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Skewed SRB in Migratory Context: a Study on the Determinants of Prenatal Sex Selection in Italy

1. Aim of the study

This paper aims to explore sex ratio at birth (SRB) of migrants in Italy in order to shed light on the possible phenomenon of sex selection at birth. Recent studies addressed the same issue for migrants of Indian and Chinese origin living in Italy (Meldolesi, 2012; Blangiardo and Rimoldi, 2012). The study of Meldolesi was limited to the period of 2006-2009 and used data on birth records, while the latter study uses data from a 2011 survey of 700 women of Chinese and Indian origin in the Lombardy region.

Our objective is to go beyond these studies, analysing births from mothers with a foreign background, from countries where sex selection at birth is widespread and that are among the largest immigrant communities in Italy. The paper aims at assessing 1) if a skewed sex ratio at birth is observed among overseas communities; and 2) the possible factors affecting skewed SRB in the migratory context. When studying the phenomenon of sex selection before birth, it is important to stress that the SRB increases with birth order, as prenatal discrimination with first births is generally infrequent (Guilmoto, 2015). Prenatal sex selection is practiced for higher order births, while first and second births are often left to chance.

The analysis of sex ratio at birth (SRB) is not a new topic in demography. Historical trends of sex ratio at birth have been studied by Graunt, Süssimilch and Gini. Gini, in particular, found that the excess of male births was universal since it was observed in every population and in all countries (1908). Recent studies (Guilmoto, 2009; 2012; Bongaarts and Guilmoto, 2015; Guilmoto, 2015), however, show that sex ratio at birth has risen in a few Asian countries since the 1980s, and it remains abnormally higher than expected for almost 30 years. The trend in SRB observed in some countries of east and southeast Asia was opposite to that observed in the rest of the world, where SRB has been stable at 104-106 in the period 1950-2000[1], and is expected to maintain the same pattern into the future (Guilmoto, 2009). A similar trend is the consequence of practices of sex selection in these areas due to the diffusion of forms of discrimination known as "son preferences." Guilmoto (2012 and 2015) uses an original interpretative framework to explain the causes of the abnormal increase of the proportion of male births in certain countries of the world. His approach is built on Coale's (1973) three preconditions of fertility decline.

According to Coale's critical review of the demographic transition paradigm, in order to have a decrease in fertility, 1) fertility should be within the calculus of conscious choice; 2) low fertility must be perceived as an advantage; and 3) effective techniques to reduce fertility (i.e., family planning methods) must be available. Guilmoto (2015) stresses that, like in Coale's model for fertility decline, there are three orders of preliminary condition or "intermediate factors" to adopt sex selection at birth. According to Guilmoto, the three preconditions to sex selection at birth are: 1) a supply factor expressed by the ability to realise sex selection at birth through the availability of sex selection technologies; 2) a demand factor expressed by the preference for either female or male children; 3) a demographic factor expressed by the decline in fertility. These factors have different impacts on the phenomenon, as the major cause of sex selection at birth in favour of male children is ascribed to son preference in patrilineal societies. Son preference is widespread in patrilineal social systems in some eastern and southern Asian countries (Das Gupta, Zhenghua, Bohua, Zhenming, Chung and Hwa-Ok 2003); however, it should be considered as a form of sexual discrimination and gender inequality. In the Program of Action of the 1994 International Conference on Population and Development (UN, 1994) held in Cairo, it was recommended to eliminate all forms of discrimination against the girl child, commonly known as "son preferences". Among those is prenatal sex selection. Sex selection is not a new phenomenon in such societies: before the availability of modern technologies, sex discrimination was perpetrated after birth,

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[1] SRB has been stable in Italy as in other countries where prenatal sex selection is not performed. However, in recent decades, SRB has decreased in some western countries such as Denmark, the Netherlands, Canada and the US (Davis, Gottlieb and Stampnitzky, 1998) while it has remained stable or has slightly increased in southern European countries, including Italy (Astolfi and Zonta, 1999). These changes have been attributed to increasing exposure to hazardous environmental conditions.

resulting in an unbalanced sex ratio of the population due to higher female mortality (Coale, 1991). Since the 1980s, thanks to the availability of prenatal diagnosis technology, couples have the ability to know the sex of the future born. As a direct consequence of early sex knowledge, couples may choose to undergo an (legal or illegal) abortion (Chen *et al*., 2013). Finally, the fertility transition has led many countries to lower levels of fertility: the decline in fertility could have exacerbated the need for sex selectivity, because with a lower number of children, the risk of not having a child of the desired sex increases.

Sex selection, either in early childhood or at birth, has important consequences from the demographic point of view because it leads to the well-known phenomenon of "missing women." In 2010, there were about 125 million missing women worldwide (Bongaarts and Guilmoto, 2015), i.e., girls who were not born or who didn't reach the age of 5 because of sex selection at birth or immediately after birth (female excess mortality). Major contributors to the bulge of missing women were India and China (Guilmoto, 2012). According to Bongaarts and Guilmoto's recent estimates (2015), since 1970, the percentage of missing women in the world increased from 3.3 to 3.7, while the number of missing women has doubled. The countries in which the percentage of missing women has increased during the same period are China, Nigeria and Indonesia. In east and southeast Asia, skewed sex ratio at birth is widespread mainly in China, Hong Kong, Singapore and Vietnam, while South Korea has managed to achieve a decrease from the elevated levels of the 1980s and now has a normal sex ratio at birth (WHO, 2011). In south Asia, the country in which skewed sex ratio at birth is more diffused is India. In the past, together with China, this country was already known for an unbalanced sex ratio as the consequence of female infanticide (Caldwell and Caldwell, 2005). As far as other south Asian countries are concerned, Nepal has witnessed an increase of male births in the last decade. Unfortunately, no reliable data are available to assess SRB in Pakistan and Afghanistan (Guilmoto, 2015).

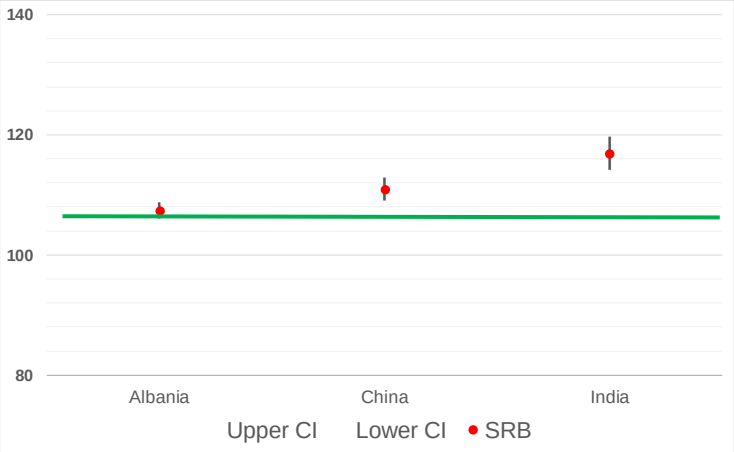
Today, sex selection at birth is diffused in other countries of the world in addition to Asian countries, in particular, since the end of the Iron Curtain. An unusual SRB has been recorded in a few countries in western Asia including Azerbaijan, Armenia and Georgia, and in two countries in southeast Europe: Albania and Montenegro.

2. Data, methods and preliminary results

Data used to elaborate descriptive statistics on births at the national level stems from the *Survey on births from the Resident Population Registers*. The Resident Population Registers, one of the vital statistics sources, is an individual and continuative survey on births, set up by the Italian National Institute of Statistics (Istat) in January 1999, and it ensures the knowledge of the main characteristics of births and parents at the municipal level. The individual sheets currently retrieve information on births (sex, date and place of birth, nationality), parents (place and date of birth, nationality, marital status) and the main details about the head of the household. Thus, live births registered in the Resident Population Registers provide a descriptive analysis of the phenomenon. The last data available refer to 2016 statistics[2]. Average SRB is calculated for the period of 2005-2016 for same-citizenship couples. Results of descriptive statistics are presented in figure 1: we found significant biases and a systematic excess in the expected number of male births; in particular, for migrants from India and China. Skewed sex ratios are also observed for births by Albanian couples starting in 2008.

2 Data referred to 2017 will be available by the end of November 2018, so they will be considered in the analysis.

Figure 1 - Skewed SRB by citizenship of both parents from 2005 to 2016, Italy

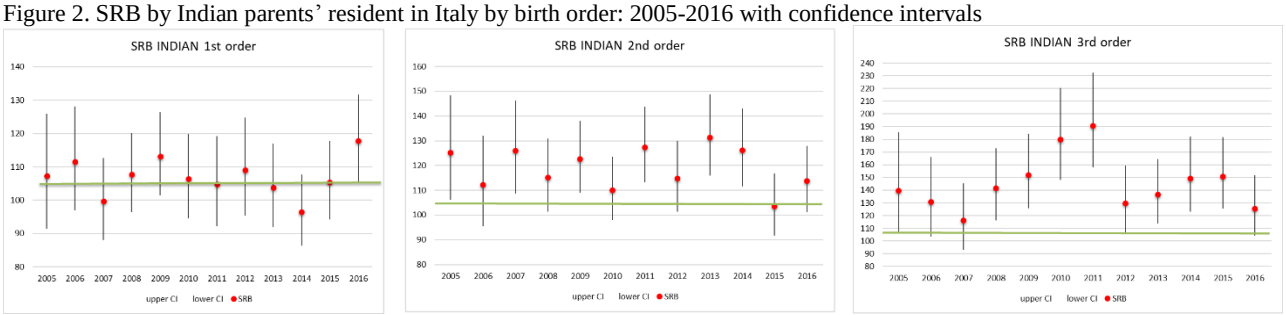


Source: *Istat, Live births registered in the Population Register (estimates)*

As the precision of SRB calculated on the small annual number of births is limited - being subjected to the binomial law - we provided the information on the statistical significance based on a 95% confidence interval for each year and for the whole period of analysis. In fact, as Guilmoto (2015) recently pointed out, due to the small size of populations, even in many countries or regions, the sex ratio cannot be reliably calculated on an annual basis, and this measurement issue is even more cogent among foreign communities and minorities.

A preliminary study on SRB at birth by birth orders was conducted for children born to foreign couples. Preliminary results show that the sex ratio at birth is above the biological constant for the period 2005-2016 for births of Albanian, Chinese and Tunisian couples from the third child and Indian couples (see figure 2) from the second child with a confidence interval of 95% above 105 (Ambrosetti, Ortensi, Castagnaro, Attili, 2017).

Figure 2. SRB by Indian parents' resident in Italy by birth order: 2005-2016 with confidence intervals



Source: *Istat, Live births registered in the Population Register (estimates)*

To improve our analysis, we take into consideration the birth's order, thanks to the *Longitudinal register on reproductive histories*[3] a database containing the offspring of all the Italian and foreign women living in Italy who have had at least one child registered in the Italian Registry from 1999 to 2013 (database under construction by Istat). We calculated the sex ratio of follow-up orders as a function of the sex of the first order births. Preliminary findings on the SRB by gender of previous children are presented in table 1-5:

[3] The methodology used to build this register is based on a deterministic record linkage original method called "Darlink". It is used, in the first instance to group all live births of the same mother in the various archives of live births recorded in the Registry " between 1999 and 2013 (Archive of brothers); then it's used to "fill the gaps" in the offspring through the mother's finding in the Lists of Municipal Registries, and, through the study of relationship within the family and the identification of its possible children to be added to.
This new database, containing a huge and valuable information asset for reading transversal and longitudinal data, allows to perform demographic and social analyses.

Table 1- SEX RATIO AT BIRTH*: Second birth by gender of first born

	First born was a boy		
	SRB	lower IC	Upper IC
Italy	109.3	109.0	109.7
Albania	108.7	105.7	111.9
Bangladesh	110.6	103.9	117.8
Sri Lanka	105.5	97.5	114.2
China	107.5	102.9	112.2
India	111.8	105.5	118.5
Pakistan	108.3	101.0	116.2
Tunisia	108.6	103.0	114.6

Source: ISTAT- Longitudinal register on reproductive histories
**by citizenship of the child. Pooled data from 1980 to 2013*

Table 2- SEX RATIO AT BIRTH*: Second birth by gender of first born

	First born was a girl		
	SRB	lower IC	Upper IC
Italy	102.6	102.2	102.9
Albania	100.1	97.3	103.0
Bangladesh	104.1	97.6	111.1
Sri Lanka	94.4	87.2	102.2
China	94.1	90.2	98.1
India	**124.8**	**118.0**	**132.2**
Pakistan	107.3	99.7	115.6
Tunisia	103.5	97.8	109.4

Source: ISTAT- Longitudinal register on reproductive histories
**by citizenship of the child. Pooled data from 1980 to 2013*

Table 3-SEX RATIO AT BIRTH*: Third birth by gender of first and second born

	First and second born were boy		
	SRB	lower IC	Upper IC
Italy	110.9	109.8	111.9
Albania	117.4	107.1	128.9
Bangladesh	112.6	96.1	132.2
Sri Lanka	80.3	62.5	102.5
China	108.3	96.6	121.4
India	117.7	96.9	143.5
Pakistan	109.1	97.1	122.6
Tunisia	102.6	92.9	113.4

Source: ISTAT- Longitudinal register on reproductive histories
**by citizenship of the child. Pooled data from 1980 to 2013*

Table 4-SEX RATIO AT BIRTH*: Third birth by gender of first and second born

	First and second born were girl		
	SRB	lower IC	Upper IC
Italy	99.9	98.9	100.9
Albania	104.1	97.2	111.6
Bangladesh	99.7	84.7	117.3
Sri Lanka	97.8	76.8	124.4
China	154.6	142.8	167.7
India	**223.4**	**194.8**	**258.1**
Pakistan	108.4	95.4	123.3
Tunisia	91.5	82.5	101.5

Source: ISTAT- Longitudinal register on reproductive histories
**by citizenship of the child. Pooled data from 1980 to 2013*

Table 5-SEX RATIO AT BIRTH*: Third birth by gender of first and second born

	First born was a girl and second born was a boy		
	SRB	lower IC	Upper IC
Italy	110.1	108.9	111.3
Albania	121.9	110.2	135.0
Bangladesh	127.3	105.3	154.6
Sri Lanka	106.5	80.1	142.0
China	116.2	102.2	132.2
India	133.3	110.8	161.3
Pakistan	91.0	80.4	103.0
Tunisia	111.5	100.0	124.4

Source: ISTAT- Longitudinal register on reproductive histories
**by citizenship of the child. Pooled data from 1980 to 2013*

Descriptive analysis by birth order (first, second and third) and sex of the previous child shows significantly increased values of SRB for Indian communities when the first and second births were girls. We performed further analysis calculating SRB for Indian descendants, by sex of the previous child and intergenesic interval between second and third birth: our findings show that when the first two children were boy, the SRB is respectively 140.7 (Lower CI 106.8-Higher CI 188.8) for an intergenesic interval of less than 4 years, and 100.0 (Lower CI 76.2-Higher CI 131.3) for an intergenesic interval of 4 years or more. While when the first two children were girls SRB is respectively 282.1 (Lower CI 228.4-Higher CI 356.8) for an intergenesic interval of less than 4 years, and 188.8 (Lower CI 157.3-Higher CI 227.1) for an intergenesic interval of 4 years or more. We can therefore conclude that the selection decreases when the interval is longer.

As further step of our analysis will be to investigate the determinants of the phenomenon. To perform this new analysis the information from the *Longitudinal register on reproductive histories* will be integrated with those from *Delivery Certificate Survey*, with the aim of outlining, in the country of destination, the factors related to this discriminatory behavior towards girls.

The *Delivery Certificate Survey* (CEDAP, Certificato di Assistenza al Parto) is collected by the Ministry of Health for births that took place in Italy. CEDAP is a continuative data source since 2002 on annual deliveries, collected in hospitals' birth departments. The dataset contains information on parents' socio-demographic background, mothers' reproductive history, pregnancy characteristics, delivery and neonatal characteristics.

The study will proceed with explorative multivariate analyses on different data sources linked together; preliminary studies were applied for the region of Lombardy because it is one of the Italian regions most affected by immigration. Although referring only to a region, in the two-year span of analysis, foreign children born in Lombardy accounted for 27% of the total number of foreign children born in Italy (Istat, 2015).

To carry out multivariate analysis on data referred to Italy, we'll implement a logistic regression model only for citizenship with imbalanced sex ratio at birth and with significant presence in Italian territory. The dependent variable is the sex of the newborn child.

Among the possible covariates: the parents' age, educational level, profession, previous abortion, the presence of prenatal diagnosis (villocentesis, amniocentesis, number of ultrasound examinations) in order to assess the possibility that these medical examinations are used as a prenatal sex selection tool and the birth order (presence of one, two or more previous children), a key variable for the study of birth selection (Guilmoto, 2015); once completed the new database containing the offspring of all the Italian and foreign women living in Italy (Istat), it'd be possible to consider, between covariates, the birth order by sex.

References

ABEYKOON A.T.P.L. (1995), "Sex Preference in South Asia: Sri Lanka an Outlier", *Asia-Pacific Population Journal*, 10 (3): 5-16. http://www.popline.org/node/294235.

AMBROSETTI e., ORTENSI L., CASTAGNARO C., ATTILI M. (2017), "Lo squilibrio dei sessi alla nascita nel contesto migratorio. Anche in Italia", *Neodemos*, 9 maggio 2017 . http://www.neodemos.info/articoli/lo-squilibrio-dei-sessi-alla-nascita-nel-contesto-migratorio-anche-italia/.

AMBROSETTI e., ORTENSI L., CASTAGNARO C., ATTILI M. (2017), "Sex imbalances at birth in migratory context: evidence from Italy". Genus, 71(2-3): 29-51.

ALMOND D., EDLUND L. (2008), "Son-biased sex ratios in the 2000 United States Census", *Proceedings of the National Academy of Sciences of the United States of America*, 105 (15), 5681-5682. http://www.pnas.org/content/105/15/5681.full.

ALMOND D., EDLUND L., MILLIGAN K. (2009), "O Sister, Where Art Thou? The Role of Son Preference and Sex Choice: Evidence from Immigrants to Canada", *NBER Working Papers 15391*, National Bureau of Economic Research, Inc. http://www.nber.org/papers/w15391.

ASTOLFI P., ZONTA L.A. (1999), "Reduced male births in major Italian cities", *Human Reproduction*, 14 (12): 3116-3119.

BLANGIARDO G.C. (2012) (a cura di), *L'immigrazione straniera in Lombardia. L'undicesima indagine regionale*, Osservatorio Regionale per l'integrazione e la multietnicità, Fondazione Ismu, Milano. http://www.orimregionelombardia.it/index.php?c=536.

BLANGIARDO G.C., RIMOLDI S. (2012), "100 milioni di bambine mancano all'appello nel mondo. E in Italia?", *Neodemos* 24/10/2012. http://www.neodemos.it/index.php?file=onenews&form_id_notizia=642.

CALDWELL B.K., CALDWELL J.C. (2005), "Family size control by infanticide in the great agrarian societies of Asia", *Journal of Comparative Family Studies*, 36(2): 205-226.

CHAHNAZARIAN A. (1988), "Determinants of the sex ratio at birth: review of recent literature", *Social Biology*, 35(3/4): 214-235. http://doi.org/10.1080/19485565.1988.9988703.

CHEN Y., LI H., MENG L. (2013), "Prenatal Sex Selection and Missing Girls in China: Evidence from the Diffusion of Diagnostic Ultrasound", *Journal of Human Resources*, 48(1): 36-70. http://jhr.uwpress.org/content/48/1/36.abstract.

DAVIS D.L., GOTTLIEB M.B., STAMPNITZKY J.R. (1998), "Reduced ratio of male to female births in several industrial countries. A Sentinel Health Indicator?", *Journal of the American Medical Association*, 279, 1018-1023.

DAS GUPTA M., ZHENGHUA J., BOHUA L., ZHENMING X., CHUNG W., HWA-OK B. (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. http://doi.org/10.1080/00220380412331293807.

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. http://doi.org/10.1111/j.1728-4457.2007.00173.x.

FARINA P. (ed.) (2010), *Indagine sulla presenza nel territorio lombardo di popolazione a rischio in relazione alla salute sessuale e riproduttiva e alle mutilazioni genitali femminili*, IRER, Milano.

GINI C. (1908), *Il sesso dal punto di vista statistica: le leggi della produzione dei sessi*, Remo Sandron Editore, Bologna.

GONZÁLEZ L. (2014), "Missing Girls in Spain", *Barcelona Graduate School of Economics Working Papers*, 760. http://www.barcelonagse.eu/sites/default/files/working_paper_pdfs/760.pdf.

GUILMOTO C.Z. (2009), "The Sex Ratio Transition in Asia", *Population and Development Review*, 35 (3): 519-549. http://doi.org/10.1111/j.1728-4457.2009.00295.x.

GUILMOTO C.Z. (2012), *Sex Imbalances at Birth. Current trends, consequences and policy implications*, UNFPA Asia and Pacific Regional Office. http://www.unfpa.org/sites/default/files/pub-pdf/Sex%20Imbalances%20at%20Birth.%20PDF%20UNFPA%20APRO%20publication%202012.pdf.

GUILMOTO C.Z. (2015) "The Masculinization of Births. Overview and Current Knowledge", *Population*, 70(2): 183-244. http://www.ined.fr/fichier/rte/General/Publications/Population/articles/2015/N2/199-PopF2-2015-Guilmoto-Article.pdf.

ISTAT (2015) *On line resource*. http://demo.istat.it/ accessed November 17th, 2015.

JACOBSEN R., MØLLER H., MOURITSEN A. (1999), "Natural variation in the human sex ratio", *Human Reproduction* 14(12): 3120-3125.

http://doi.org/10.1093/humrep/14.12.3120.

MELDOLESI A. (2012), *Mai nate. Perché il mondo ha perso 100 milioni di donne*, Mondadori Università, Milano.

QADIR F., KHAN M.M., MEDHIN G., PRINCE M. (2011), "Male gender preference, female gender disadvantage as risk factors for psychological morbidity in Pakistani women of childbearing age - a life course perspective", *BMC Public Health*, 11, 745. http://doi.org/10.1186/1471-2458-11-745.

SBS RADIO, *The news "it's a girl", still unwelcome in some cultures in Australia* http://www.sbs.com.au/radio/storystream/news-its-girl-still-unwelcome-some-cultures-australia (accessed November 17th, 2015).

SINGH N., PRIPP A.H., BREKK E.T., STRAY-PEDERSEN B. (2010), "Different sex ratios of children born to Indian and Pakistani immigrants in Norway", *BMC Pregnancy and Childbirth*, 10(1): 40-45. http://doi.org/10.1186/1471-2393-10-40.

UNITED NATIONS (1994), *Programme of Action of the United Nations International Conference on Population & Development*, Cairo, September.

VERROPOULOU G., TSIMBOS C. (2010), "Differentials in sex ratio at birth among natives and immigrants in Greece: An analysis employing nationwide micro-data", *Journal of Biosocial Science*, 42(3): 425-430. http://dx.doi.org/10.1017/S0021932009990599.

WHO (2011), *Preventing Gender-biased Sex Selection, UNFPA, Report of the International Workshop on Skewed Sex Ratios at Birth: Addressing the Issue and the Way Forward*. Hanoi, UNFPA.