Speeding up for a Son: Sex Ratio Imbalances by Birth Interval Among South Asian Migrants to Canada

Alicia Adsera & Ana M. Ferrer

Canadian Studies in Population

ISSN 0380-1489

Can. Stud. Popul.
DOI 10.1007/s42650-020-00025-9

Springer

Canadian Studies in Population
https://doi.org/10.1007/s42650-020-00025-9

Speeding up for a Son: Sex Ratio Imbalances by Birth Interval Among South Asian Migrants to Canada

Alicia Adsera[1] · Ana M. Ferrer[2]

Received: 30 November 2017 / Accepted: 9 July 2019/Published online: 14 May 2020

Abstract

We use the 2001 and 2006 Canadian Census to study sex ratios at second birth among South Asian migrants, conditional on both the spacing between the first two children and the gender of the first-born. We find that South Asian women have an abnormally high share of boys after a first-born girl. Their sex ratio at birth is particularly skewed when the time span between the first two births is short. Several mechanisms may explain this finding. Couples with strong son preferences may attempt to conceive a boy fairly soon after a girl is born Sex-selective abortion may also happen more frequently after conceptions that occur fairly close to the birth of a first girl, because couples may limit the number of repeated abortions later in the interval. Even if sex ratios decrease over time within the birth spell, they still remain somewhat higher for live births spaced three years or longer.

Résumé

Nous utilisons les recensements canadiens de 2001 et 2006 pour l'étude des ratios à la deuxième naissance, conditionnelle à l'espacement entre les deux premiers enfants et aux sexe du premier-né. Les femmes sud-asiatiques ont un taux anormalement élevé de naissances masculines après une naissance feminine. Leur rapport de masculinité à la naissance est particulièrement biasé lorsque l'intervalle de temps entre les deux premières naissances est court. Plusieurs mécanismes peuvent expliquer cette conclusion. Les couples ayant une préférence marquée pour le s garçons peuvent tenter d'een concevoir un assez tôt après la naissance d'une fille, et toute avortement sélectif peut arriver plus fréquemment après la conception qui se produisent assez près de la naissance d'une première fille. Mais les couples peuvent limiter le nombre d'avortements répétés plus tard dans l'intervalle. Même si les sex ratios diminuent avec le temps au cours de la période de naissance, ils restent encore un peu plus élevés pour les naissances espacées de trois ans ou plus.

Keywords Son preference · Imbalanced sex ratios · Birth spacing · Immigrant fertility · Sex-selective abortion

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s42650-020-00025-9) contains supplementary material, which is available to authorized users.

1 Introduction

Son preference prevails with varying intensity across Southeast Asian societies (Das Gupta et al. 2003; Chung and Das Gupta 2007) with the highest sex ratio imbalances found in Northern Indian states (Bhat and Zavier 2003). In the latter, boys are valued for their physical labor, earn more than girls, and are expected to care for their elderly parents, particularly in patrilocal societies (Pande and Astone 2007, Jain 2014). Cultural and religious reasons such as rising dowry costs that parents of girls bear also bolster son preference (Anderson 2007). In many of these societies, such as China, only men can continue the family lineage, and, according to Hindu tradition, only sons can light the funeral pyre of their parents (Almond et al. 2013).

Among migrants moving to more developed societies where children are no longer viewed as a guarantee for old-age insurance or required for agricultural labor, and where female labor force participation is relatively high, the economic motivations for son preference should eventually disappear. In addition, intermarriage and cultural assimilation should dilute the relevance of lineage. Still, because cultural norms are slow to change, some immigrant groups are likely to 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 by US immigrants from countries with a marked son preference.

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. Despite the general trend toward convergence, a few recent papers find abnormal sex ratios among some groups of first-generation immigrants in destinations such as Canada, Norway, Spain, the UK, and the USA, denoting some degree of persistence of son preference (Almond et al. 2013; Singh et al. 2010; Gonzalez 2014; Dubuc and Coleman 2007; Abrevaya 2009; Almond and Edlund 2008). However, some of these patterns have weakened as of lately (see Tønnessen et al. 2013 for the case of Norway).

As detailed in the next section, the observed abnormal sex ratios are the result of a combination of forces (see also Portner 2015 for an excellent overview). Those eager to have a son (after a girl is born) may, first, shorten the distance between conceptions, but second, may be more amenable to selectively abort female fetuses taking advantage of the easily accessible abortion in Canada, and conceive again after a recovery period. At the same time, some moderating factors such as the desire for siblings to be relatively close in age or the reluctance of undergoing multiple abortions may work in the opposite direction of son preference. As a result, depending on the relative strength of those factors, sex ratios may change as months since first births lapse.

To the extent of our knowledge, this is the first paper within this research agenda that analyzes how sex ratios at birth vary within the birth spell depending on the gender of the first child among migrants to developed countries. Even though Portner (2015) focuses mostly on the implications of son preference on birth spacing in a developing setting, he also includes an analysis of how sex ratios vary within different birth spells with large Indian datasets. Rossi and Rouanet (2015) also analyze differences in birth spacing and sex ratios in a subset of African countries.

We employ the 20% confidential sample of the 2001 and 2006 Canadian Census. To obtain large enough samples to analyze detailed ethnic and religious groups combined with months passed since the previous births, we focus on the second parity. There are not enough observations to provide credible estimates of changes within the birth spell for higher parities. In addition, as fertility in most countries has been falling, second births are becoming more relevant to fulfill the goal of having a son. We find that, after the birth of a first girl, sex ratios for South Asians (and Sikhs) that had all their children in Canada are particularly skewed when the time span between the first two births is short. However, sex ratios still remain slightly higher among live births spaced three years or longer. This persistence is even higher when we include in the sample women who had children either in Canada or abroad.

2 Research Question

To establish the presence of son preference in the absence of direct preference indicators (which could anyway suffer from social desirability bias), researchers resort to analyze the fertility behavior of couples directly. First, those eager to have a son are expected to be more likely to continue to the next parity either if they only have girls or if they would like a larger male offspring (Arnold 1985). In developed countries, recent papers find increases in the likelihood of an additional birth (particularly a third child) among South Asian families without sons (Almond et al. 2013 for Canada, Abrevaya 2009 for the USA), a sign of endurance of son preference.

A second regularity traditionally observed in the data has been a shortening of the spacing between births after the birth of a daughter, as 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% for those whose first child was a son and 65% 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. 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.

A third fertility pattern associated with son preference is the increase of male to female ratio above the generally expected rate of around 1.05. Until the use of reliable prenatal sex determination techniques, abnormal sex ratios at birth were really not present. Data either showed early death of girls by neglect or infanticide and/or larger families of those attempting to conceive a son. The introduction of the ultrasound had two important consequences on fertility behavior. First, it gave rise to sex-selective abortion and, with it, to an increase in the shares of boys among second or higher

parities at birth. That was particularly apparent among the more educated and urban population in India (Portner 2015) and in areas with the strongest son preference such as Northern Indian states (Arnold et al. 2002; Bhat and Zavier 2003). In developed settings, this regularity is found, in some cases, in second births and, particularly, in third births, among different groups of Asian migrants in the USA (Almond and Edlund 2008; Abrevaya 2009), in Canada particularly among non-Muslims or non-Christians (Ray et al. 2012; Almond et al. 2013), in the UK (Dubuc and Coleman 2007), in Norway (Singh et al. 2010), and in Spain (Gonzalez 2014). 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.

A second consequence of ultrasound availability, as Portner (2015) notes, is that birth spacing on its own cannot be employed any longer to uncover son preference but rather in combination with observed sex ratios. When sex-selective abortion is available, spacing among those with son preference may increase since those who abort will have to wait to recover to conceive again (van Soest and Saha 2018). The ultimate sex ratio bias is the result of several competing forces at play. The relative strength of those drivers may vary within a birth spell depending on the months elapsed since the previous birth and result in more or less skewed birth ratios.

On the one hand, even if the timing of conceptions after one birth is independent of the presence of a son, sex ratios for births that happen close to the previous one could still be high. Even though the sex ratio at birth among couples without son preference (and probably among those with son preference who already have a first boy) would be within normal limits, sex ratios can shoot up as couples with son preference and no sons may choose to abort if the woman is carrying another girl. After an abortion, those couples will need to wait to conceive again while the woman undergoes a period of recovery. That would increase spacing between births in this group of women, temporarily moderating the sex bias (Portner 2015). However, over time, the sample of those still trying to conceive a second child will be increasingly biased toward those with son preference and this will lead to further increases in the sex ratio within the birth spell.

Nevertheless, the following dynamics may moderate the increase in the sex ratio. Some couples with son preference will continue their pregnancies regardless of the gender of the baby if they either prefer to refrain from undergoing multiple abortions, want to achieve their desired family size before a woman's fecundity decreases (biological clock), and/or prefer to avoid and/or want to keep a reasonable distance between their children.

On the other hand, if the timing of initial conceptions is correlated with the strength of son preference (together with the gender of the previous child), the overrepresentation of couples keen on producing a son after a girl among the first set of conceptions (even if some of them eventually abort female fetuses) would particularly skew the ratios among those births close to the previous one. Thereafter, the same moderating forces mentioned above would operate as before among those with son preference. Furthermore, in this scenario, couples without son preference, who may have not sped up as much as others to conceive immediately after the first birth (regardless of the gender of the first child), will constitute a larger share of potential parents and will certainly not contribute to abnormal sex ratios later within the birth spell. In this case, we may observe some decrease in the skewness of sex ratios over the birth interval.

Even though its main focus is on changes in birth spacing, Portner (2015) is the only paper that also includes an analysis of this pattern in the Indian case. He uses the Indian National Family and Health Surveys for Hindu women from 1972 to 2006 to reveal some increases in the spacing mostly for third births among urban women with eight or more years of education as the ultrasound became extensively available in the country. In addition, he finds that sex ratios for third births increase with duration within the spell. Conversely, sex ratios decrease with duration for the second births, arguably because there is less anxiety to produce the son at low parity compared to third or more so some women may prefer not to have multiple abortions.

As there are different forces pulling the sex ratio in both directions, it is an interesting empirical question to investigate its pattern within a spell in a developed country setting where we expect the preference for sons among migrants to be more moderate than in their original countries of birth. In this paper, we focus on second births for two reasons. First, they are more relevant in countries with fertility around or below replacement rate and, second, they afford larger sample sizes than those available for later parities that facilitate the detailed analysis (by birth spacing) required.

3 Data and Canadian Background

The Canadian context is particularly well-suited to explore the continuity of son preference among Southeast Asians after migration. The reason is twofold. On the one hand, abortion is Canada is fairly accessible: it is provided through universal health coverage, clinics are available country-wide, and there are essentially no legal barriers to abort regardless of gestational age (Almond et al. 2013), except for restrictions in PEI during the sample period. On the other hand, Canadian migrants constitute around 20% of the population and the share of immigrants of Asian origin has increased during the last two decades, particularly of those arriving from areas with a strong tradition of son preference such as Northern Indian states (where the majority of Sikhs live and in which the highest skewed ratios across India are observed) (Bhat and Zavier 2003). While Sikhs comprise only 2% of India's population and Hindus about 80%, 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). 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).

This study uses 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 form with a rich set of variables including immigrant status, country of birth, and religion (only for the 2001 Census). In order to reduce computing time, we select all immigrant women 16 to 45 years of age who are either married or in a common law relationship plus a 20% random sample of native-born women. We weight observations accordingly.

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," which exploits the fact that the vast majority of young children live with their mother and uses the date of birth of both mother and children to reconstruct each woman's fertility history (see Dubuc 2009 for a detailed discussion of the method). To minimize

the concern of missing some children, we restrict our sample to women age 45 or younger whose oldest child in the household was 14 or younger. Results are robust to more restrictive women's age cutoffs. We chose age 14 because, if children generally start leaving the house around age 18, the age difference between a missing child and the oldest child we observe would be at least 4 years, a sizable age difference in the sample.

Within women born in Southeast Asia, a broad geographic area in which son preference may be expected to different degrees, we differentiate three major groups of countries: (1) China plus Hong Kong, Singapore, Mongolia, Macao, and North and South Korea; (2) South Asia (India, Pakistan, and Bangladesh); (3) Other Southeast Asia (Sri Lanka and Vietnam).[1] With data of the 2001 Census, in which religious affiliation is available, we create the following categories: Christians, Muslim, Hindu, Sikh, Other (a small miscellaneous category that includes Jews, Buddhists, and other), and no religion. We only use women's characteristics to define all these categories.

The sample includes mothers with at least two children. Except when indicated, we restrict the sample to women whose children were all born in Canada to ensure that these mothers 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 prevalence of boys among first and second children in the joint sample of natives and immigrants is around 51.4%. The average woman is 36 years of age and the average age at first birth is just under age 26. Immigrant women of all origins represent 20.8% of the sample. The large majority of these immigrant women are of Asian origin (a share of 17.8% of all the sample). Around 2.8% of all women in the sample 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% (see Table 1A in Appendix).

4 Probability of a Son in the Second Birth

4.1 Who Displays Abnormal Sex Ratios?

Before looking at birth intervals, 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.[2]

$$Y = \beta_1 \text{Girl} + \beta_2 \text{SP} + \beta_3 (\text{Girl*SP}) + \alpha X + \varepsilon \quad (1)$$

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 to a particular population group (by origin or religion) that is likely to exhibit fertility patterns associated with son preference, that is, abnormally

[1] The literature does not find evidence of strong son preference in these last two countries (with sizable samples) with the exception of recent minor imbalances in third births for Vietnam (Almond et al. 2013). In the Census years, 2001 and 2006, raw sex ratios for second births did not display any significant imbalance for Vietnam.

[2] Results with alternative limited dependent variable methods instead of OLS are qualitatively similar.

high prevalence of second-born sons. 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 Southeast Asians in Canada.

Table 1 shows the estimated difference in the probability that the second child of a woman born in a particular region of Southeast Asia (divided, by rows, between South Asia, China group, Other SE) is a son if her first child is a girl relative to different comparison groups of women in the sample of all immigrants. Results are essentially the same if both natives and immigrants are included in the sample. We calculate the reported differences as the sum of the relevant coefficients in Eq. (1). The first column reports $\beta_1 + \beta_3$, the differential prevalence of boys among Southeast Asian women of a certain region with a first-born girl compared to Southeast Asian women of the same region with a first-born boy. The second column reports $\beta_2 + \beta_3$, the differential between Southeast Asian women of a particular region with a first-born girl and non-Southeast Asian immigrant women who also had a girl in the first place. Finally, the third column reports $\beta_1 + \beta_2 + \beta_3$, the differential between Southeast Asian women with a first-born girl and non-Southeast Asian women who had a boy in the first place. Among the different groups of Southeast Asian women, only those born in South Asia are significantly more likely to deliver a boy after the birth of a girl compared to either those born in the same region who had a boy, or to non-Southeast Asian immigrant women regardless of the gender of their first born. The estimated difference ranges from 4.5 to 3.6 percentage points. For the other two subgroups of Southeast Asian immigrants (namely, China group and Other Southeast Asian), we do not find any abnormally high probability of conceiving a boy after the birth of a girl.

This is consistent with findings in Ray et al. (2012) who show that, among live births in Ontario between 2002 and 2007, only women born in India and South Korea (a small group) were significantly more likely to have a son at the second birth and those in India at the third one.

To analyze whether sex ratios vary across some potential measures of cultural assimilation, in separate models (available upon request), we have included interactions of the gender of the first child with variables such as language spoken at home or a dummy indicating whether the immigrant arrived to Canada before or after age 18. Those variables are never significant. The estimates for our main variables of interest remain.

4.2 Do Sex Imbalances Vary with Time Between Births?

To study whether the sex ratio varies within the birth spell among groups that display abnormal sex ratios in the second parity, we estimate a variation of the first model that takes into account the number of months that have elapsed between the first and the second birth.

$$Y = \beta_1 \text{Girl} + \beta_2 \text{SP} + \beta_3 (\text{Girl*SP}) + \sum_n \alpha_n \text{Time}_n + \sum_n \gamma_n (\text{Time}_n \text{*Girl}) + \sum_n \delta_n (\text{Time}_n \text{*SP}) + \sum_n \theta_n (\text{Time}_n \text{*Girl*SP}) + \mu X + \varepsilon \quad (2)$$

$$n = 15, 24, 36$$

Table 1 Difference in the probability that the second child of a woman born in a particular region of Southeast Asia is a son if her first child is a girl relative to different comparison groups of women in the sample of all Canadian immigrants

Comparison group	Same group with first-born boy	Non-SE Asian immigrants with first-born girl	Non-SE Asian immigrants with first-boy
Woman born in Southeast Asia with a first-born girl:			
	$\beta_1 + \beta_3$	$\beta_2 + \beta_3$	$\beta_1 + \beta_2 + \beta_3$
South Asian	0.045	0.036	0.040
	(0.000)	(0.000)	(0.000)
China group	− 0.015	− 0.001	0.003
	(0.268)	(0.953)	(0.758)
Other S.E. Asian	0.005	0.005	0.009
	(0.640)	(0.528)	(0.270)

Data from 2001 and 2006 Census. The sample includes all immigrant women with at least two children and whose children were all born in Canada (unweighted N. Obs. 65,320). All estimates are from a single model that includes dummies for first-born girl, for South Asia (India, Pakistan, and Bangladesh), China group (China, Hong Kong, Singapore, Mongolia, Macao, and North and South Korea), and other Southeast Asian origins (Sri Lanka and Vietnam) and the interaction of all these origin dummies with girl, as well as basic controls (dummies for age at first birth, educational attainment, 2006 Census, Vancouver and Toronto). *P* values for the difference between both groups in parenthesis

The dependent variable *Y* takes a value 1 if the second child is a boy and 0 otherwise. Models include all covariates in Eq. (1) besides a set of dummies *Time* that indicate the spacing between the first two births, (for example 15 months or less, 16 to 24 months). We interact these *Time* indicators both with the gender of the first child and with a dummy indicator for the group that exhibits patterns of son preference (South Asians) as well as with the interaction of both. The aim of the exercise is to see whether, for this group, the probability of giving birth to a boy at each point of the birth interval varies significantly by the gender of the first child. We indicate the reference category in each model.

Table 2 displays the estimated 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 the gender of her first child relative to different groups in the population (natives and immigrants; only immigrants, Southeast Asian immigrants). The last two columns only include women born in South Asia: first, only those whose children were all born in Canada and, second, all of them regardless of the birthplace of their children to see whether or not their sex ratios are more or less skewed compared to those who make all their childbearing decisions in Canada.

The main finding is that the sex ratio imbalances are larger when the second birth happens within the first two years after the first child was born than when the two births are more spaced. The first panel of Table 2 reports the difference in the probability that the second child is a son for a South Asian woman with a girl with respect to non-South Asians with a boy born more than 36 months before the second child. The difference is large and significant throughout the birth interval but particularly large around the first 24 months. For example, using the sample of all immigrant women (column 2), the difference stands at 5.6 percentage points. For the third year, they drop to 4.1 points and to 2.8 points for births occurring 36 months after the first or later.

Table 2 South Asian immigrants: 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 includes all: Children born	Natives and immigrants Canada	Immigrants Canada	SE Asians Canada	South Asians Canada	South Asians Anywhere
Difference between South Asian with a girl and all others with a boy born 36+ months $\beta_3 + \beta_2 + \beta_1 + \alpha_n + y_n + \delta_n + \vartheta_n$					
Months					
15 or less	0.055	0.056	0.044	0.057	0.081
	(0.037)	(0.035)	(0.113)	(0.050)	(0.001)
16–24	0.057	0.057	0.045	0.059	0.055
	(0.002)	(0.002)	(0.026)	(0.007)	(0.002)
25–36	0.040	0.041	0.029	0.042	0.043
	(0.017)	(0.017)	(0.128)	(0.039)	(0.009)
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 a boy and all others with a boy born 36+ months $\beta_2 + \alpha_n + y_n + \delta_n + \vartheta_n$					
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)		
Difference between South Asian with a girl and South Asian with a boy born at same time interval $\beta_3 + \beta_1 + y_n + \vartheta_n$					
Months					
15 or less	0.069	0.069	0.070	0.072	0.090
	(0.056)	(0.057)	(0.055)	(0.048)	(0.003)
16–24	0.075	0.075	0.075	0.075	0.059
	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)
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)
N. Obs	141,910	65,320	27,455	9,060	14,030

Data from 2001 and 2006 Census. Samples include all women with at least two children in the group specified in column headings. 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 in the last column that includes children born anywhere

Within South Asians, the difference in the prevalence of sons for births happening within the first year and a half of the birth of a girl is over 8 percentage points compared to births

happening three years after a boy, when children born both in and outside Canada are included in the last column.[3] When only Canadian-born children are included (in column 4), the difference for births within the first 15 months is more moderate, 5.7 percentage points. The fact that the sex imbalances are somewhat smaller when the sample only includes women with all Canadian-born children could either indicate the gradual adaptation of South Asian migrants to cultural patterns in Canada or more moderate preference for sons among those who wait to start their childbearing after arriving into Canada.

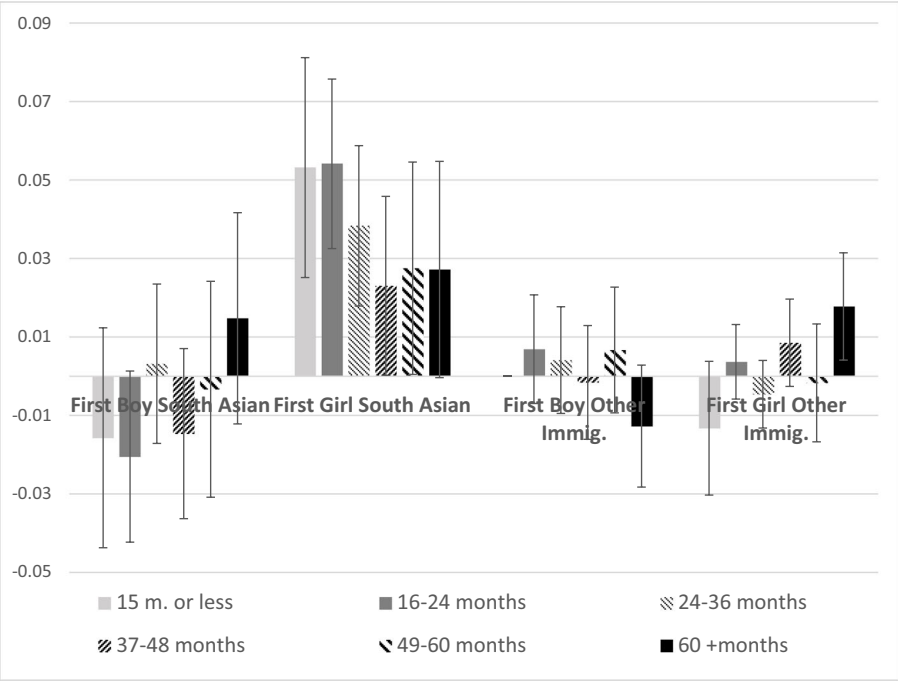
The second panel of Table 2 reports the differences between South Asians who already have a son and the rest of the population who delivered a boy more than 36 months after the birth of a first son. The estimates confirm that there are no significant differences independent of the timing of the births and the sample employed.

As noted in section 2, the abnormal sex ratios among births close to the previous one are to be expected in cases when either a pattern of early conception co-varies with the strength of son preference or when they are uncorrelated because some couples who aim for a boy may be more likely to sex-selectively abort female fetuses in the early months of the interval. However, a relatively faster conception rate among those eager to have a boy may increase the relative skewness of the first months. Even though this is not a paper that focuses on birth spacing, we conducted a basic exercise to see whether the data could support this explanation. We ran models to test whether second birth rates for different groups were significantly larger than the rest at particular intervals. Interestingly, we found that they were significantly higher (around 1.7 percentage points) only for South Asians for the period of the 15 months immediately following the birth of the first child—the results are available upon request. These findings seem to confirm that South Asians without sons may speed up second conceptions and that, despite some of those conceptions never materialize in births, their birth rates are still high early on.

To explore in more detail what happens to the sex ratio after the third year, we also estimate all the models of Table 2 with time dummies for the third, fourth, and fifth year as well as one for births taking place 60 months after the first child or later (Table 2A in Appendix). Figure 1 displays results from this model specification when the reference group are non-South Asian immigrant women with two sons born 15 months or less apart (column 2 in Table 2A). The negative gradient in the difference in the prevalence of boys for South Asian mothers with a girl versus other migrants with a boy by months since the previous birth is apparent, particularly when compared to the lack of significant differences among any of the other groups in the graph. Yet, sex ratios revamp slightly in the fifth year and for births after 60 months, even though all of these differences fail to achieve significance due to small sample sizes.

This finding suggests that some women, who abort a female fetus, conceive again after waiting some months for recovery and may choose to abort a second time. This would increase spacing and boost sex ratios later within the spell (Portner 2015). In this line, and looking at third births, Urquia et al. (2016) find that sex ratios among Indian-born women living in Ontario are particularly skewed if they have previously undergone induced abortions (particularly two or more and at later stages of the pregnancy

[3] In separate estimates available upon request, the difference goes up to 11 percentage points at 1% significance if the second birth happens within the first 12 months.



Note: Estimates from the model in the second column in Table 2A in the electronic Appendix. The sample includes all immigrant women with at least two children, all Canadian-born. Data Census 2001 & 2006. *** p<0.01, ** p<0.05, * p<0.1

Fig. 1 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 non-South Asian immigrant women with two sons born 15 months or less apart). Estimates from the model in the second column in Table 2A in the electronic Appendix. The sample includes all immigrant women with at least two children, all Canadian-born. Data Census 2001 and 2006. ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

when the gender of the child could be ascertained) and the mean birth interval for third births among Indian-born is the longest for a male child born after two girls.

However, the fact that sex ratios in later periods are lower than those in the first two years may indicate that, first, those who did not rush to conceive are now transiting to the second parity and constitute a larger share of potential mothers and, second, that some moderating forces may be reducing the willingness to conduct multiple abortions.

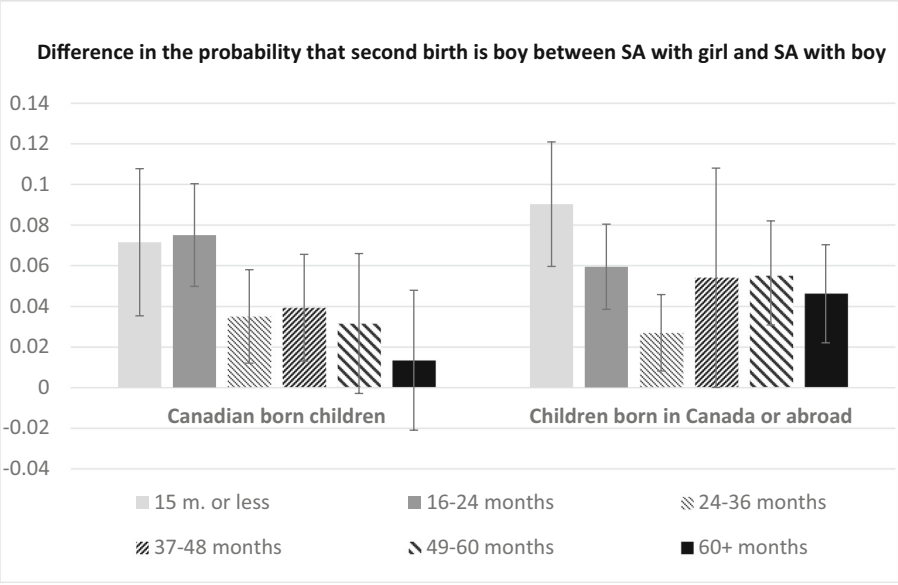
In the third panel of Table 2, we present the difference in the prevalence of second sons born at the same month interval of South Asian immigrant mothers by the gender of their first child. South Asians who had a girl first are around 7 to 7.5 percentage points more likely to deliver a boy if the second birth happens 24 months or less after the first one than South Asians who already have a son. In the last column, when we include children born either in Canada or abroad, the difference increases to around 9 percentage points for births happening within the first 15 months and 5.9 for those between 16 and 24 months. The difference by the gender of the first child is already more muted in both samples, at respectively 3.5 and 2.7 points, for all births occurring in the third year (between 25 and 36 months after the first) and not significant except at a 15% level. The gap within South Asians remains only

moderately high at around 3.1 percentage points for women with all Canadian-born children but rises to 5.2 if children born anywhere are included for births happening after 36 months.

Figure 2 reports more detailed estimates of the dynamics in place after the third year. The ratio continues to decrease for those with all Canadian-born children and it is never significant (columns 4 and 5 in Table 2A). It is 3.9 points higher for those with a first-born girl compared with those with a boy in the fourth year, 3.1 from 48 to 60 months and down to 1.3 for births 60 months and after. Conversely, when we include all South Asian women regardless of the place of birth of all their children, the sex ratio differences remain persistently high and always significant at 5%: 5.4 points in births between 36 and 48 months; 5.5 points between 48 and 60 months; and 4.6 points for those born 60 months and after. This seems to indicate that some of the moderating factors mentioned before are operating among those who have borne all their children in Canada, but that preferences for male offspring may be more entrenched among those who had at least one of their children abroad.

5 Discussion

The study finds that, among South Asian immigrants, the probability of delivering a son is higher if the first-born is a girl. It also shows that the bias in the sex ratio



Note: Estimates from the model in the last two columns in Table 2A in the electronic Appendix. The sample includes all South Asian women with at least two children. Data Census 2001 & 2006. *** p<0.01, ** p<0.05, * p<0.1

Fig. 2 Estimated difference in the probability of having a son at second birth within South Asian immigrants at the same time elapsed between the first and second birth by gender of the first child. Estimates from the model in the last two columns in Table 2A in the electronic Appendix. The sample includes all South Asian women with at least two children. Data Census 2001 and 2006. ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

decreases with the months elapsed between the two first births even though it remains abnormally high even past the first three years.

As explained in section 2, abnormal sex ratios are likely to vary by the month elapsed since the previous birth as a result of different forces operating simultaneously. They are high close to the previous birth because among those who conceive early, some couples with a strong preference for sons may abort female fetuses. The extent to which these ratios are skewed depends on how correlated son preference and the timing of conceptions are. If couples who prefer a boy both speed up conception of a second child after the birth of a first girl and are more likely to use sex-selective abortion, the sex differences in early births would be particularly high (as it is in our data). As the second birth gets farther apart from the first, relatively more couples without strong son preference (who did not move "as" fast as the others to have another child even after a girl was born) may be trying to conceive. In addition, some women that, after delivering a girl, aborted a female fetus are also trying to conceive again. Whether or how soon sex ratios return to normal depends on the strength of moderating forces such as the unwillingness to abort for a second time and/or preferences to maintain a reasonable gap in years between siblings regardless of their gender.

The majority of previous studies of sex ratio imbalances among immigrants in developed settings find significant differences for third and fourth parities but not that much for the second one, with the exception of Indians in Abrevaya (2009). Portner (2015), who analyzes in detail changes in sex ratios within a spell in India, finds significant deviations in male to female ratios that increase within the spell for third births and only moderate and decreasing ones for second births of urban educated Indian women.

Even though we might expect that sex ratios are less skewed for second births than for higher parities, we chose to analyze second births for two reasons. First, looking at sex ratios simultaneously by months since births and by children's gender imposes many demands on the data. When attempting to estimate basic models for the third parity, we ran (as expected) into small cell problems. Second, with the increase in women's education and its accompanying reduction in family size, the need to give birth to a son binds at a lower parity than in the past. This may be particularly relevant for Canada given its selective immigration policy on educational grounds. Table 3 presents the differential prevalence of boys among South Asians, both in the sample of all mothers (panel A) and then only for women with at least some post-secondary education (panel B). We compare them first to all natives and migrants; and second, only to migrants,

Results in the first row of Table 3 in panel A indicate that South Asian women with a first-born girl were 4.5 percentage points more likely to deliver a boy as a second child than South Asians who already had a first-born son. When we restrict the sample to women with at least some post-secondary education in panel B, educated South Asian women who had a girl in the first place are 5.2 percentage points more likely to deliver a son next time around than South Asians who already had a son. Thus, the difference is slightly higher among post-secondary educated. Women who are more educated 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 though education may decrease son preference altogether, a smaller family size target may make it more pressing to deliver a boy at low parities for those who still want a son. Abrebaya (2009)

Table 3 Difference in the probability that the second child of a South Asian immigrant woman is a son if her first child is a girl relative to different groups of women within each sample

Sample includes all:	Natives and Immigrants	Immigrants	Natives and Immigrants	Immigrants
	Panel A: all mothers		Panel B: mothers with post-secondary education	
Comparison group				
South Asian with boy	0.045	0.045	0.052	0.052
$\beta_3 + \beta_1$	(0.000)	(0.000)	(0.002)	(0.002)
All others with girl	0.026	0.034	0.021	0.034
$\beta_3 + \beta_2$	(0.003)	(0.000)	(0.102)	(0.009)
All others with boy	0.042	0.036	0.043	0.031
$\beta_3 + \beta + {}_2\beta_1$	(0.000)	(0.000)	(0.001)	(0.016)
N. Obs	141,910	65,320	88,869	39,052

Data from 2001 and 2006 Census. Each model includes dummies for first-born girl, for South Asian and their interaction as well as basic controls in Table 1. Unweighted number of observations reported. *P* values for the difference between both groups in parenthesis. All children are Canadian-born

shows that sex imbalances are similar among Indians in the USA across education levels. However, Almond et al. (2013), who use the sample of families of South or East Asian ancestry (at least one of the grandparents) in Canada, find that mothers with less than a university degree display somewhat stronger patterns of son preference in the third births than the more educated. 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 2003; Gaudin 2011). Portner (2015) shows that the largest deviations in sex ratios in India are for urban educated women.

Religious affiliation offers another way to identify groups that are likely to display more son preference than others. In our data, only the Census of 2001 contains an indicator for the religious affiliation of the individual. We include separate dummies for each religious category (instead of origin) and their interactions with gender of the first child in Eq. (1) with Christians as the reference group. Only Sikh women who delivered a girl in the first place display abnormal ratios compared to either Sikhs with a boy or to Christians (or to all non-Sikhs if used as the reference group instead). We do not find any significant differences for any of the other religious groups. Even within India, the fertility behavior of Hindus and, particularly, of Sikhs has been observed to better align with patterns of son preference implying the use of more sex-selective abortion than that of other groups and the Northern states where the majority of the Sikh population lives are the ones that depict the higher gender imbalances at birth (Bhat and Zavier 2003). Almond et al. (2013) also find abnormal sex ratios within South East Asians in Canada to be large for third births among non-Muslims or non-Christians (especially Sikhs).[4] Among migrants to Canada, Sikhs constitute a relatively large group compared to their share of the population at origin.

[4] For third births, in estimates not shown here, the difference among those having two girls is large for both Sikhs and Hindus, but only significant for Sikhs.

Table 4 Predicted difference in the probability that the second child is a son between a Sikh with a girl compared to all others with a boy born 36+ months before the second child, by months between first and second births

Sample includes all:	Natives and immigrants	Immigrants
Difference between Sikh with a girl and all others with a boy born 36+ months $\beta_3 + \beta_2 + \beta_1 + a_n + y_n + \delta_n + \theta_n$		
Months		
15 or less	− 0.013	− 0.012
	(0.799)	(0.813)
16–24	0.073	0.092
	(0.061)	(0.014)
25–36	0.024	0.039
	(0.507)	(0.226)
36+	− 0.001	0.020
	(0.961)	(0.472)
N. Obs	72,160	31,360

Data from 2001 Census. The model includes all basic controls in Table 1. Unweighted number of observations reported. *P* values in parenthesis. All children are Canadian-born

We find that the estimated gap within Sikhs by gender of their first child is smaller in a sample that includes both natives and immigrants, around 3.4 percentage points (and not significant), than when only immigrants are included, around 4.5 percentage points (and significant at 5%). This is possibly due to the fact that the first sample also includes second-generation Sikhs among natives who are likely to have weaker links to their ancestor's culture and less (or none) son preference than the foreign-born Sikhs. Estimates from the 2011 National Household Survey (NHS) indicate that around 35% of Sikhs living in Canada were born in the country. Since the Census does not include information about the region of origin of immigrants within India, we can only argue that results suggest differences by religion background even though we cannot test whether regional origin is the main determinant.

To see whether the sex ratio among Sikhs varies within the second birth spell, we re-estimate model (2) in a similar manner. Since religion is only available in the 2001 Census, the sample of Sikhs in each cell is fairly small once we divide it by months between births—particularly for the first interval of births occurring at 15 months or less. Table 4, column 2, shows the difference in the probability of having a son between a Sikh woman with a girl and all non-Sikh immigrants with a first born son and children spaced more than three years apart. For those mothers who delivered a second child between 16 and 24 months since the previous birth, the difference is significant and large, 9.2 percentage points. Even though in Table 4 the difference is still high (at 3.9 points) among births that take place between 25 and 36 months, for all the other intervals, it is not significant (most likely due to lack of power). The difference for second births between 16 to 24 months after the first is lower, at 7.3 points, when the sample includes also natives, among them native-born Sikhs, than when only foreign-bon Sikhs are included.

This study has shown that patterns of son preference are still present among South Asian immigrants to Canada. However, the decreasing sex ratio found within the second birth interval may indicate that, with exposure to the culture and economic opportunities in the destination country, migrants may be less likely to undergo multiple abortions and lessen their eagerness to have a son. Recent data from Norway also seems to indicate convergence of sex ratios among these groups to normal levels (Tønnessen et al. 2013). Future work should examine whether differences in the institutional context (i.e., abortion availability), or opportunities to integrate, especially via female labor market participation or support from the welfare state may speed those changes in some settings more than in others. In addition, it would be ideal to analyze some of the patterns within birth spells found in the paper more comprehensively with larger datasets (such as population registrars).

Acknowledgments We appreciate the help of the staff at the University of Waterloo RDC center.

Funding Information This work was partly supported by NIH under grant number P2C HD047879-15.

References

Abrevaya, J. (2009). Are there missing girls in the United States? Evidence from birth data. *American Economic Journal: Applied Economics, 1*(2), 1–34 http://www.aeaweb.org/articles?id=10.1257/app.1.2.1.

Almond, D., & Edlund, L. (2008). Son-biased sex ratios in the US 2000 Census. *PNAS, 105*(15), 5681–5682. https://doi.org/10.1073/pnas.0800703105.

Almond, D., Edlund, L., & Milligan, K. (2013). Son preference and the persistence of culture: evidence from Asian immigrants to Canada. *Population and Development Review*, 75–95. https://doi.org/10.1111/j.1728-4457.2013.00574.x.

Anderson, S. (2007). The economics of dowry and brideprice. *The Journal of Economic Perspectives, 21*(4), 151–174.

Arnold, F. (1985). Measuring the effect of sex preference on fertility: the case of Korea. *Demography, 22*(2).

Arnold, F., Kishor, S., & Roy, T. K. (2002). Sex-selective abortions in India. *Population and Development Review, 28*(4), 759–785.

Bhat, P. N. M., & Zavier, A. J. F. (2003). Fertility decline and gender bias in Northern India. *Demography, 40*(4), 637–657 http://www.jstor.org/stable/1515201.

Bumpass, L. L., Rindfuss, R. R., & Palmore, J. A. (1986). Determinants of Korean birth intervals: the confrontation of theory and data. *Population Studies, 40*(3), 403–423. https://doi.org/10.1080/0032472031000142326.

Chung, W. J., & Das Gupta, M. (2007). The decline of son preference in South Korea: the roles of development and public policy. *Population and Development Review, 33*(4), 757–783. https://doi.org/10.1111/j.1728-4457.2007.00196.x.

Das Gupta, M., Jiang, Z., Li, B., Xie, Z., Chung, W., & Bae, H. (2003). Why is son preference so persistent in East and South Asia? A cross-country study of China, India and the Republic of Korea. *Journal of Development Studies, 40*(2), 153–187. https://doi.org/10.1596/1813-9450-2942.

Dubuc, S. (2009). Application of the own-children method for estimating fertility by ethnic and religious groups in the UK. *Journal of Population Research, 26*(3), 207–225. https://doi.org/10.1007/s12546-009-9020-7.

Dubuc, S., & Coleman, D. (2007). An increase in the sex ratio of births to India-born mothers in England and Wales: evidence for sex-selective abortion. *Population and Development Review, 33*(2), 383–400. https://doi.org/10.1111/j.1728-4457.2007.00173.x.

Gaudin, S. (2011). Son Preference in Indian Families: Absolute versus Relative Wealth Effects. *Demography, 48*(1), 343–370.

Gonzalez, L. (2014). Missing Girls in Spain, Cuadernos Económicos *del ICE N. 87*, 205–222.
Hemochandra, L., Singh, N. S., & Singh, A. A. (2010). Factors determining the closed birth interval in rural Manipur. *Journal of Human Ecology, 29*, 209–213.
Jain, T. (2014). Where there is a will: fertility behavior and sex bias in large families. *Journal of Human Resources, 49*(2), 393–423. https://doi.org/10.2139/ssrn.1367907.
Jayachandran, S., & Kuziemko, I. (2011). Why do mothers breastfeed girls less than boys? Evidence and implications for child health in India. *Quarterly Journal of Economics, 126*(3), 1485–1538. https://doi.org/10.1093/qje/qjr029.
Jha, P., Kumar, R., Vasa, P., Dhingra, N., Thiruchelvan, D., Moineddin, R. (2006). Low male-to female sex ratio of children born in India: national survey of 1·1 million households. *Lancet, 367*, 211–218.
Lhila, A., & Kosali, S. (2008). Prenatal health investment decisions: does the child's sex matter? *Demography, 45*(4), 885–905. https://doi.org/10.1353/dem.0.0032.
Nemeth, R. J., & Bowling, J. M. (1985). Son preference and its effects on Korean lactation practices. *Journal of Biosocial Science, 17*, 451–459. https://doi.org/10.1017/S0021932000015960.
Pabilonia, S., & Ward-Batts, J. (2007). The effect of child gender on parents' labor supply: an examination of natives, immigrants, and their children. *The American Economic Review, 97*(2), 402–406. https://doi.org/10.1257/aer.97.2.402.
Pande, R. P., & Astone, N. M. (2007). Explaining son preference in rural India: the independent role of structural versus individual factors. *Population Research and Policy Review, 26*(1), 1–29. https://doi.org/10.1007/s11113-006-9017-2.
Portner, C.C. 2015. Sex-selective abortions, fertility, and birth spacing. *Policy Research working paper*; no. WPS 7189. Washington, DC: World Bank Group.
Ray, J. G., Henry, D. A., & Urquia, M. L. (2012). Sex ratios among Canadian live born infants of mothers from different countries. *CMAJ: Canadian Medical Association Journal, 184*, E492–E496. https://doi.org/10.1503/cmaj.120165.
Rossi, P., & Rouanet, L. (2015). Gender preferences in Africa: a comparative analysis of fertility choices. *World Development, 72*, 326–345.
Singh, N., Pripp, A. H., Brekke, T., & Stray-Pedersen, B. (2010). Different sex ratios of children born to Indian and Pakistani immigrants in Norway. *BMC Pregnancy and Childbirth, 10*, 40. https://doi.org/10.1186/1471-2393-10-40.
Statistics Canada. 2005. Population by religion, by province and territory (2001 Census), Statistics Canada: Census of Population http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/demo30a-eng.htm.
Statistics Canada. 2012. Census: language – linguistic characteristics of Canadians, Census year 2011, no. 1, Census in Brief Catalogue no. 98-314-X2011003, Statistics Canada http://www12.statcan.gc.ca/census-recensement/2011/as-sa/98-314-x/98-314-x2011001-eng.cfm.
Tønnessen, M., Aalandslid, V., & Skjerpen, T. (2013). Changing trend? Sex ratios of children born to Indian immigrants in Norway revisited. *BMC Pregnancy and Childbirth, 13*, 170.
Urquia, et al. (2016). Sex ratios at birth after induced abortion. *CMAJ, 188*(9), E181–E190. https://doi.org/10.1503/cmaj.151074.
Van Soest, A., & Saha, U. R. (2018). Relationships between infant mortality, birth spacing and fertility in Matlab, Bangladesh. *PLoS One, 13*(4), e0195940. https://doi.org/10.1371/journal.pone.0195940.

Affiliations

Alicia Adsera[1] · **Ana M. Ferrer**[2]

✉ Alicia Adsera
adsera@princeton.edu

[1] Woodrow Wilson School of Public and International Affairs, Princeton University and IZA, Princeton, NJ, USA

[2] Department of Economics, University of Waterloo and IZA, Waterloo, ON, Canada