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Speeding up for a son? Fertility transitions among Asian migrants to Canada

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Speeding up for a son? Fertility transitions among Asian migrants to Canada

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Abstract

We use the 2001 and 2006 Canadian Census to study how the sex-ratios at second birth, conditional on both the spacing between the first two children and the gender of the first, vary across place of birth or religious affiliation. We find that South Asian women give birth to a higher proportion of boys after a first-born girl compared to both natives and other immigrant groups with girls and also to South Asians with a first-born boy. Across religious groups, Sikhs present a similar behavior. These abnormal sex-ratios are particularly skewed when the time span between the first two births is short. This clearly indicates that sex-selective abortion happens more frequently after conceptions that occur fairly close to the birth of a first girl. Sex ratios return (close) to normal for these groups if live-births are spaced three years or longer.

1. Introduction

During the last decades the share of boys among newborns has been rising dramatically in places such as China and India particularly at high parities. A large literature has explored this phenomenon and attempted to count the number of "missing women" in some countries, particularly in South Asia and the Middle East (Sen 1992, 2003; Klasen and Wink 2003). Both unequal treatment of children across gender-lines and sex-selective abortion produce abnormal shares of boys in societies where families express a strong preference for having a son. Son preference prevails with varying intensity across South East Asian society (Das Gupta et al. 2003; Chung and Das Gupta 2007; Jayaraman, Mishra and Arnold, 2009; Gaudin 2011) and exhibits regional variation, with the highest boy shares found in Northern Indian states (Bhat and Zavier 2003). A variety of socio-economic and religious reasons accounts for this taste for sons. In developing rural economies boys may provide more physical labor in the fields and have higher expected wages than girls (Das Gupta et al. 2003; Pande and Astone 2007). Parents in traditional economies with little social programs for old age, and where males are the main providers of resources, may attach more value to male than to female offspring as old-age insurance. Poor households might deem daughters too expensive if dowries are demanded in order to marry them off, before they move with their husband's family as it happens in India. Predictably, son preference is more pervasive in patrilocal societies (Jain et al. 2014, Ebenstein 2014).

Cultural and religious reasons also bolster son preference. Since many of these societies are patrilineal, only men can continue the family lineage, and according to Hindu tradition, sons are "needed for cremation of the deceased parents, because only sons can light the funeral pyre" (Almond et al. 2013). Bhat and Zavier (2003) show how, in India, Hindus and particularly Punjabi Sikhs (mostly residing in Northern India) display the highest levels of son preference. Similarly, castes that have achieved high ritual status ("Sanskritized") usually display male-preference with regard to dowry, and marriage (with large lavish wedding for Sikh daughters), among other things (Chakraborty and Kim 2010). Lately, families of lower castes with high economic resources have also emulated those behaviors (Gaudin 2011). In China where lineage is traced through male descendants, the one child policy has exacerbate this problem by imposing restrictions on family size.

If couples continued to bear children until they achieved their desired gender balance, son preference could boost family sizes. However, with availability of sex-selective abortion,

economic forces and rising education that moderate the desired number of children might lead to small families (Jha et al. 2006; Bhat and Zavier 2007).[1]

As migrants move to more developed societies where children are no longer viewed as guarantee for old-age insurance or required for agricultural labor, and where female labor force participation is relatively high, some of the socio-economic motivations for son preference should disappear. In addition, intermarriage and cultural assimilation may dilute the relevance of lineage. It is plausible, however, that immigrants arriving from areas with strong son preference still display some differential treatment across gender lines. Pabilonia and Ward-Batts (2007) and Lhila and Kosali, (2008), for example, show evidence of differences in parental labor supply and prenatal health behavior conditional on the gender of the child in developed countries by immigrants from countries with marked son preference, like China, India, South Korea and Taiwan.

With regard to childbearing patterns, the literature generally finds that the fertility behavior of immigrants converges to that of natives at destination, with varying degrees of speed depending on origin and age at arrival (see Adserà and Ferrer 2014b for an overview). Within this strand of research, the assimilation model suggests that couples migrating from a country with high fertility rates or with distinct gender-preferences may initially follow their own country's fertility patterns but gradually adjust to those of their host country (either within the first generation or the next) (Andersson 2004, Coleman and Dubuc 2010, Fernandez and Fogli 2006, Blau et al. 2013). Despite the general trend towards convergence, a few recent papers find some persistence of abnormal sex-ratios among first generation immigrants in destinations such as US, Norway, Canada, UK, and Spain (Abrevaya 2009, Edlund and Almond 2008, Singh et al. 2010, Almond et al. 2013, Dubuc and Coleman 2007, Gonzalez 2014).

Within this research agenda, this is the first paper that analyzes the differences in sex-ratios at birth among migrants depending on both the spacing between the first and second child and the gender of the first child. To this aim we employ the 20% confidential sample of the 2001 and 2006 Canadian Census to obtain large enough samples to focus in detailed ethnic and religious groups as well as months elapsed between births. As explained in Section 2, our rationale to study these patterns is based on the expectation that couples eager to produce a son

[1] In addition to sex-selective abortion, discrimination of girls may manifest itself through lower human capital investments or more housework for girls than for their brothers, among other things (Mishra, Roy, and Retherford 2004, Lin and Adserà 2013).

(after a girl is born) may shorten the distance between births and may be more amenable to selectively abort female fetuses if conceived relatively close to the birth of the previous child. We find that South Asian women give birth to a higher proportion of boys after a first-born girl compared to both natives and other immigrant groups with girls and also to South Asians with a first-born boy. Across religious groups, Sikhs present a similar behavior. These abnormal sex-ratios are particularly skewed when the time span between the first two births is short. This clearly indicates that sex-selective abortion happens more frequently after conceptions that occur fairly close to the birth of a first girl. Sex ratios return (close) to normal for these groups if live-births are spaced three years or longer.

The remainder of the paper is organized as follows. Section 2 discusses the empirical implications of son preferences on childbearing patterns as well as previous findings on developed (destination) countries. The following section describes the data employed in the analysis. Sections 4 and 5 present the main findings, first, on the probability of having a son conditional on the gender of the first child and second, on how this probability varies by time elapsed between births. The paper concludes with a general discussion.

2. Research Question and Canadian Background

In order to unveil whether or not son preference endures among immigrants originating from societies in which sons are favored over daughters, it is important to understand how preferential treatment of boys is expected to impact fertility behavior. First, couples who are eager to have a son may be much more likely to have another child if the previous one was a girl or if they consider they do not have enough male-offspring. Unfortunately it is very difficult to unveil preferences about the gender composition of children from the data generally available and, when those questions are asked, they are bound to be biased by social desirability[2]. Even so, a researcher can estimate whether the likelihood to continue to the next parity varies with the gender of the previous child (children). To test this, he or she requires information about the number and gender composition of a woman's offspring. Unfortunately this information is not always available. In birth registrars, for example, the gender of previous births to the same woman is not typically recorded. With household surveys or Census information it is possible to

[2] Lin and Adserà (2013), for example combine two questions of the National Family Health Survey of India, 2005-2006 (one regarding the ideal number of children to be born and the second, the ideal gender composition of that offspring) to obtain a measure of son preference. Some researchers note that the bias of the answers can be handled by introducing appropriate controls in the analyses (Bhat and Zavier 2003, Pande and Astone 2007, Gaudin 2011).

reconstruct the fertility history of a woman only with some limitations. Almond et al. (2013) use families of South or East Asian ancestry (at least one of the grandparents) in the 2001 and 2006 Canadian censuses whose children were born in Canada to conduct this type of exercise. They find that first generation SE Asian women with a first born girl are 2.2% more likely to have another child within the six years following that birth than those who had a first-born son. The difference is only significant among non-Christian or non-Muslim, and particularly strong among Sikhs (a 5.1% more likely). Differences for third births after two girls are born are not only significant among first generation but also among second generation South or East Asian immigrants. In the US Census data, Abrevaya (2009) only finds significant differences of a birth five years after the previous one for the third parity among women of Chinese, Indian and Korean origin.

A second pattern associated with son preference is an increase in the shares of boys among the second (or third) child, especially when the first-born (or two first-borns) were girls. This regularity is found among different groups of Asian migrants in Abrevaya (2009), and Almond and Edlund (2008) in the US; Ray et al. (2012) and Almond et al (2013) in Canada; Dubuc and Coleman (2007) in the UK, Singh et al. (2010) in Norway and Gonzalez (2014) in Spain.

In the 2000 US Census, Almond and Edlund (2008) find male-biased sex ratios (particularly for third births) among children born to parents of Chinese, Korean and Asian Indian origin who only had daughters. Dubuc and Coleman (2007) use the birth registry in England and Wales to calculate the sex ratio by parity for the period 1969-2005. Even though they cannot distinguish by the gender of the previous child, they still find Indian-born mothers are more likely to have a boy as their third (or later) child than other women. The unbalanced ratio appears significantly only in the later period between 1990 and 2005. Similarly Gonzalez (2014) finds that among Indian mothers the ratio of boys per 100 girls among second births stands at 117 and it is more than twice as large for third and later births in the sample of 2007-2012 Spanish birth certificates. Abrevaya (1990) employs three different US datasets to find an increase in boys to girl ratio for the third and fourth child among Chinese, Korean and Indians (and also in the second birth for the latter group). Conditioning on the gender of previous children with the California birth data 1970-2005, the likelihood of a boy in the second and third births is significantly higher for Indians and Chinese who did not have any sons before. Among Canadian women of South East Asian origin, Almond et al (2013) find higher sex ratios (mainly for the third parity) for

parents of daughters among Indians and to some extent among Chinese. Ratios are particularly elevated for Sikhs in the third parity and for non-Christian and non-Muslim in general.

Besides these most researched consequences of son preference, a third potential implication, which constitutes the main focus of this paper, is that the ratio of newborn boys over girls is likely to be higher among births that happen very close to the previous one than among those that are more spaced. This pattern could result from different forces operating simultaneously. First, after the birth of a daughter, parents with strong son preference may be anxious to conceive again with the hope of having a son. In their analysis of the determinants of Korean birth intervals for the period 1963-1972, Bumpass et al (1986) find significant interactions between the timing of births and the presence of sons. These differences are more moderate for second births than for third ones, but still significant. After 28 months since the first birth, the proportion of women with a second child stands at 51 per cent for those whose first child was a son and 65 per cent for those who had a girl. The gap closes to less than 6 points at 40 months. Similarly, Hemochandra et al. (2010) show that birth intervals are shorter in rural Manipur among families who still want more sons. This eagerness to produce a son may result in behaviors that lead to the relative neglect of girls. Jayachandran and Kuziemko (2011) find shorter breastfeeding periods for girls than for boys in absence of a brother in India. They argue that, since women are thought to be less fertile while breastfeeding, the shorter period is in part aimed at increasing the prospect of a new pregnancy that may produce the desired son. Likewise, in the 1974 Korean National Survey, Nemeth and Bowling (1985) find that the absence of sons significantly reduces the chances that a mother will breastfeed.

Second, among those who speed up to conceive another child after a girl is born, the likelihood of using prenatal diagnostics and a subsequent abortion is likely higher that for those who already have sons. However, since couples may refrain from undergoing multiple abortions, may want to achieve their desired family size before a woman's fecundity decreases and/or may have some views regarding the ideal (not too long) spacing between siblings, they may eventually choose to deliver a baby girl. Finally, couples without son preference, who may not speed up as much to conceive immediately after the first birth as those with a male-bias, will certainly not contribute to abnormal sex ratios. As a result of all these forces, it is natural to expect that some unwanted girls will not be delivered if conception happens close to the previous birth (particularly that of a girl), and sex ratios will be abnormally high. As couples with lesser preferences for boys start to conceive and those with son preference continue to try to produce a

boy, the boy to girl ratios should drop slowly toward normal levels. Portner (2015) uses the National Family and Health Surveys for Hindu women from 1972 to 2006 to reveal some of these patterns among women with eight or more years of education.

Finally, a fourth implication of son preference not explored here could be an increase in the spacing between deliveries rather than conceptions when sex-selective abortion is employed. After a first conception, women have to wait for the ultrasound to distinguish the gender of the fetus and then decided whether or not continue with the pregnancy. If a pregnancy is terminated, a resting time is required before a new conception. Portner (2015) estimates a model where, fertility, abortion and birth spacing are choice variables and provides some suggestive evidence for India.

Overall, the ability to selectively abort a fetus conditional on their gender is required for the second, third and fourth implications to follow. Dubuc and Coleman (2007) note that, especially in the context of developed countries, it is not possible to explain the abnormal ratios found in the data through under-registration of girls or infanticide, but rather through prenatal diagnosis. In this paper we focus on the second and, particularly, on the third implications of son preference discussed above. We present results for second births, though we comment in the text on some results for third births. Previous literature shows that the degree to which son preference is revealed in the data increases with parity and is only significant for second births among Indians (or south Asians) in some settings while more pervasive for third births. However, the larger sample sizes available for second births than for later parities facilitate the detailed analysis (by birth spacing) required to test the third implication.

The Canadian context is particularly well-suited to explore the continuity of son preference among South East Asians after migration. The reason is two folded. On the one hand abortion is Canada is fairly accessible. As detailed in Almond et al (2013), abortion is provided through universal health coverage, clinics are available country-wide and there are essentially no legal barriers to abort regardless of gestational age. On the other hand, Canadian migrants constitute around 20 per cent of the population and, among them, the share of Asians has increased during the last two decades. In this regard, the Census affords large samples to test whether the empirical implications of son preference appear in the data. Further, among migrants form South Asia, those originating from areas with a particularly strong tradition of son preference such as Northern Indian states (where the majority of Sikhs live) are overrepresented in Canada (Bhat and Zhavier 2003, 2007). While Sikhs comprise only 2 per cent of India's

population and Hindus about 80 per cent, the total number of Sikhs and Hindus among both foreign and Canadian-born in the 2001 Census stood at 278,000 and 297,000 respectively (Statistics Canada 2005). Further, among migrant languages in the 2011 Census, Punjabi was the most frequently reported home language in Vancouver and Calgary and the second one in Toronto and Edmonton (Statistics Canada 2012).

3. Data

We use the confidential files of the Canadian Census for the years 2001 and 2006 that include a 20% sample of the population that completed an extended Census with a rich set of variables. Estimates from the 2006 Canadian census indicate that 20% of the population is foreign born and that yet another 13% are the children of foreign born parents or second generation Canadians. As a result, the census provides large samples and a diversity of origin countries that facilitates our analysis. In order to reduce computing time to a reasonable length, from each Census, we select all immigrant observations plus a 20% random sample of native-born individuals. We weight observations accordingly.

We link all individuals belonging to the same household and select all non-aboriginal women between 16 and 45 years of age who are either married or in a common law relationship. For each woman we have information on immigrant status and country of birth. The 2001 Census also contains information on the religious affiliation of each individual.

Census data does not provide complete fertility histories of women but rather reports the number of children living in the household. We employ the "own children method", that exploits the fact that the vast majority of young children live with their mother, as an alternative means to obtain fertility measures. Since the date of birth of both mother and children is known, it is possible to reconstruct each woman's fertility history quite accurately. To the extent that some children do not live with their mothers (because they either reside with another relative or have already left the household to study or form a household of their own) that method may underestimate the fertility of women (for a detailed discussion of the method see Dubuc 2009). To minimize the concern of missing some children, we restrict our sample to women age 45 or younger whose oldest child in the household is 14 or younger.[3] We choose age 14 as a cutoff

[3] Results are robust to more restrictive age cutoffs but, given the small samples of our groups of interest, we use women up to 45 years of age. In a separate piece that also employed Canadian Census data to study fertility of migrants and natives, we showed results obtained with the "own-children's method" to be robust to different age

because, if children generally start leaving the house around age 18 (mostly for education), the age difference between that missing child and the oldest child we observe would be at least 4 years, a sizable difference in the sample.

Within SE Asia we create dummies for three major groups of countries: 1) China (China plus Hong Kong, Singapore, Mongolia, Macao, and North and South Korea); 2) South Asia (India, Pakistan and Bangladesh); 3) Other SE Asia (Sri Lanka and Vietnam).[4] With data of the 2001 Census we create the following categories for religious affiliation: Christians, Muslim, Hindu, Sikh, Other (a small miscellaneous category that includes Jews, Buddhists and other) and no religion. We define these categories of place of birth or religion only taking into account women's characteristics. This is different from Almond et al. (2013) that defines SE Asian families as those having at least one grandparent (of either side) from that ancestry born outside Canada.

Table 1A in the appendix presents basic descriptive statistics of the major variables. The prevalence of boys among first and second children for the joint sample of natives and immigrants is similar and within the expected range, around 51.4%. The average woman in the sample is 36 years of age and the average age at first birth is just under age 26. Immigrants constitute close to 21% of the sample and around 2.8% of all women were born in South Asia. Among religions, Christians are the largest group with a share of 80% of the sample followed by those without religion (around 14%). Muslims comprise around 2.3% of the sample and both Hindus and Sikhs around 1%.

4. Probability of a Son in the Second birth

We first test whether the probability of having a son increases among groups with a tradition of son preference if the first child is a girl. In particular, we estimate the following OLS model.

$$Y = \beta_1 Girl + \beta_2 SP + \beta_3 (Girl * SP) + \alpha X + \varepsilon \qquad (1)$$

where the dependent variable *Y* takes a value 1 if the second child is a boy and 0 otherwise. The dummy variable *Girl* takes a value 1 if the first-born child was a girl and the variable *SP* refers

cutoffs and to the use of the actual number of children of each woman available in the 1991 Census (Adserà and Ferrer 2014a).

[4] We separate these two countries (with sizable samples) because the literature has not considered them among those with strong son preference though some recent papers mention imbalances in third births for Vietnam (Almond et al 2013). However, in the Census years 2001 & 2006 raw sex ratios for second births did not display any significant imbalance for this country.

to a particular population group (by origin or religion) that is likely to exhibit fertility patterns associated with son preference; that is, abnormally high prevalence of second-born sons. The first three coefficients are the parameters of interest and in particular, β_3, which indicates whether within groups suspected of strong son preference the probability of giving birth to a boy varies significantly by the gender of the first child. All models include a vector of controls *X*, namely, dummies for age at first birth, educational attainment, a dummy for the 2006 Census as well as controls for residence in Vancouver and Toronto since they are the major destination cities of South East Asians in Canada.

We run all the specifications in the paper either by requiring that all children in the family were born in Canada or without imposing that condition. Even though results do not vary much across samples, the restriction is meant to ensure that women were facing the same institutional framework (particularly in relation to abortion accessibility) than natives and other migrants at the time of all their births. The majority of the results in the tables restrict the sample to Canadian born children.

Table 1 shows the estimated difference in the probability that a South Asian woman who had a girl in the first place delivers a son as her second child compared to different groups of women. In panel A, the sample includes all women regardless of their educational attainment and, in panel B, only women with at least some post-secondary education. The reported differences are calculated as the sum of the relevant coefficients in equation (1). For instance the first row reports $\beta_3 + \beta_1$, the differential fertility of South Asian women with a first-born girl to South Asians with a first-born boy. The following row reports $\beta_3 + \beta_2$, the differential fertility of South Asian women with a first-born girl to non-South Asian women in the sample who also had a girl in the first place. Finally the third row reports $\beta_3 + \beta_2$, the differential fertility of South Asian women with a first-born girl to non-South Asian women who had a boy in the first place. While Almond et al. (2013) limit their sample to South East Asians, Table 1 displays results in three different samples: one that includes all natives and migrants; a second one that only includes migrants, and a third one that is limited to those born in South East Asia. As a result the reference group changes in each column. For each sample results are shown both with and without the restriction that all children in a family be born in Canada.

In the first column of Table 1 in Panel A, the value of 0.05 indicates that South Asian women with a girl as a first child were 5 percentage points more likely to deliver a boy as a

second child than South Asians who already had a first-born son. In the second column, when the sample only includes women whose children were all Canadian-born, the difference is still remarkably high, around 4.5 percentage points. As expected the estimated gap is similar both in the sample of migrants and in the sample of SE Asian women. Compared to the rest of the population with a girl, South Asians with a first born girl are between 2.6 and 3.4 percentage points more likely to deliver a boy, depending on the particular sample employed, and between 3 to 4.3 percentage points more likely than the rest of the population with a first born son.

When we restrict the sample to women with at least some post-secondary education in Panel B, estimated gaps are similar to those in Panel A, if not larger. This is not surprising since more educated women may prefer smaller families and, as a result, the need to achieve the desired number of sons should bind at earlier parities (second births). Thus, even if education may, on the one hand, decrease son preference altogether; a smaller family size target, on the other hand, may make it more pressing to deliver a boy at low parities for those who still want a son. Abrebaya (2009) shows that sex imbalances are similar among Indians in the US across education levels. However, for the third births, Almond at al. (2013) find that mothers with less than a university degree display somewhat stronger patterns of son preference.[5] In India, the smaller family sizes resulting from rising income levels and educational attainment have been coupled with rising biases in sex ratios facilitated by the technological advances in sex-determination (Jha et al 2006, Bhat and Zavier 2007, Gaudin 2011). Table 1 estimates show that educated South Asian women who had a girl in the first place are up to 6.3 percentage points more likely to deliver a son next time around than South Asians who already have a son if we include families with children born both in and outside Canada. When only Canadian children are included in the sample, the difference stands at around 5.2 percentage points.

In separate models that also include interactions of gender of the first child for the other two subgroups of S.E. Asian immigrants (namely, China and Other SE Asian), we do not find any abnormally high probability of conceiving a boy among these groups (see Table 2A in the appendix).[6]

[5] In separate results not shown here we also find that patterns of son preference in the third parity are more apparent among women with less than post-secondary education who might have been more inclined to try for a third child in order to achieve a son than their more-educated counterparts.

[6] When looking at third parity, in results not shown here, besides South Asians without sons, women in the China group with two daughters also display abnormally high ratios. However given the small sample of Chinese families with three Canadian-born children coefficients fail to achieve significance, but they do once children born outside Canada are included.

Next we study the gender ratio of the second child by religious affiliation. Almond et al (2013) find abnormal sex ratios within South East Asians to be large for those who are not Muslims or Christians (especially among Sikhs and for the third birth). As noted, within India, the Northern states where the majority of the Sikh population lives are the ones that depict the higher gender imbalances at birth. Among migrants to Canada, Sikhs constitute a relatively large group compared to their share of the population at origin. From natural conception, we should expect to observe a relatively balanced distribution of the gender of the first two children across families. In contrast, in our sample only around 15% of Sikh women have two girls compared to 31% with two boys (see Table 3A). Among Hindus the proportion with two girls stands at 19.4% just a bit below the 20% of Muslims or 21-22% of other groups. Among, non-Sikhs, the share of families with two boys ranges from 27.2% among Muslims to 25% among Christians.

We include separate dummies for each religious category and their interactions with gender of the first child in equation (1). We choose Christians as the reference group, though results are similar when only including interactions for Sikhs and using all non-Sikhs as the reference instead. Table 2 displays the estimated difference in the probability that a Sikh woman, who delivered a girl in the first place, will have a son compared to either Sikhs with a boy or to Christians. The gap within Sikhs by gender of the first child is smaller in the sample that includes both natives and immigrants, around 3.4 percentage points, than when only immigrants are included, around 4.5 percentage points. This is not surprising since in the first sample some of the Sikhs are second-generation Canadians with likely weaker links to their ancestor's culture and less (or none) son preference than the foreign-born. Estimates from the 2011 National Household Survey (NHS) indicate that around 35% of Sikhs living in Canada were born in the country. We do not find any significant differences for any of the other religious groups. However, for third births, in separate results, the coefficient for the interaction with two girls is large both for Sikhs and Hindus but only significant for Sikhs. Results are consistent with Almond et al. (2013).

5. Sex imbalances and birth spacing

Next we study whether the sex ratio is particularly skewed among children born relatively close to their first siblings as expected from the third implication of son preference discussed in section 2. To see whether this pattern fits the data, we first look at the raw distribution of families

by the gender composition of the first two children and the months elapsed between their births. Figure 1 shows these distributions both for non-Sikh migrants and for Sikh migrants separately. In the upper graph of Figure 1 the distribution by months between the two first births for non-Sikh migrants is remarkably similar across different combinations of the gender of children. Conversely, the distributions are somewhat different for Sikh migrants. In the left hand side of the lower graph, among births occurring relatively early after the first one, families with boy-boy and girl-boy are the most prevalent, followed by those with boy-girl and finally those with two girls. Interestingly, in the other extreme of the distribution, for births occurring after four years since the first one, families with two girls are now relatively abundant.[7] Of course the small number of Sikhs in our sample is bound to produce some noise in these descriptive distributions.

To study whether some of these differences are significant in a multivariate regression analysis, we estimate a variation of the first model by taking into account the number of months that have elapsed between the first and the second birth.

$$Y = \beta_1 Girl + \beta_2 SP + \beta_3 (Girl * SP) + \sum_n \alpha_n Time_n + \sum_n \gamma_n (Time_n * Girl) + \sum_n \delta_n (Time_n * SP) + \sum_n \theta_n (Time_n * Girl * SP) + \mu X + \varepsilon \qquad n= 15,24, 36 \qquad (2)$$

The dependent variable *Y* takes a value 1 if the second child is a boy and 0 otherwise. In addition to the covariates in (1), equation (2) now includes a set of dummies *Time* that indicate the spacing between the first two births, either 15 months or less, 16 to 24 months and 25 to 36 months. The reference category includes those who had a second child more than 36 months after their first one was born. These *Time* indicators are then interacted both with the gender of the first child and with the particular group that is likely to exhibit son preference.

Table 3 displays the difference in the probability that the second child of a South Asian mother is a son by the months elapsed between the first and second birth and by gender of her first child relative to different groups in the population. As detailed in Table 3, these difference are calculated from adding up the relevant coefficients from the estimated equation (2). We employ four different samples: first, all natives and migrants; second, only migrants; third, women born in South East Asia and finally only those born in South Asian to study differences

[7] The appendix Fig 1A includes similar graphs for South Asians and non-South Asians and appendix Fig 2A for Sikhs and non-Sikhs in the sample that includes both natives and immigrants. The patterns are remarkable similar to those in Figure 1, but somewhat a bit more muted.

within the group. Except for the last column, the sample is restricted to those families whose children were all born in Canada.

As expected, the sex-ratio imbalances are somewhat larger when the second birth happens within the first two years since the first child was born. Compared with a South Asian woman who already has a son, those who had a girl first are around 7 to 7.5 percentage points more likely to deliver a boy if the second birth happens 24 months or less after the first one. In the last column, when we allow children to be born either in Canada or abroad, the difference increases to over 8 percentage points for births happening within the first 15 months and 5.5 for those between 16-24 months. The difference is already more muted, for births occurring in the third year (between 25-36 months after the first) and only significant in the last column. The gap within South Asians stands at around 3.5 percentage points (4.3 if all children are included) and, it is even smaller for births after 36 months, around 3 percentage points (5 if all children included). As expected, compared to non-South Asians with a boy born after 36 months from the first child, in the second panel of Table 3, the differences are also large and significant. Further, estimates in the last panel of Table 3 confirm that no significant differences are apparent between South Asians who already have a son and the rest of the population independent of the timing of the births.

Figure 2 displays results from the model specification of column 2 in Table 3. The comparison group in this case is all non-South Asian immigrants with a first-born son and children born in Canada more than 36 months apart. The gradient in the difference in the prevalence of boys for South Asian mothers with a girl by months since migration is remarkable, particularly when compared to the lack of significant difference among any of the other groups in the graph. [8] When looking at differences within South Asians alone, in Figure 3, the gradient is also obvious, both when only Canadian children are included (first set of estimates) or when this restriction is lifted (second set of estimates).

In separate estimates (presented in Table 4A in the appendix), we redefine the time intervals to look at the very close births that happen within one year. As a result the second time interval now encompasses births between 13-24 months instead of 16-24 months. The rest of the model is the same as that in Table 3. Figure 3A in the Appendix is similar to Figure 3 but with

[8] The negative gradient is also apparent in models with third birth parities, not presented here, for South Asians with already two girls and, particularly large for Sikhs with two girls, but not significant for this group due to lack of power.

this new specification of the time intervals between the first and second births. In this specification the negative gradient by months since previous birth is more remarkable for the first two intervals. Within South Asians, the difference for births happening within a year of the birth of a girl hikes up to 11%, compared to births three years after a boy, when children born both in and outside Canada are included.

Even though the sample for Sikhs is fairly thin once we divide it by months between births, we estimate model (2) to compare Sikhs to non-Sikhs. Results are presented in Table 4 for the difference with respect to a non-Sikh with a first born son and children spaced more than three years. For those mothers who delivered a second child between 16 and 24 months since the previous birth, the difference is significant and large, over 7.3 percentage points in the sample that includes both natives and immigrants and up to 9.7 to 9.7 percentage points when the sample is restricted to either all immigrants or SE Asian immigrants. Even though it is still elevated among births that occur between 25 and 36 months, for all the other intervals the difference is not significant (most likely due to lack of power).

6. Concluding remarks

This is the first paper to explore whether the gender imbalances among second children of Asian immigrants varies by the time elapsed since the birth of the first child. We find that, both among South Asians immigrants and among Sikhs (especially those born outside Canada), the probability of delivering a son is higher if the first-born is a girl. Further the bias in the sex ratio decreases with the months elapsed between the two first births. These findings conform to the expectation that couples who prefer a boy may both speed up conception of a second child after the birth of a first girl and be likely to resort to selective abortion. As the second birth gets farther apart from the first, the composition of new mothers should include a combination of people without strong son preference (many of whom did not move "as" fast as the others to have another child after a girl was born), some women who aborted and are now carrying sons and some who may have aborted before, but now either do not want to do it again or prefer to keep the distance between siblings not too large. As a result, the sex ratio of newborns should move toward normal levels.

The majority of previous studies of the prevalence of son preference among immigrants in developed settings find significant differences for third and fourth parities but not that much for

second, with the exception of Indians in Abrevaya (1990). Even though we recognize that results are likely much weaker for second births, we chose to analyze them for two reasons. First, looking at sex ratios by months since births and children's gender imposes many demands on the data. Running into small cell problems for third births was a concern that we confirmed in some of the basic models for third parity we succinctly refer to in the text. In fact, the sample of Sikhs for second parity was already fairly small. Second, with the increase in women's education and its accompanying reduction in family size, the need to produce a son binds at earlier parities. This may be particularly relevant for Canada given its selective immigration policy on educational grounds. In that regard, trends toward lower fertility among more educated couples should not necessarily be associated with a return to normal sex-ratios.

Finally, we find indications of assimilation to Canadian fertility patterns among Sikhs. The smaller bias in sex ratios we find when both first and second generation Sikhs are included in the relevant group as opposed to when only those born abroad are included indicates a lessening of son preference across generations. This is consistent with findings of assimilation among second generation SE Asians in Canada observed in Almond et al (2013).

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Table 1. Difference in the probability that the second child of a South Asian woman is a son if her first child is a girl relative to different groups of women

Sample	**Natives and Immigrants**		**Immigrants**		**South East Asians**	
Children born:	All	Canadian	All	Canadian	All	Canadian
Panel A: All Mothers						
Comparison group						
South Asian with boy	0.050	0.045	0.050	0.045	0.050	0.045
$\beta_3 + \beta_1$	(5.39)	(3.82)	(5.38)	(3.82)	(5.39)	(3.83)
All others with girl	0.029	0.026	0.034	0.034	0.033	0.033
$\beta_3 + \beta_2$	(3.92)	(2.96)	(4.59)	(3.77)	(3.82)	(3.12)
All others with boy	0.043	0.042	0.036	0.036	0.033	0.030
$\beta_3 + \beta_2 + \beta_1$	(5.94)	(4.67)	(4.89)	(3.98)	(3.88)	(2.87)
N.Obs	168,565	141,910	91,975	65,320	40,220	27,455
Panel B: Mothers with Post-secondary Education						
Comparison group						
South Asian with boy	0.063	0.052	0.063	0.052	0.063	0.033
$\beta_3 + \beta_1$	(5.17)	(3.12)	(5.16)	(3.11)	(5.18)	(2.91)
All others with girl	0.026	0.021	0.035	0.034	0.034	0.035
$\beta_3 + \beta_2$	(2.71)	(1.64)	(3.57)	(2.62)	(3.02)	(2.38)
All others with boy	0.048	0.043	0.034	0.031	0.052	0.026
$\beta_3 + \beta_2 + \beta_1$	(4.98)	(3.43)	(3.51)	(2.41)	(3.13)	(1.78)
N.Obs	107,209	88,869	57,392	39,052	23,910	14,820

Note: Data from 2001 & 2006 Census. The model includes dummies for first born girl, for South Asian and their interaction as well as basic controls: dummies for age at first birth, educational attainment, 2006 Census, Vancouver and Toronto. Unweighted number of observations reported. T-stats for the difference between both groups in parenthesis.

Table 2. Difference in the probability that the second child of a Sikh woman is a son if her first child is a girl relative to different groups of women

Sample	**Natives and Immigrants**	**Immigrants**
Children born:	**Canadian**	**Canadian**
Comparison group		
Sikhs with boy	0.034	0.045
$\beta_3 + \beta_1$	(1.35)	(1.91)
Christians with girl	0.014	0.028
$\beta_3 + \beta_2$	(0.77)	(1.57)
Christians with boy	0.026	0.031
$\beta_3 + \beta_2 + \beta_1$	(1.39)	(1.76)
N.Obs	72,160	31,360

Note: The model includes all basic demographic controls in Table 1 as well as interactions of all religious affiliations and a dummy for a first born girl. The reference group is Christians. The sample is restricted to children born in Canada. T-stats for the difference between both groups in parenthesis. Data from Census 2001.

Table 3. South Asians: Difference in the probability that the second child is a son by the months elapsed between the first and second birth and gender of the first child

Sample	Natives and Immigrants	Immigrants	SE Asian	South Asian	South Asian
Children:	**Canadian**	**Canadian**	**Canadian**	**Canadian**	**All**
Difference between South Asian with girl and South Asian with boy born at same time interval					
		$\beta_3 + \beta_1 + \gamma_n + \theta_n$			
Months					
15 or less	0.069	0.069	0.070	0.072	0.081
	(0.056)	(0.057)	(0.055)	(0.048)	(0.001)
16-24	0.075	0.075	0.075	0.075	0.055
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
25-36	0.035	0.035	0.035	0.035	0.043
	(0.129)	(0.126)	(0.127)	(0.128)	(0.009)
36+	0.029	0.029	0.030	0.031	0.052
	(0.099)	(0.100)	(0.098)	(0.087)	(0.000)
Difference between South Asian with girl and all other with a boy born 36+months					
		$\beta_3 + \beta_2 + \beta_1 + \alpha_n + \gamma_n + \delta_n + \theta_n$			
Months					
15 or less	0.055	0.056	0.044	0.057	0.090
	(0.037)	(0.035)	(0.113)	(0.050)	(0.003)
16-24	0.057	0.057	0.045	0.059	0.059
	(0.002)	(0.002)	(0.026)	(0.007)	(0.005)
25-36	0.040	0.041	0.029	0.042	0.027
	(0.017)	(0.017)	(0.128)	(0.039)	(0.152)
36+	0.028	0.028	0.016	0.031	0.052
	(0.039)	(0.042)	(0.317)	(0.087)	(0.000)
Difference between South Asian with boy and all other with a boy born 36+months					
		$\beta_2 + \alpha_n + \gamma_n + \delta_n + \theta_n$			
Months					
15 or less	-0.014	-0.013	-0.026	-0.015	-0.010
	(0.581)	(0.618)	(0.338)	(0.596)	(0.684)
16-24	-0.018	-0.018	-0.030	-0.017	-0.004
	(0.332)	(0.348)	(0.140)	(0.448)	(0.806)
25-36	0.006	0.006	-0.007	0.007	0.016
	(0.742)	(0.723)	(0.727)	(0.721)	(0.337)
36+	-0.001	-0.001	-0.014	N/A	N/A
	(0.918)	(0.939)	(0.378)		
N.Obs	141,910	65,320	27,455	9,060	14,030

Note: The model includes all basic controls in Table 1. P-values in parenthesis. N/A: the comparison is not applicable because the group is the reference in the sample. All children are Canadian-born except for the last column that includes children born anywhere.

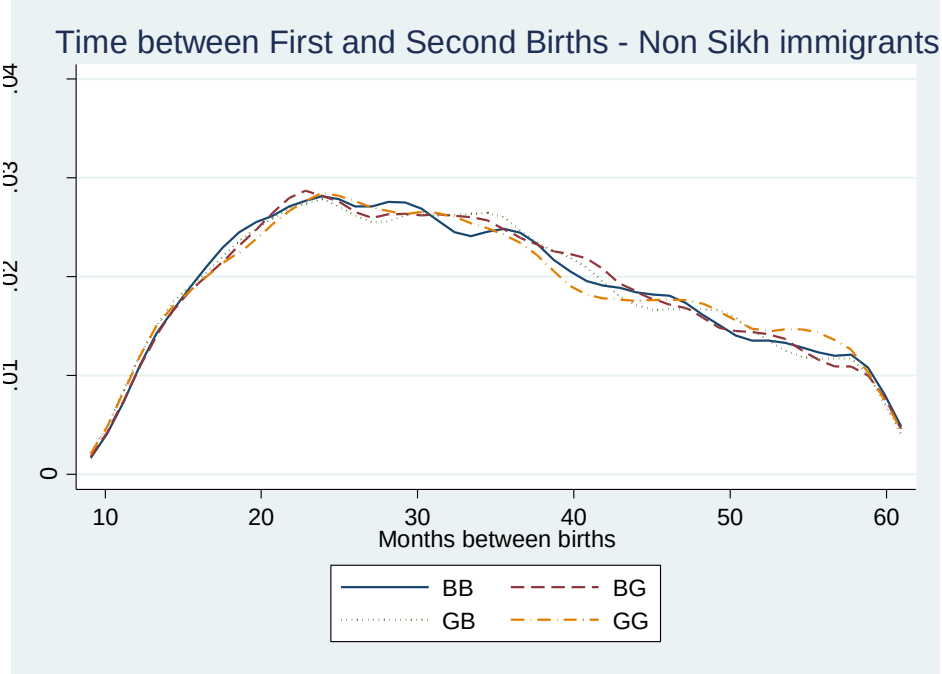
Table 4. Sikhs: Difference in the probability that the second child is a son by the months elapsed between the first and second birth and gender of the first child.

Sample	**Natives and Immigrants**	**Immigrants**	**SE Asian**
Children:	**Canadian**	**Canadian**	**Canadian**
Difference between Sikh with girl and all other with a boy born 36+months			
	$\beta_3 + \beta_2 + \beta_1 + \alpha_n + \gamma_n + \delta_n + \theta_n$		
Months			
15 or less	-0.013	-0.012	-0.012
	(0.799)	(0.813)	(0.828)
16-24	0.073	0.092	0.097
	(0.061)	(0.014)	(0.015)
25-36	0.024	0.039	0.020
	(0.507)	(0.226)	(0.555)
36+	-0.001	0.020	0.017
	(0.961)	(0.472)	(0.565)
N.Obs	72,160	31,360	12,165

Note: Data from 2001 Census. The model includes all basic controls in Table 1. P-values in parenthesis. All children are Canadian-born.

Figure 1: Distribution of months between the first and second child: By Religion and Gender of the first two children: Sikh and non-Sikh

A) Non Sikh immigrants:



B) Sikh Immigrants

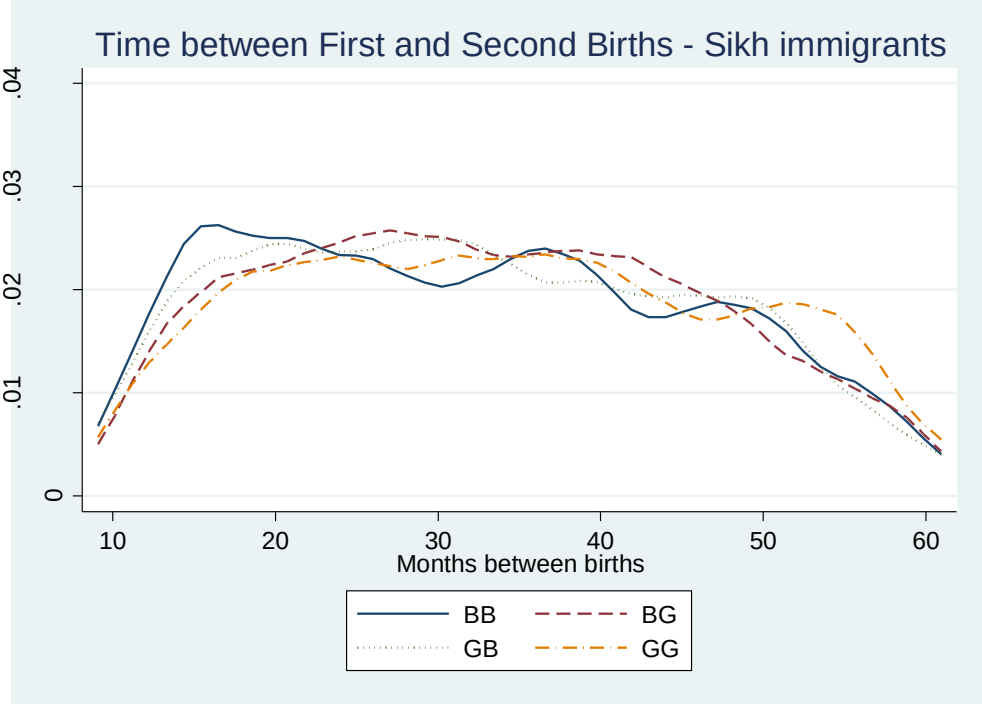
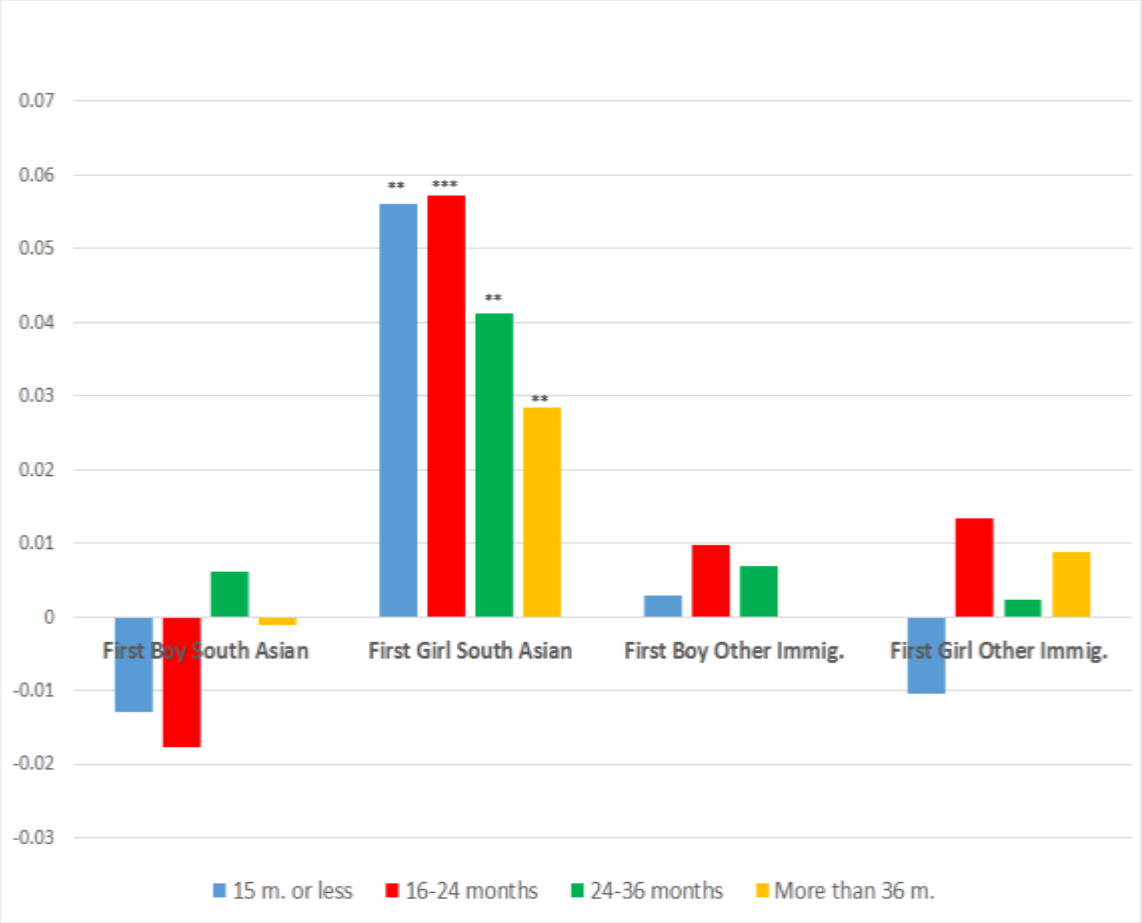
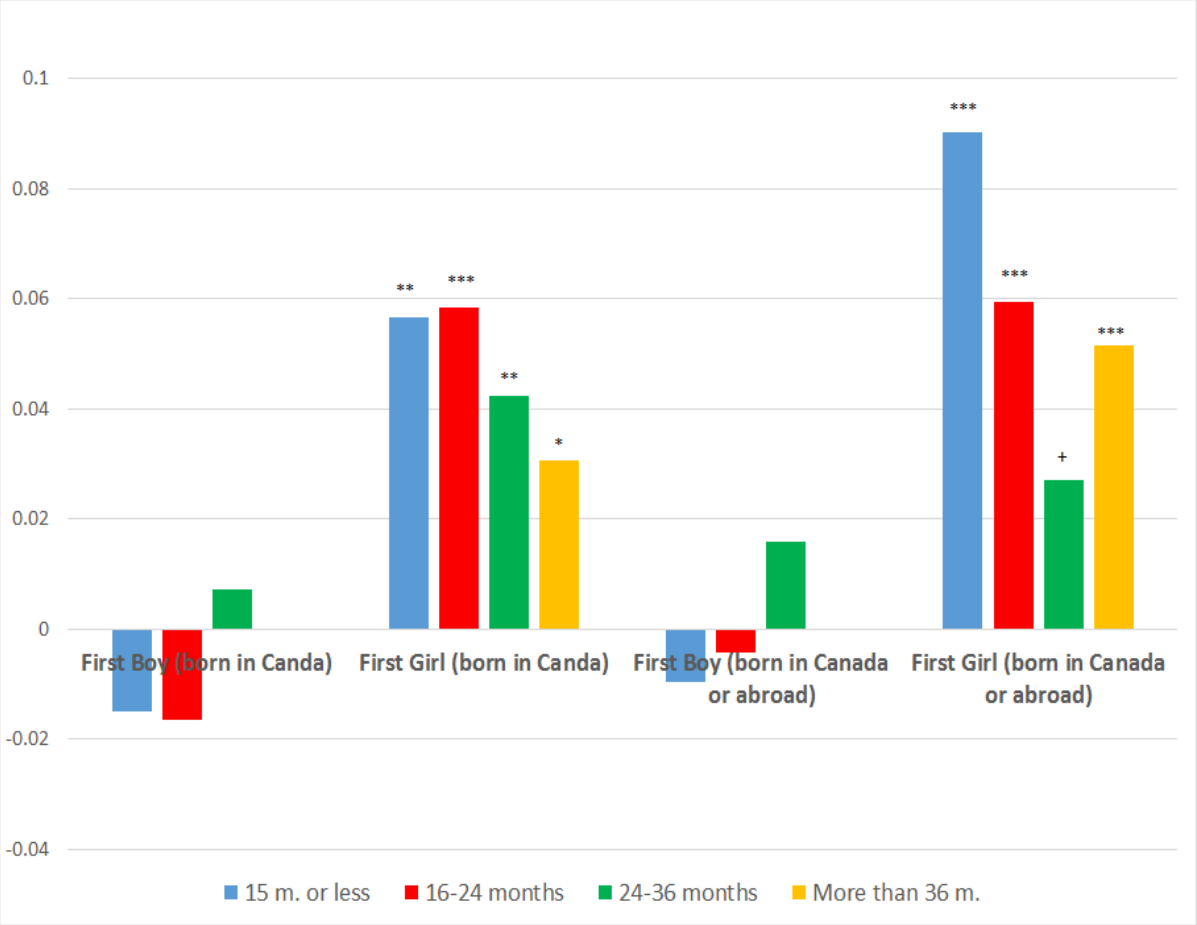


Figure 2: Estimated difference in the probability of having a son at second birth, by gender of the first child and months elapsed between the first and second birth (relative to all other immigrant women with a first-born son and children spaced more than 36 months).



Note: Estimates from the second column in Table 3. The sample only includes immigrant women with all Canadian-born children. Data Census 2001 & 2006. *** p<0.01, ** p<0.05, * p<0.1

Figure 3: Estimated difference in the probability of having a son at second birth within South Asians by gender of the first child and time elapsed between the first and second birth (relative to a South Asian with a first-born son and children spaced more than 36 months).



Note: Estimates from the last two columns in Table 3. The first model only includes South Asian women with all Canadian-born children and the second model allows their children to be born anywhere. Data Census 2001 & 2006. *** p<0.01, ** p<0.05, * p<0.1, + p<0.15

To be included as an Electronic Appendix

Table 1A. Sample Descriptive Statistics

Variable	Mean	Std. Dev.
First child Boy	0.514	0.50
Second child Boy	0.514	0.50
Age	36.601	5.84
Age at 1st Birth	25.885	4.65
Months between 1st and 2nd births	39.287	26.23
Education:		
Below HS	0.145	0.35
High School	0.255	0.44
Trades & Non-Univ. Postgraduate	0.342	0.47
College (BA)	0.216	0.41
Graduate	0.042	0.20
Place of Birth:		
Immigrant	0.208	0.41
Asian	0.178	0.62
South Asian	0.028	0.16
China Korea +	0.032	0.18
Other S.E. Asia	0.030	0.17
Religious affiliation		
Christian	0.799	0.40
Sikh	0.010	0.10
Muslim	0.021	0.14
Hindu	0.012	0.11
Other Religion	0.023	0.15
Vancouver	0.057	0.23
Toronto	0.155	0.36
2006 Census dummy	0.481	0.50

Table 2A: Difference in the probability that the second child of a SE Asian woman is a son if her first child is a girl relative to different groups of women.

Comparison group	Same group with boy	Other immigrants with girl	Other immigrants with boy
Woman origin within SE Asia:			
South Asian	0.045	0.036	0.040
	(3.82)	(3.78)	(4.22)
China group	-0.015	-0.001	0.003
	(-1.11)	(-0.06)	(0.31)
Other SE Asian	0.005	0.005	0.009
	(0.47)	(0.63)	(1.1)

Note: Data from 2001 & 2006 Census. The sample includes all immigrant women whose children were all born in Canada (Unweighted N. Obs. 65,320). The model includes dummies for first born girl, for South Asian, China (group) and other SE Asian origins and the interaction of all these origin dummies with girl, as well as basic controls in Table 1. T-stats for the difference between both groups in parenthesis

Table 3A. Distribution of the gender of the first two children by religious affiliation in the sample of natives and migrants

Religion	**Two Boys**	**Boy & Girl**	**Girl & Boy**	**Two Girls**
Christian	0.250	0.266	0.262	0.222
Muslim	0.272	0.254	0.268	0.205
Hindu	0.257	0.272	0.276	0.194
Sikh	0.310	0.260	0.282	0.147
Other Religion	0.254	0.245	0.283	0.218
No Religion	0.260	0.272	0.259	0.210

Table 4A. Difference in the probability that the second child is a son by the months elapsed between the first and second birth and gender of the first child.

Sample	Natives and Immigrants	Immigrants	SE Asian	South Asian	South Asian
Children:	**Canadian**	**Canadian**	**Canadian**	**Canadian**	**All**
Difference between South Asian with girl and South Asian with boy born at same time interval					
Months					
12 or less	0.061	0.061	0.062	0.063	0.083
	(0.324)	(0.326)	(0.317)	(0.310)	(0.115)
13-24	0.074	0.074	0.074	0.075	0.067
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
25-36	0.035	0.035	0.035	0.035	0.027
	(0.129)	(0.126)	(0.127)	(0.128)	(0.152)
36+	0.029	0.029	0.030	0.031	0.052
	(0.099)	(0.100)	(0.098)	(0.087)	(0.000)
Difference between South Asian with girl and all other with a boy born 36+months					
Months					
12 or less	0.068	0.068	0.056	0.068	0.108
	(0.125)	(0.121)	(0.210)	(0.132)	(0.004)
13-24	0.055	0.055	0.043	0.057	0.058
	(0.001)	(0.001)	(0.018)	(0.005)	(0.000)
25-36	0.041	0.041	0.029	0.042	0.043
	(0.017)	(0.017)	(0.127)	(0.039)	(0.009)
36+	0.028	0.028	0.016	0.031	0.052
	(0.039)	(0.042)	(0.316)	(0.087)	(0.000)
Difference between South Asian with boy and all other with a boy born 36+months					
Months					
12 or less	0.006	0.007	-0.006	0.005	0.025
	(0.891)	(0.870)	(0.890)	(0.909)	(0.529)
13-24	-0.020	-0.019	-0.031	-0.019	-0.009
	(0.229)	(0.249)	(0.084)	(0.347)	(0.565)
25-36	0.006	0.006	-0.006	0.007	0.016
	(0.737)	(0.723)	(0.728)	(0.721)	(0.338)
36+	0.001	0.001	-0.014	N/A	N/A
	(0.924)	(0.939)	(0.380)		
Unweighted Obs	141,910	65,320	27,455	9,060	14,030

Note: The model includes all basic controls in Table 1. P-values in parenthesis. N/A: the comparison is not applicable because the group is the reference in the sample. All children are Canadian-born except for the last column that includes children born anywhere.

Figure 1A: Distribution of months between the first and second children and their gender: South Asians compared to all other women

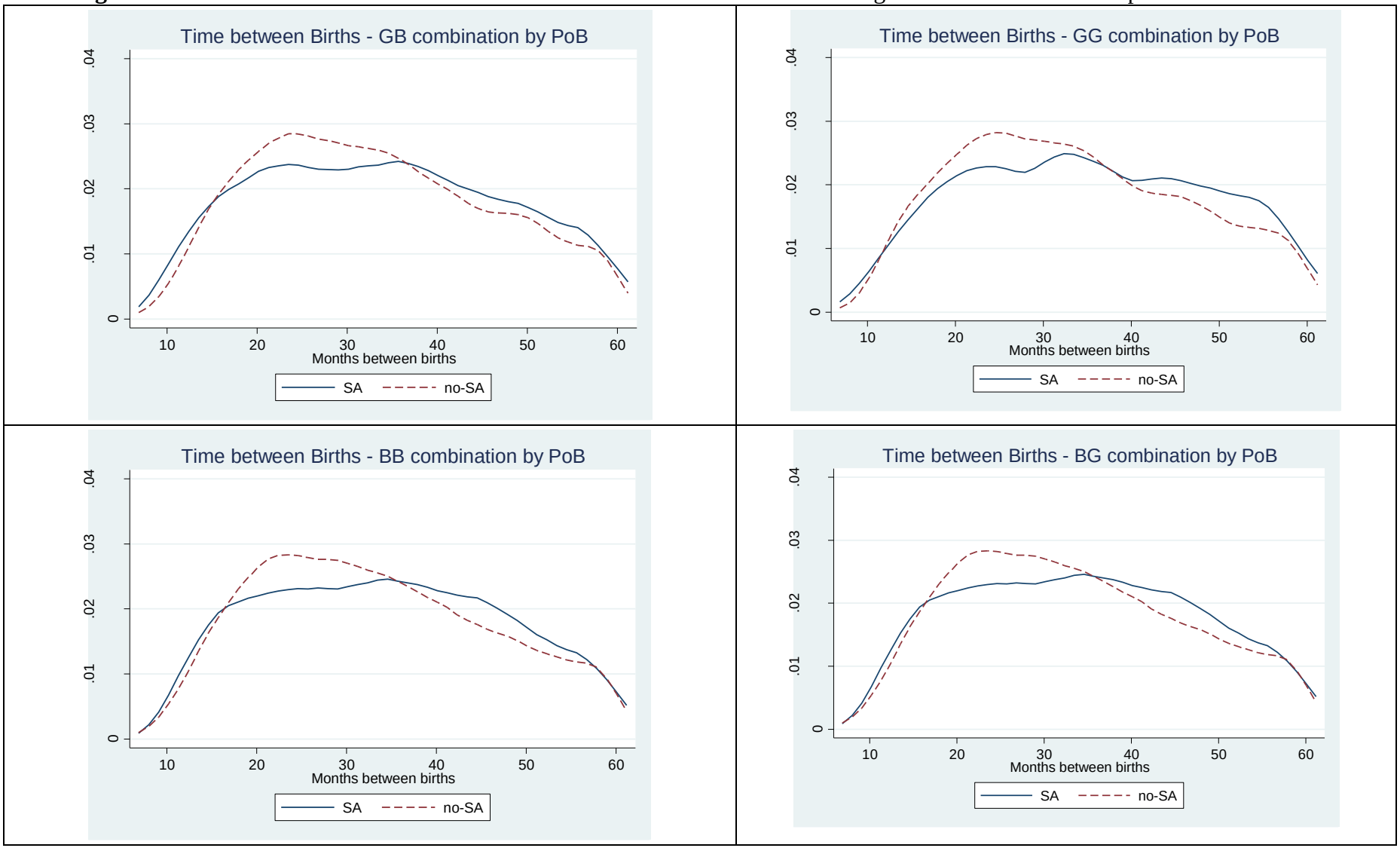


Figure 2A: Distribution of months between the first and second children and their gender: Sikhs (both natives and foreign born) compared to all other women

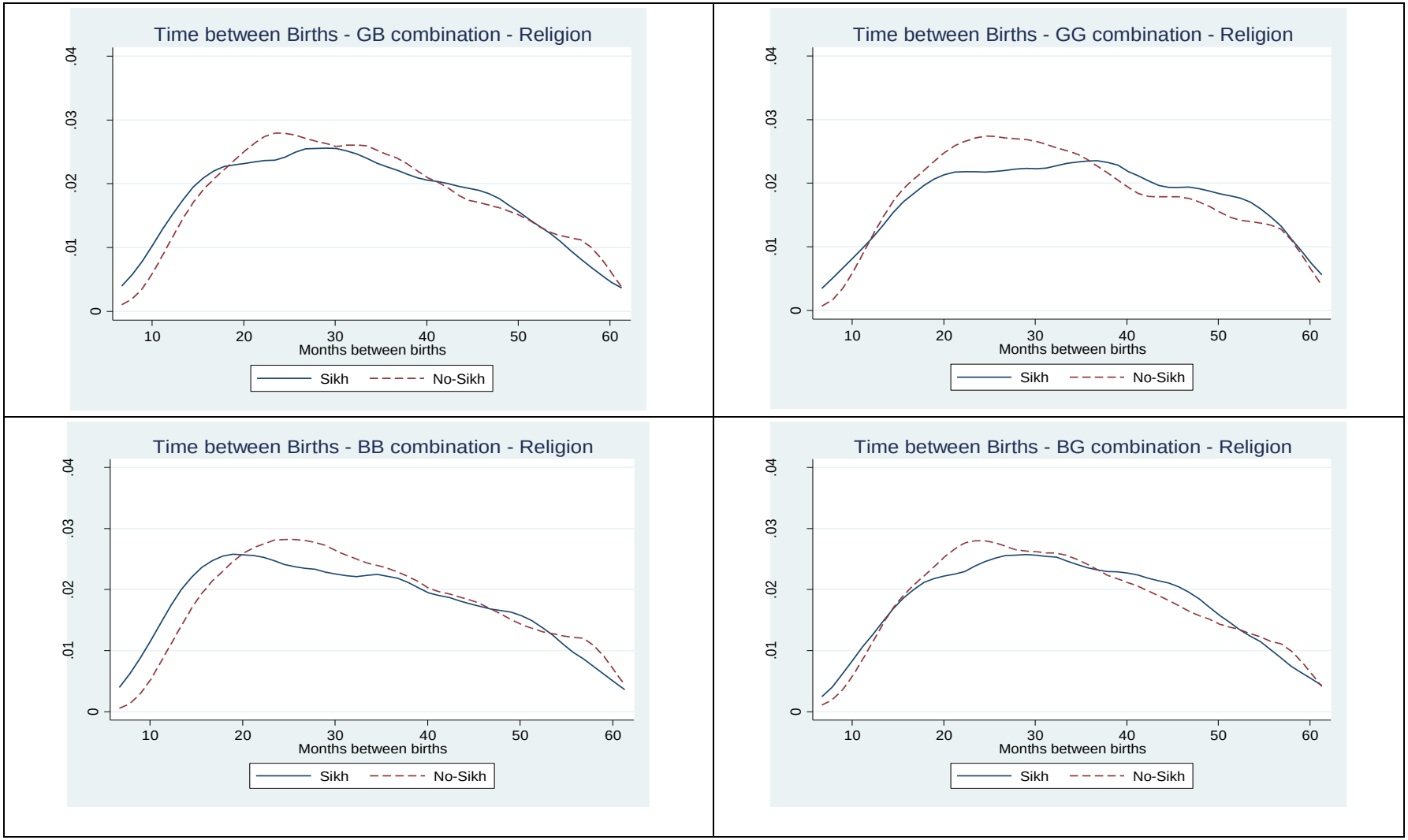
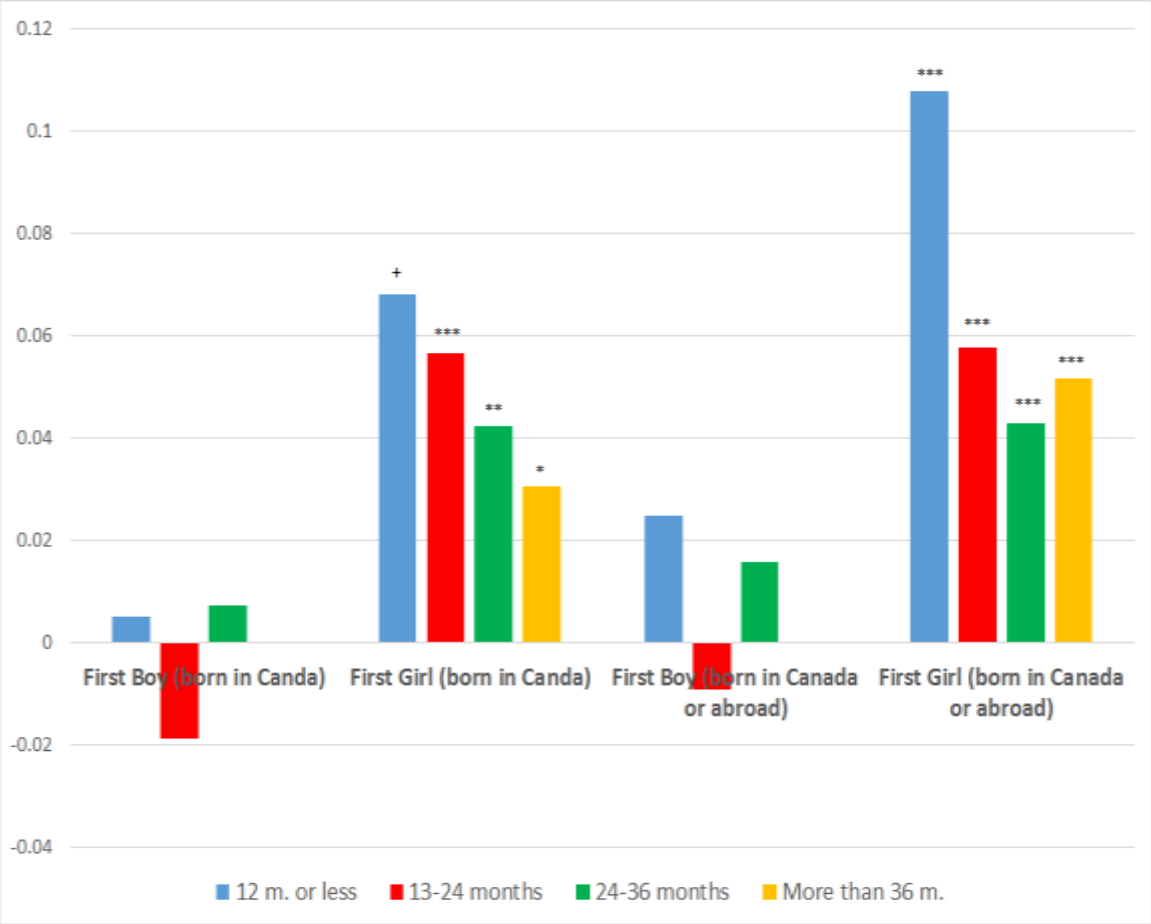


Figure 3A. Estimated difference in the probability of having a son at second birth within South Asians by gender of the first child and time elapsed between the first and second birth (relative to a South Asian with a first-born son and children spaced more than 36 months)



Note: Estimates from the last two columns in Table 3A in the Appendix. The first model only includes South Asian women with all Canadian-born children and the second model allows children to be born anywhere. Data Census 2001 & 2006. *** p<0.01, ** p<0.05, * p<0.1.