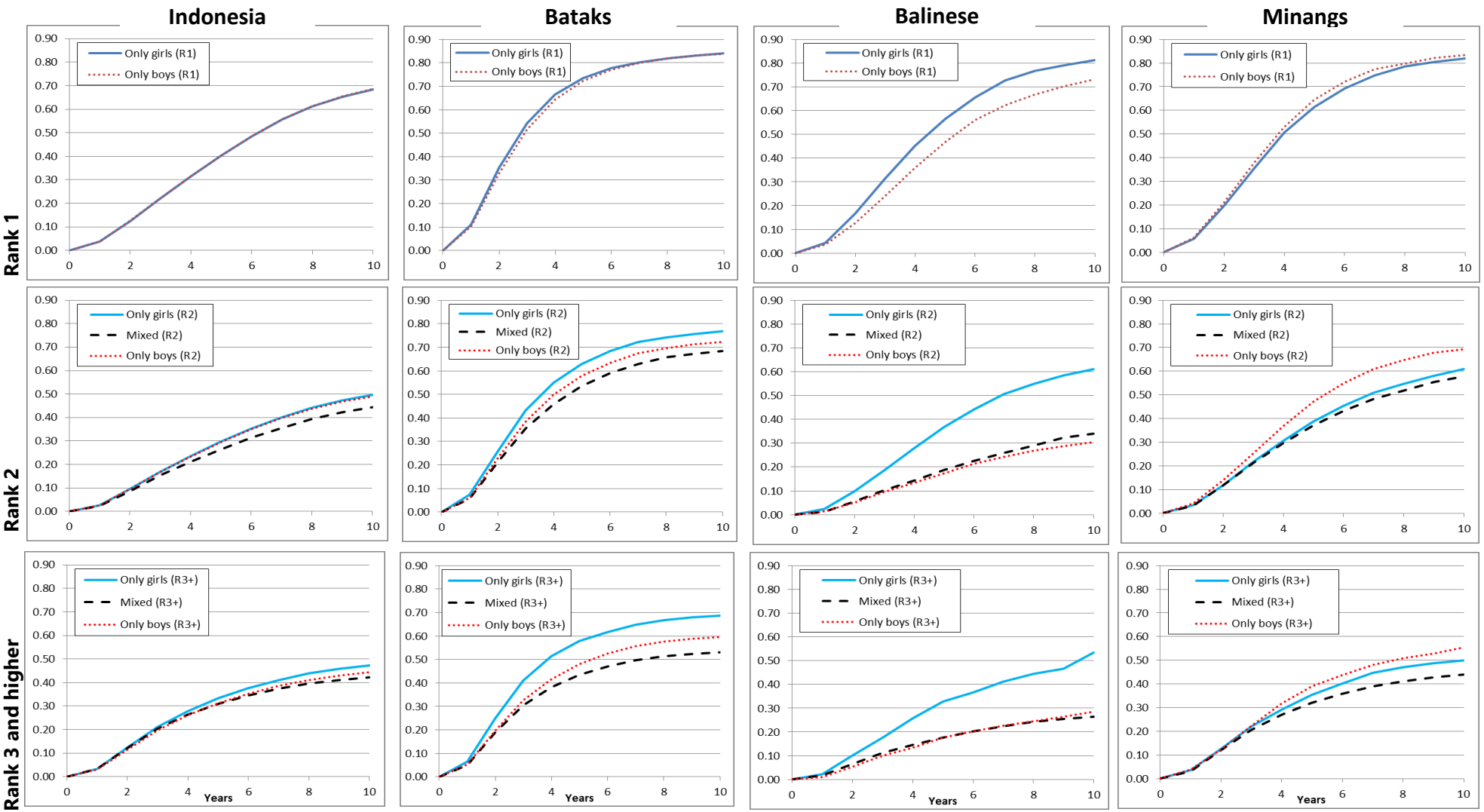

Figure 2: Sibling progression ratios by previous gender composition and child rank (R1, R2 and R3+), Indonesia and selected ethnic groups, 2000-2010.
Probabilities of having a younger sibling estimated by Kaplan-Meier procedure
Source: same as for Figure 1

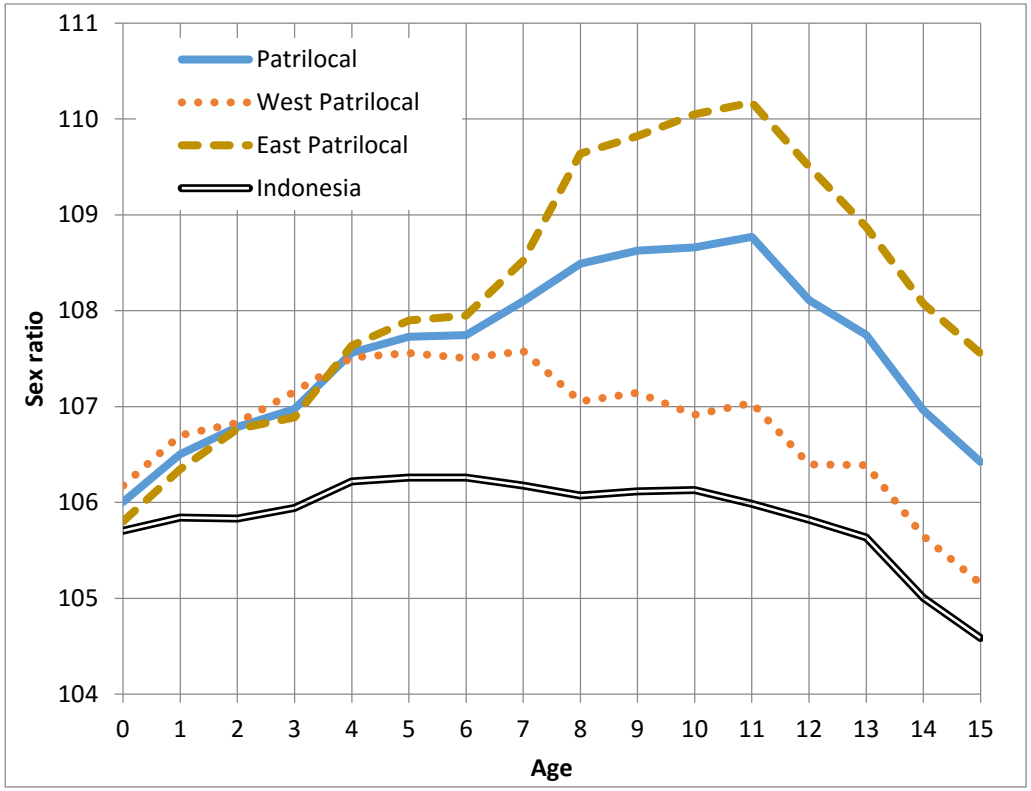

Figure 3: Age-specific sex ratio of children below 16, Indonesian provinces, 2010
Values smoothed by moving averages
Source: same as for Figure 1

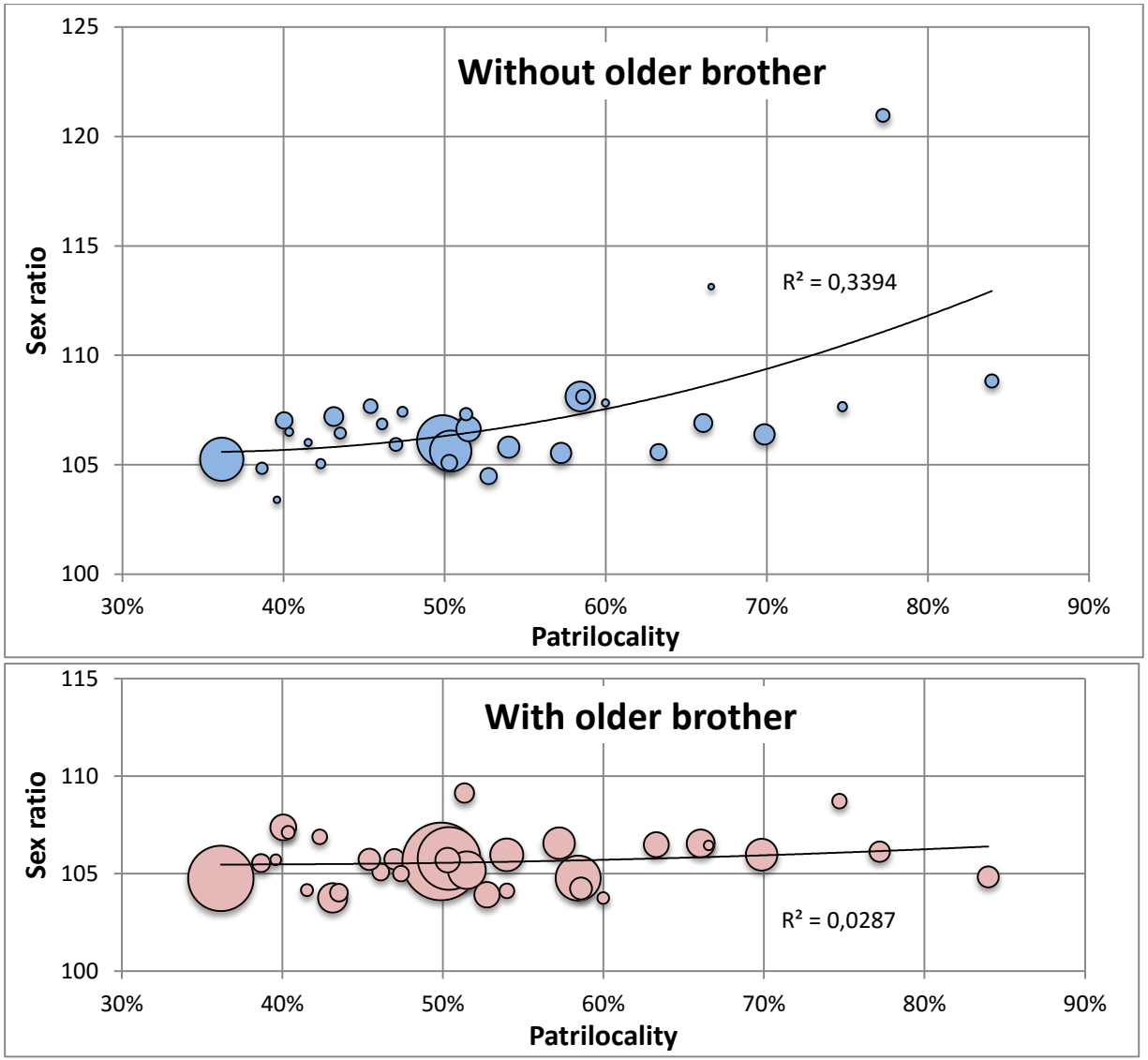

Figure 4: Patrilocality level and child sex ratio according to the presence of an older brother, Indonesian provinces, 2010
Circles proportional to the size of the child population *Source*: same as for Figure 1