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Title: Why Rural and Urban Sex Ratios among Young Adults Are Skewed in Most Countries of the World

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Abstract

Skewed sex ratios at birth have raised questions about marriage squeeze prospects in 12 countries, most notably including China and India. We argue that, more commonly, international and internal migration have an impact on sex ratios of a similar or larger magnitude. In order to assess the causes of skewed sex ratios among young adults, we focus on the cohort born from 1980 to 1990 in almost all countries of the world. We decompose country-level sex ratios into three factors: sex ratio at birth, relative probability of survival and sex-selective migration. Furthermore, we analyse the rural and urban sex ratios to find that while 44 countries have imbalanced country-level sex ratios, as much as 108 of the 201 investigated countries have either rural or urban imbalanced sex ratios among young adults in 2015. We also find a strong log-linear relationship between sex ratios and population density in sub-national regions in Europe.

1. Introduction

Skewed sex ratios at birth (SRB) have raised concerns about marriage squeeze prospects. For instance, Jiang et al. (2016) estimate that in the coming decades, there will be 0.1-0.3 excess men for each Chinese women. According to Guilmoto (2012), grooms in China and India will outnumber brides by at least 50%, as long as the SRB does not fall. The existing literature finds that skewed sex ratios have very diverse and potentially harmful consequences. They may increase crime and violence (Edlund et al. 2013) and spread of sexually transmitted diseases (Bien et al. 2013), as well as affect economic behaviour (Wei and Zhang 2011), fertility decisions (Kesternich et al. 2020) and bargaining power of women (Stopnitzky 2017) or harm health and well-being of the overrepresented sex (Zhou and Hesketh 2017). Importantly, most of those studies see mating opportunities or intrasexual competition as the driving force. Therefore, sex ratios may matter particularly for young adults by affecting their opportunities for family formation.

Here, we argue that international and, particularly, internal migration have an impact of a similar, or in some cases even much larger, magnitude on sex ratios among young adults (SRYA) at the national level. However, since most people find their partners through direct contact, individuals experience sex ratios in their physical environment, i.e., at the local level (Becker 1981; Oppenheimer 1988; Noë 2017). Therefore, we focus on the spatial distribution of young women and men at lower levels of geographical disaggregation within countries: urban and rural SRYA and at the relationship between population density and SRYA at the regional level. We find that urban or rural SRYA are imbalanced in most countries of the world.

Following the convention, in this paper, higher sex ratios are understood as a larger number of men relative to the number of women. We focus on the cohort born from 1980 to 1990. As in existing studies (e.g. Billari and Dalla-Zuanna 2013; Jiang et al. 2016), we focus on people aged 30. While we admit it is an arbitrary choice, we belive it is also most ilustrative. Around that age, most people in most countries have already married, while those who have not found their partners yet, experience the marriage squeeze the most.

The study comprises three parts distinguished by the geographical level of analysis. First, we use World Population Prospects (WPP) data produced by the United Nations Population Division (UNDP) to decompose the sex ratios at age 30 at the national level into three factors: sex ratio at birth (SRB), probability of survival of men relative to women and net international migration of men relative to women. We conduct this exercise for all countries and territories of the world with total population larger than 90 thousand.

Second, we use Urban and Rural Population by Age and Sex (URPAS) estimates by UNDP to look at the rural and urban sex ratios for the age group 25-34 for the same set of countries. We also show how they changed over time for this age group and for the cohort born between 1980 and 1990.

Third, we focus on the European Union Nomenclature of Territorial Units for Statistics 3 (NUTS3) regions, using Eurostat data. We discuss the results for the six biggest countries which ever joined the European Union. This allows us to show that the local imbalance of sex ratios among young adults is not related to SRB but to population density, implying a large effect of internal migration. In consequence, in most of the investigated cases, relatively more men live in the least densely populated regions.

Overall, this study offers the first global view on rural and urban sex ratios among young adults and reveals the strong relationship between population density and sex ratios. Although geographical analysis of sex ratios has been a basis for research on internal migration as early as in the 19th century (Ravenstein 1889) and it still constitutes an important part of development studies (see e.g. Chant and McIlwaine 2015), mapping of sex ratios by age group has been very rare and focused on individual countries (e.g. Edlund 2005 on Sweden). Relevant exceptions are the paper by Menashe-Oren and Stecklov (2018) on the relationship between demographic transitions and migration in Sub-Saharan Africa and by Wiest et al. (2012) on the masculinization of rural Europe.

The global picture helps to realize how international inter-regional migration flows influence sex ratios. Depending on the size of the country, the impact may be relatively larger in the sending country (e.g. in Albania) or in the country of destination (e.g. in the Gulf countries). Unsurprisingly, international migration has a larger impact on smaller countries, particularly on small islands.

Most importantly, we show that the problem of skewed SRYA resulting in a marriage squeeze –so far most commonly related to the phenomenon of "missing girls"– can concern many areas all over the world due to sex-selective internal migration. While SRB are considered imbalanced in 12 countries (Chao et al. 2019), we find that, at the age of 30, national sex ratios are excessively low in 22 countries and excessively high in 22 countries. Even more impressively, most countries –108 of the 201 under study– suffer from imbalanced SRYA in rural areas, urban areas or both.

2. Data and methods

Following Billari and Dalla-Zuana (2013), we use the WPP data to estimate the population of people aged 30 for each sex separately:

(1) $P_{s,30,t+30} = B_{s,t} * p_{s,30,t} * m_{s,30,t+30}$,

where the subscript *s* takes the values of *m* for male and *f* for female and:

$P_{s,30,t+30}$ = population of people aged 30 at time *t*+30;

$B_{s,t}$ = number of people born at time *t*;

$p_{s,30,t}$ = probability of survival until the age 30 for the cohort born at time *t*;

$m_{s,30,t+30}$ = 1 – net migration rate until the age 30 for the cohort born at time *t*.

The migration factor is estimated by inversion of the formula (1):

(2) $m_{s,30,t+30} = P_{s,30,t+30} / (B_{s,t} * p_{s,30,t})$

This approach implies that any measurement errors influence the estimates of migration. Since this method does not yield 1 for the world population, we divide the migration factor estimated for each country by the world-level migration factor. As long as the errors for a specific country or region have no different impact than those on the world level or are equal for both sexes, they do not affect our conclusions.

We focus on the cohort born in the decade 1980-1990, starting and ending in July of each year, i.e., in the decade centred around 1985. The population born in 1985 is calculated as the sum of births in the periods 1980-1985 and 1985-1990 divided by 10. Similarly, we estimate the sex ratio at birth in 1985 as the average of the sex ratios reported for the periods 1980-1985 and 1985-1990. It is used to calculate the number of boys and girls born in 1985.

The probability of survival is estimated by multiplication of respective probabilities: for the age groups 0-1 and 1-4 in the years 1985-1990, for the age group 5-9 in the years 1990-1995, 10-14 in 1995-2000, etc. In the main specification, the population of people aged 30 in 2015 is calculated as the sum of people aged 25-34 in 2015 divided by 10. For an intertemporal comparison, the same exercise is repeated for the cohort born in 1955.

By dividing the formula (1) for men by the same formula for women, we get:

(3) $P_{m,30,t+30} / P_{f,30,t+30} = (B_{m,t} / B_{f,t}) * (p_{m,30,t} / p_{f,30,t}) * (m_{m,30,t+30} / m_{f,30,t+30})$

In this way, the sex ratio at age 30 is decomposed into the effects of SRB, relative probability of survival and sex-selective migration.

Two alternative measures are used to produce results presented in Appendix 3. The first uses the population aged 30 in the annual data instead of taking the average of the age groups 25-34. The second uses the average of such yearly estimates for the 10 years corresponding to the births 30 years earlier, i.e., for the cohort born between 1980 and 1990, for years 2011-2020. In both cases,

the global migration factor is larger than in the original method and, therefore, the latter – corresponding to a group most closely corresponding to that in the data on births– is preferred. Finally, the results based on the estimates of SRB by Chao et al. (2019) are provided in Appendix 4. They do not contradict the conclusions presented below.

In the second part, we use URPAS data provided in five-year intervals from 1980 to 2015 at national level for 233 countries and territories, as well as for regions and subregions. They are estimated based on censuses and population registers. Due to lack of data on rural and urban probability of survival by sex, we cannot conduct a reliable decomposition as at the national level. Here, we focus on the 201 countries with population larger than 90 thousand, as in the case of country-level decomposition.

In the third part, we focus on six large European countries using Eurostat data. The European Union is a good case study for two reasons. First, detailed data at subnational level are reliable and comparable. NUTS3 regions are similar in terms of number inhabitants: from 150 000 to 800 000 inhabitants, with few exceptions. They allow to overcome the problems of the urban-rural divide: that a binary variable obscures the continuous nature of the relationship between population density and sex ratios and that countries differ in the definition of urban and rural areas. Instead, we use population density to show that more densely populated areas of Europe attract significantly more young women (relative to men). Second, Europe has a very low child and youth mortality and the son or daughter preferences do not play any role at the macro scale (Miranda, Dahlberg, and Andersson 2018, Chao et al. 2019), which makes internal migration the most likely explanation of the observed patterns. In this part, we compare children (0-9 years old) and young adults (25-34 years old), merging two 5-year cohorts in each group to decrease volatility. The latter range comprises the average age at which people in almost all EU countries marry for the first time.

3. Results

3.1. National level sex ratios

The literature on SRB finds significant heterogeneity between regions, estimating the reference levels as ranging from 1.031 in sub-Saharan Africa to 1.067 in Oceania. In fact, SRB are particularly high in 12 countries: Albania, Armenia, Azerbaijan, China, Georgia, Hong Kong, India, Republic of Korea, Montenegro, Taiwan, Tunisia, and Vietnam, reaching as much as 1.179 in China in 2005 (Chao et al. 2019). Among those countries, Tunisia has the lowest historical maximum SRB estimated as 1.085, which we set as an indicative benchmark of imbalanced sex ratios.

In this way, we find 22 countries with SRYA in 2015 higher than that threshold. Most of those cases are driven by extremely sex-selective international migration. The Arab states of the Persian Gulf stand out with men outnumbering women over four times in Qatar (4.40), followed by United Arab Emirates (2.98), Oman (2.88), Bahrain (2.18), Kuwait (1.41), and Saudi Arabia (1.31). They are followed by Equatorial Guinea (1.60) and Western Sahara (1.17) in sub-Saharan Africa, Brunei Darussalam (1.18) and Bhutan (1.17) in Asia, and small islands around the world: Maldives (1.88), Samoa (1.20), Seychelles (1.17), Cabo Verde (1.13) and Guam (1.10). In contrast, in India (1.10), Republic of Korea (1.10) and Singapore (1.09), high SRB is the most important factor. In Albania (1.19), Afghanistan (1.10), Slovenia (1.10), and Malaysia (1.09), international migration and SRB contribute in a similar way to the high SRYA.

Importantly, those cases are followed by several post-communist countries with SRYA comparable to China's 1.06: Bulgaria, Czechia, Estonia, Latvia, Montenegro, Poland, and Romania with SRYA between 1.06 and 1.08 (along with Djibouti and Malta). Only five of all the above mentioned countries figure on both lists (Albania, China, India, Montenegro, Republic of Korea), which reinforces our argument that international migration may be even more important than SRB in determining marriage squeeze at the national level.

Only few countries in the world note SRB stably lower than 1.00: Gabon, Malawi, Mozambique, Uganda, and Zambia. There are as many as 51 countries with an SRYA in 2015 lower than 0.984, which is the lowest SRB in the recorded history, found in Namibia in 1991 (Chao et al. 2019). If we apply the mirror reflection of the benchmark corresponding to high sex ratios (i.e., 1 – 0.085 equal to 0.915), we find 22 countries with excessively low sex ratios in 2015. The most extreme cases are Nepal (0.56) and Hong Kong (0.74). Three further Asian countries are Lebanon (0.87), Armenia (0.88), and Sri Lanka (0.89). Low SRYA also characterize several countries in Sub-Suharan Africa: Zimbabwe (0.80), Eswatini (0.81), Réunion (0.87), Guinea (0.88), Botswana (0.90), Niger (0.91), and Senegal (0.91). In Latin America, only El Salvador (0.83) and French Guiana (0.89) fall below the benchmark, but Mexico (0.94) must be mentioned as the most populous country in the world with a relatively low SRYA. Again, extreme SRYA can be found on small islands around the globe: Curaçao (0.67), Guadeloupe (0.70), Martinique (0.74), Mayotte (0,76), Kiribati (0.78), Aruba (0.80), Vanuatu (0.86), and Saint Vincent and the Grenadines (0.88).

Importantly, two of those countries experience female-biased SRYA despite being identified as those where the phenomenon of "missing girls" has occurred. This is because the excessively high SRB occurred in later cohorts. In both Armenia (with SRB in 1985 equal to 1.054 according to WPP and 1.063 according to Chao et al. 2019) and Hong Kong (1.067 and 1.066, respectively), the relatively high SRB in 1985 was overturned by sex-selective international migration until 2015.

Since the SRB are very well studied, here, we focus on the two remaining factors, displayed on Figure 1. The numerical results for all countries with total population larger than 90 thousand (due to data availability) are presented in the Appendix 2. There seems to be no association between relative probability of survival until 30 and sex-selective migration.

Importantly, in some countries, migration and mortality may cancel out a high SRB. For instance, in Spain, despite the SRB of 1.06, the SRYA is equal to 1.00 due to higher net migration of women than men and differential mortality playing a minor role. In contrast, the SRB of 1.05 in Eritrea is cancelled out mostly by much lower relative mortality of women (0.94). Therefore, not only the countries with extreme SRYA should be of interest but also those that are extreme in terms of one or more factors.

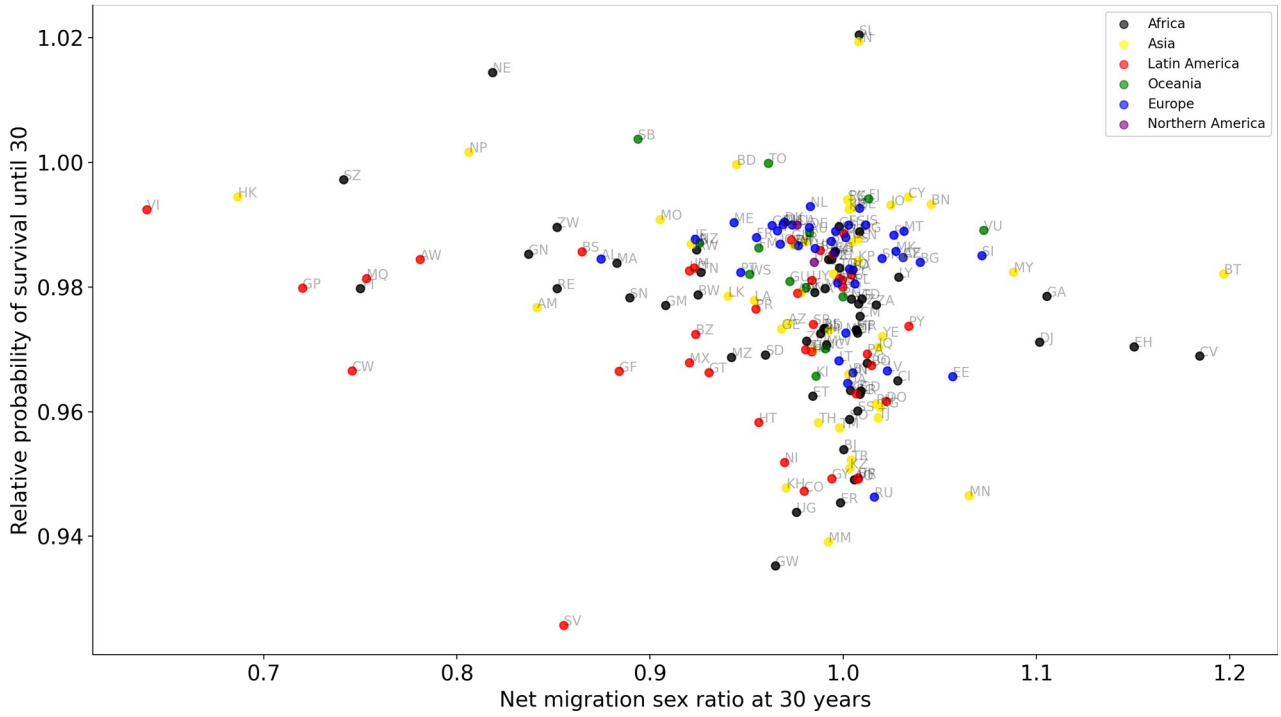
In some cases, a combination of two factors leads to high sex-ratios, e.g., migration and relatively high SRB in the above mentioned post-communist countries. In El Salvador, Guinea-Bissau, Mexico, Uganda, Zimbabwe the higher mortality of men and more frequent emigration of women leads to a particularly low sex ratio among young adults. For instance, in Uganda, migration (0.95) and relative probability of survival (0.94) contribute equally to the very low SRYA (0.92).

Most of the countries with extreme SRYA are characterized by extreme migration factors. We find low migration factors in Ireland (0.91) and Portugal (0.91), as well as Bahamas (0.89) and Solomon Islands (0.90). In those countries, migration offsets the high SRB and, together with lower probability of survival of men, produce relatively low SRYA. In contrast, the high migration factor in Lesotho (1.08) combined with a relatively low SRB (1.03) and probability of survival (0.96) produces an SRYA of 1.06 only.

With a few exceptions, differential mortality plays a limited role. In Angola, El Salvador, Eritrea, Guinea-Bissau, Myanmar, Syria, Uganda, and Venezuela the relative probability of survival is between 0.93 and 0.95. All those countries have been affected by internal or international conflicts in the investigated period. Importantly, less young men than women die only in three countries: India, Niger, and Sierra Leone.

In sum, we identify 22 countries with excessively high SRYA and 22 countries with excessively low SRYA in 2015. With the exception of the well known cases of excessively high SRB (Albania, China, India, Republic of Korea), the most important cause of skewed sex ratios at the national level is international migration.

Figure 1. Migration factor and relative probability of survival, sub-regions, 2015.



Data source: WPP, own estimation.

These global phenomenon is not unique to the cohort born in 1985. Applying the same benchmarks, we find 22 countries with excessively high SRYA and 17 countries with low SRYA in 1985, i.e., for the cohort born in 1955. Already then, the Gulf countries were marked by outstandingly high SRYA. Similarly, Brunei Darussalam, Guam, India, Samoa, Western Sahara maintained very high SRYA over the period. On the other side, several of the countries characterized by high SRYA in 1985 –Côte d'Ivoire, Jordan, Libya, and Somalia– equalized them until 2015. Others –Angola, Bangladesh, Belize, French Guiana, Hong Kong, Jordan, Macao, and Mayotte– ran into the opposite imbalance and have now significantly more young women than men. Although all those changes can be attributed mostly to the changing patterns of migration, the SRB notably decreased in Hong Kong (by 0.02), while relative probability of men's survival decreased in Angola (by 0.01), Bangladesh (0.02), Côte d'Ivoire (0.02), India (0.04), and Jordan (0.04) and increased in United Arab Emirates (0.04), Bahrain (0.07), French Guiana (0.05), Guam (0.02), Libya (0.03), Mayotte (0.03), Samoa (0.02), Saudi Arabia (0.03), Somalia (0.02), Qatar (0.02), and Western Sahara (0.02). It must be stressed that those changes are –with the exception of India and United Arab Emirates– much smaller than those in migration factor.

The countries with lowest SRYA in 1985 were mostly in Sub-Saharan Africa –Burkina Faso, Eswatini, Guinea, Guinea-Bissau, Lesotho, Namibia, and Niger– and small islands around the world: Antigua and Barbuda, Cabo Verde, Curaçao, Puerto Rico, Saint Vincent and Grenadines, US Virgin Islands, and Vanuatu. Two remaining cases were Cambodia and El Salvador. Although the

SRYA grew in all of those countries but Curaçao and El Salvador, the SRYA remained imbalanced until 2015 in most of them. In Antigua and Barbuda, Burkina Faso, Puerto Rico, and US Virgin Islands, the SRYA was close to balanced in 2015, thanks to a less sex-selective migration. A change in mortality was the most important factor in Cambodia. Interestingly, Cabo Verde turned from being the most feminized country in the world in terms of young adults in 1985 to one of the most masculinized in 2015, a change that can be attributed entirely to changing migration patterns. A less dramatic process in the same direction occurred in Lesotho.

The same exercise has been conducted with the estimations of SRB by Chao et al. (2019) and with two alternative estimations of the population of young adults in 2015. The results are presented in Appendices 3 and 4. They generally confirm the conclusions presented above.

3.2. Urban and rural sex ratios

The above mentioned inequalities are locally exacerbated by internal migration. Figure 2 displays sex ratios for the age group 25-34 in 137 countries with total population above 2 million in 2015. Full numerical results for all 201 countries with population above 90 thousand (as in the previous section) are presented in Appendix 5. The age group 25-34 is equivalent to the synthetic cohort used above for the decomposition.

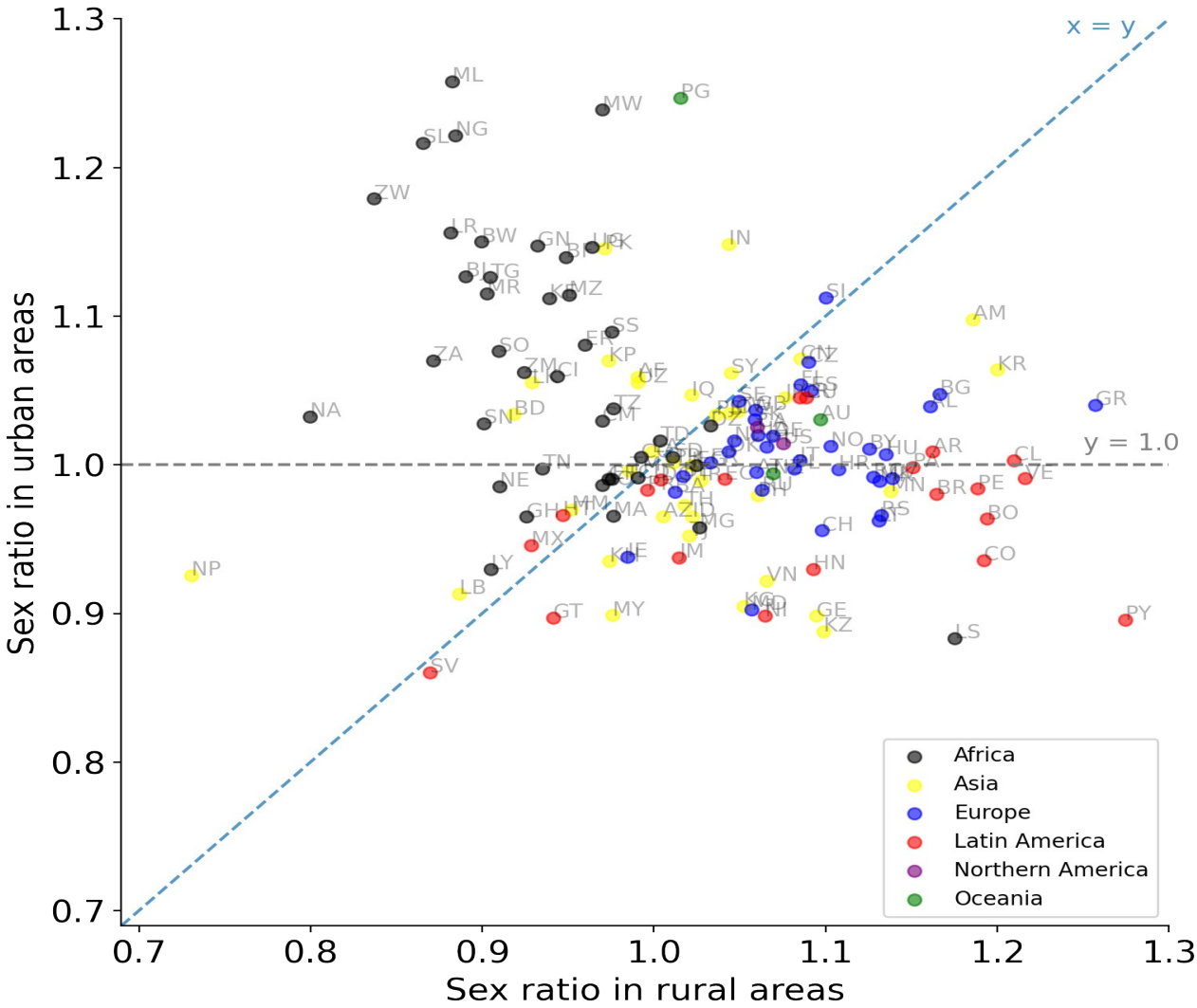
Applying the same thresholds as above (0.915 and 1.085), we find 40 countries with high urban SRYA and 19 countries with low urban SRYA in 2015. There are 58 countries with high rural SRYA and 29 countries with low rural SRYA. In total, 108 of 201 investigated countries have at least one of the SRYA beyond the chosen ranges. A simulation of the share of countries with imbalanced SRYA for different ranges is presented in Appendix 6.

Generally, we find that most African and some Asian countries stand out in that they have higher urban than rural sex ratios. Having relatively more young men in cities, they are a global exception. In contrast, countries in Europe, the Americas and parts of Asia have relatively more young women in cities and more young men in rural areas.

The imbalances are large in many cases. For instance, the rural sex ratio of 1.28 in Greece means that there are 28% more young men than women in rural areas, a phenomenon that has already been subject of qualitative studies (e.g. Kaberis and Koutsouris 2013). Some outliers with either rural or urban sex ratios beyond the range from 0.7 to 1.3 are not displayed on the Figure 2, but presented in Appendix 5. First of all, they include the Gulf countries: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates. Their sex ratios span from 1.3 to 4.3 with similar imbalances in

rural and urban areas. This is not surprising, given the finding from the previous section that their national SRYA are high. The second group of outlying countries are Burundi, Rwanda, and Yemen with low overall urbanization rates but urban sex ratios over 1.3 and rural sex ratios much below 1.0. They are the countries with most striking rural-urban imbalances in SRYA. Finally, Bhutan has generally large SRYA (1.34 urban and 1.19 rural), which contrasts with Mayotte's very low SRYA (0.82 and 0.66). In turn, Uruguay has balanced rural SRYA (1.00) and very high rural SRYA (1.44).

Figure 2. Rural and urban sex ratios for the age group 25-34 in 137 largest countries, 2015.

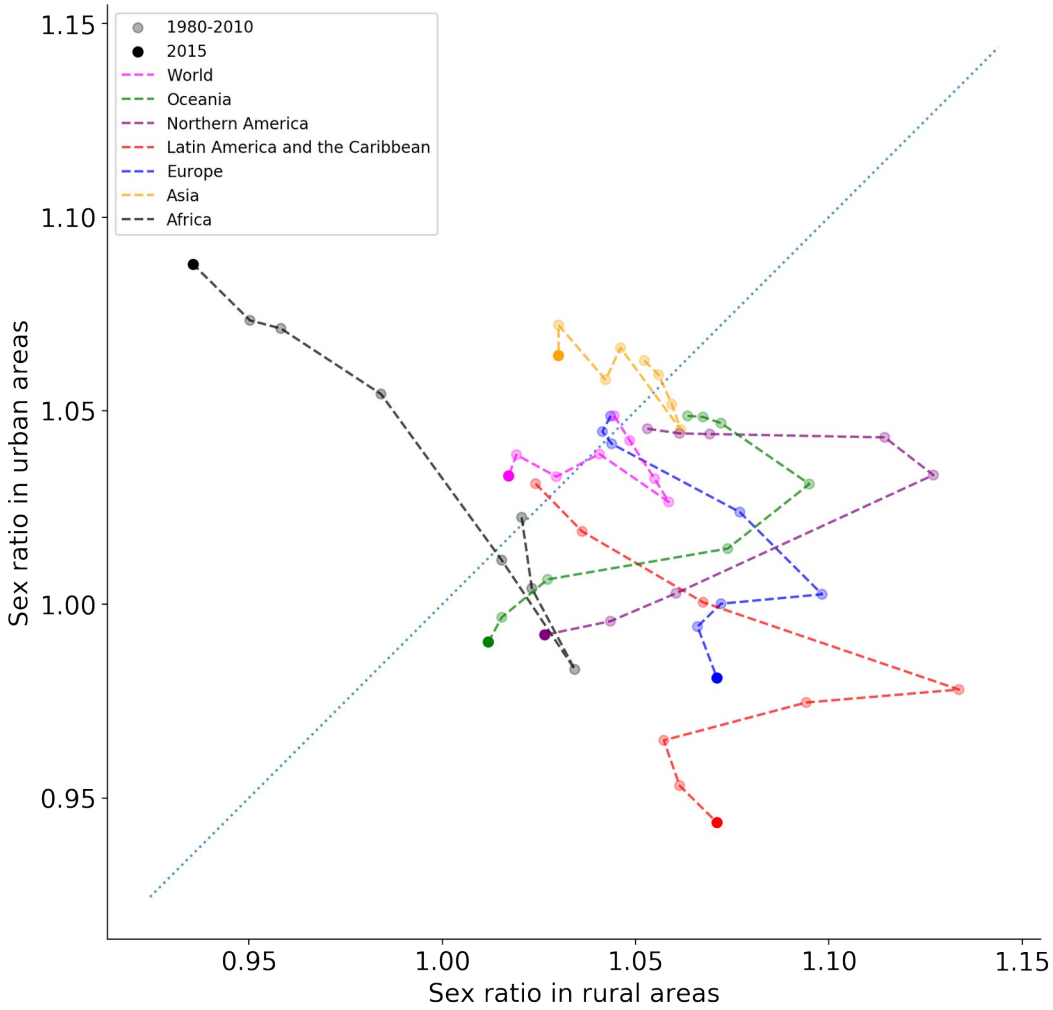


Data source: URPAS. Polities with less than 2 mln inhabitants excluded for clarity. 13 outliers not included in Figure 2 are mentioned in the text.

Those differences could be caused by skewed SRB and mortality differences between women and men in rural and urban areas. It turns out that the SRB are close to equal in urban and rural areas on

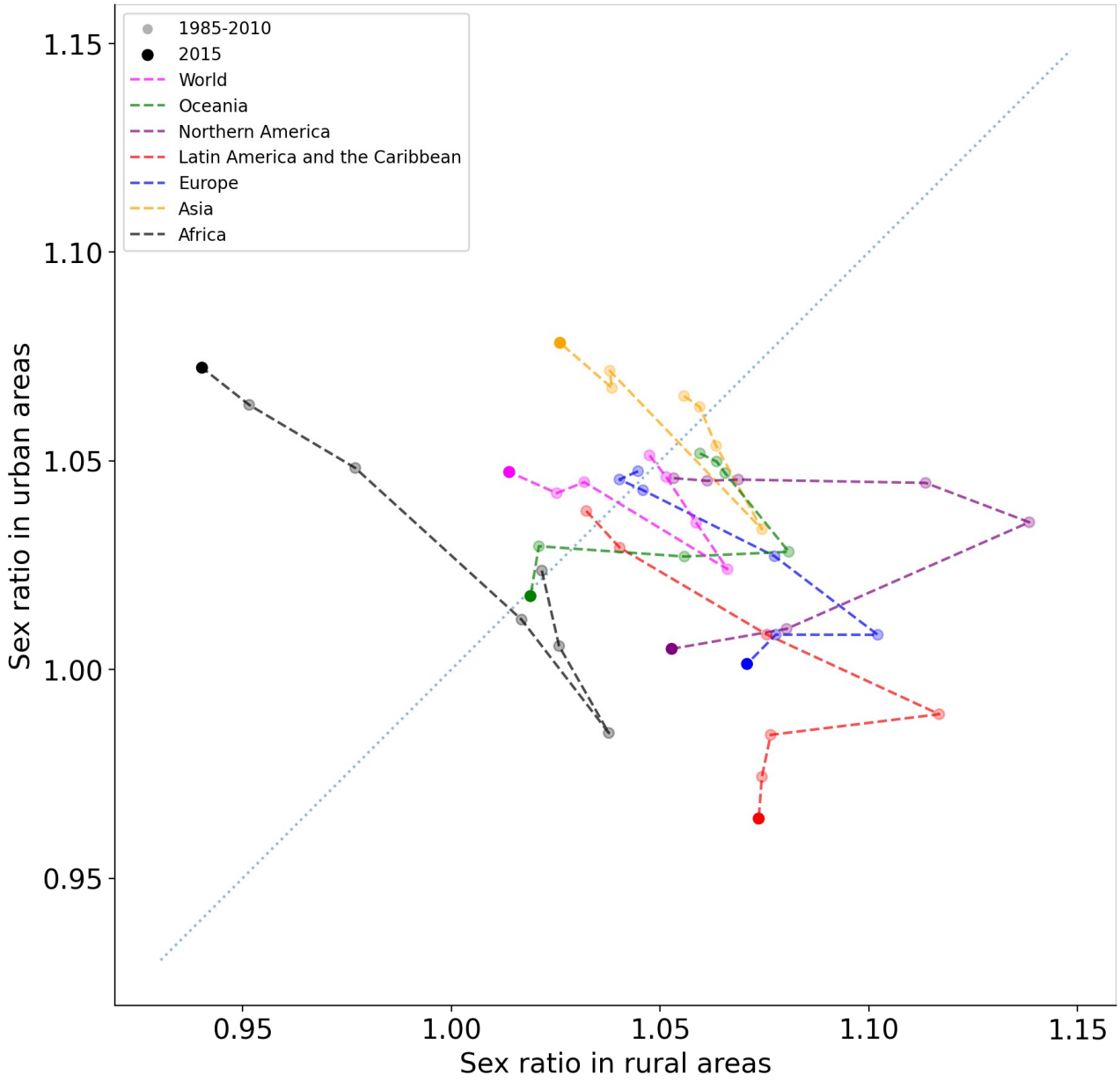
all continents in both parts of the cohort under study: people born in the years 1980-1984 (Figure 3) and 1985-1989 (Figure 4). Moreover, in Europe, North America and Oceania rural and urban sex ratios do not change for older children. They grow for young adults in rural areas and fall in urban areas. Since mortality is relatively low on those continents and national SRYA are not among the most imbalanced, the divergence of rural and urban areas must be caused by sex selective migration: more women than men migrate to cities. A very similar process, although starting already in childhood, occurs in Latin America. To the contrary, more men than women appear in urban areas in Africa and Asia.

Figure 3. Rural and urban sex ratios for the cohort born in 1980-1984, years 1980-2015.



Data source: URPAS. Each dot reflects one measurement year. Dots are connected in the order from 1980 to 2015. Darker dot for each colour marks year 2015.

Figure 4. Rural and urban sex ratios for the cohort born in 1985-1989, years 1985-2015.



Data source: URPAS. Each dot reflects one measurement year. Dots are connected in the order from 1980 to 2015. Darker dot for each colour marks year 2015.

It is important to ask whether those discrepancies are a new phenomenon and if they grow or disappear with time. Since 1980, the global rural and urban SRYA remained relatively balanced, although a small shift should be noticed: from higher rural than urban SRYA in 1980 to the opposite in 2015 (Figure 5). This suggests that, on average, women in the world move to cities more often now than in 1980, relative to men. However, some regional changes in time are large and in different directions.

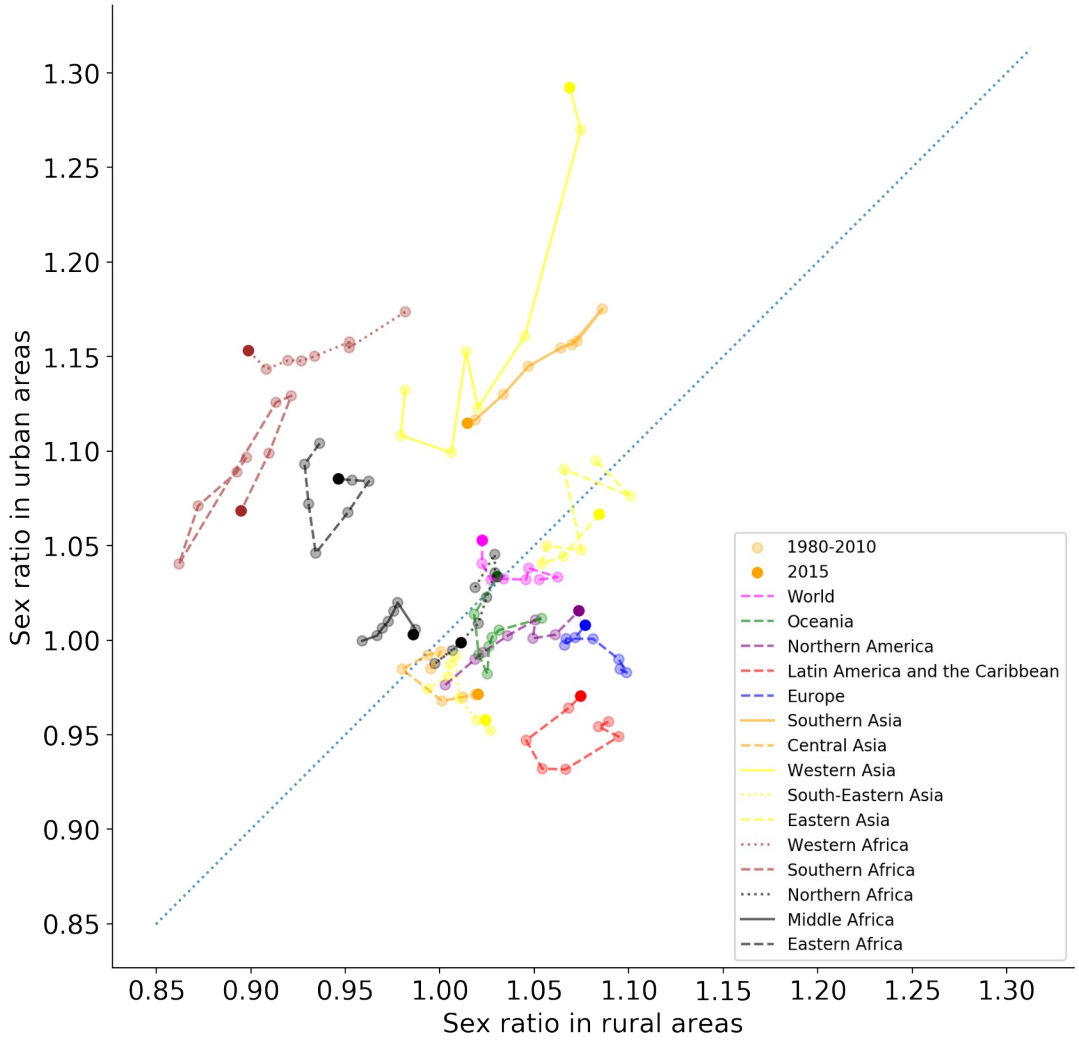
First, both urban and rural SRYA rose considerably in Western Asia, which reflects the immigration to the outlying Gulf countries mentioned above. A trend similar in direction but not smaller in scope occurred in Northern America. In contrast, SRYA in Southern Asia decreased, starting from an abnormally high level.

In Europe, we can observe a trend of increasing urban SRYA and decreasing rural SRYA, particularly in the 1980s and 1990s. The gap shrunk but it is still not negligible: there are 8% more young men than women in rural areas and nearly the same number of women and men in urban areas. The opposite has happened since 2000s in South-Eastern Asia and Central Asia, where cities have become more feminized in contrast with rural areas, marking a divergence from balance. Rural SRYA decrease in Western Africa (from 0.98 to 0.90) with relatively stable urban SRYA, while an opposite trend can be seen in Middle Africa (from 0.96 to 0.99).

In other regions, the patterns are not so clear, particularly in Eastern Asia, Eastern Africa and Southern Africa. After a reversal of the feminizing trend in rural areas, Latin America in 2015 has a similar distribution of young adults as in 1980 with feminized cities (on par with South-Eastern Asia, Central Asia and Europe) and masculinized rural areas.

In sum, although the global average SRYA are not very imbalanced, many regional processes occur. Most prominently, while there is an increasing number of men in Western Asia and North America (relative to women), the opposite happens in Western Africa. While rural and urban SRYA in Europe become more balanced, some regions remain imbalanced (Latin America, Eastern and Southern Africa) or even diverge from balance (Central Asia and South-Eastern Asia) between rural and urban areas.

Figure 5. Rural and urban sex ratios for the age group 25-34, years 1980-2015.

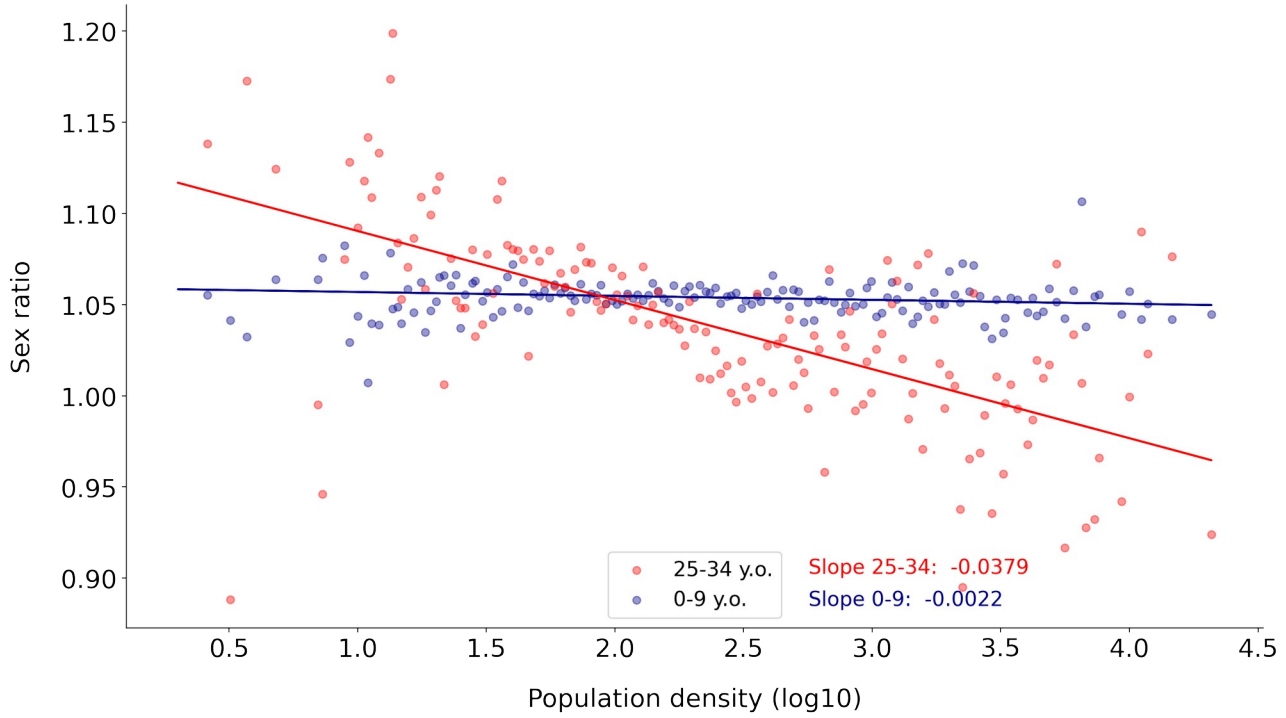


Data source: URPAS. Each dot reflects one measurement year. Dots are connected in the order from 1980 to 2015. Darker dot for each colour marks year 2015. The Figure displays aggregate values for regions defined by the UN, with Asia and Africa divided into subregions.

3.3. Regional sex ratios in Europe

As expected, in Europe, the sex ratios among children are not related to population density (Figure 6). If there was no migration, SRYA should be close to the European level of SRB around 1.055 (Chao et al. 2019) due to the low mortality. In turn, we find a notable divergence of SRYA: they are higher in the least densely populated areas and lowest in the most densely populated areas. Despite considerable variability, the relationship is close to log-linear: for population density 10 times larger, the sex ratio of young adults is 0.038 lower or, in other words, there are 3.8 p.p. less men in comparison to women. Figures 3-5 suggest that the divergence of rural and urban sex ratios in Europe occurs with life course but comparing younger cohorts with older ones, we observe that the imbalance decreases.

Figure 6. Sex ratios in NUTS3 regions in the European Union, age groups 0-9 and 25-34, 2015.

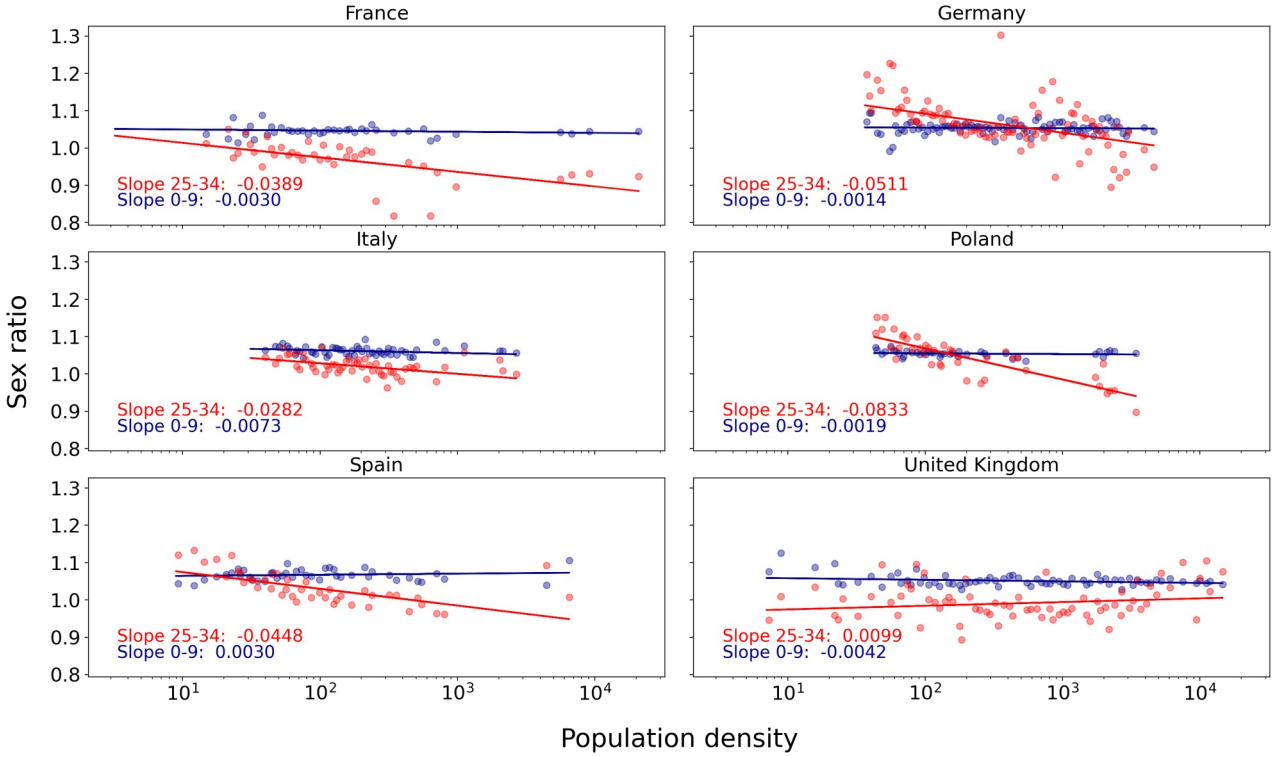


Data source: Eurostat. Blue colour shows the age group 0-9, red colour shows the age group 25-34. NUTS3 regions are divided into 200 bins. Slopes come from OLS regressions of sex ratio on population density. Population density is logarithm of inhabitants per square kilometre.

These results are not driven by some outlying cities or countries with higher population density and lower sex ratios. Figure 7 displays the same comparison of age groups for the six largest countries of the European Union in 2015 separately. Despite considerable differences, the general pattern repeats in all of those countries besides the United Kingdom. Importantly, SRYA in France are lower for almost all population densities, reflecting a general feminization of the French society, which, according to the decomposition results in Appendix 2, is caused by international migration. In contrast, sex ratios in rural areas of Germany and Poland are significantly higher than 1 as opposed to sex ratios in urban areas, which are much lower. This is caused mostly by internal migration, as has been suggested in previous studies (Eckhard and Stauder 2018).

The UK contrasts with other states in two important respects. First, the masculinization of rural areas does not occur. Sex ratios are lower among young adults than among children in regions with lowest population density. Second, sex ratios are much above 1 for most densely populated areas. It may show that global business centres like London attract more men. The irregular pattern makes the UK a particularly interesting case for further studies.

Figure 7. Sex ratios in NUTS3 regions in 6 largest EU countries, age groups 0-9 and 25-34, 2015.



Data source: Eurostat. Blue colour shows the age group 0-9, red colour shows the age group 25-34. NUTS3 regions are divided into 200 bins. Slopes come from OLS regressions of sex ratio on population density. Population density is the logarithm of inhabitants per square kilometre.

Conclusions

While only 12 countries are considered to have experienced imbalanced SRB in the recent decades (Chao et al. 2019), we find that 44 countries have imbalanced SRYA if we define a balanced sex ratio by the range from 0.915 to 1.085 –resulting from conservative estimates of what is considered an imbalanced SRB– and the SRYA as the proportion of men aged 30 to women in the same age. Half of those 44 countries have a surplus of women and half of them have a surplus of men. Analysing subnational patterns, we find that most –108 out of 201– investigated countries with population larger than 90 thousand have rural, urban or both SRYA beyond those thresholds.

We show that SRYA are very different in urban and rural areas and the patterns vary among regions of the world (Figure 1-5). In addition, SRYA are strongly dependent on population density (Figures 6-7). Imbalances do not appear only in countries known for skewed SRB or gender inequality but also in developed countries where women are relatively empowered. The European case strongly suggests that the main cause is internal migration: SRYA are as close to sex ratios among children

and SRB in less as in more densely populated regions. The change occurs abruptly for young adults (Figure 2).

The findings are consistent with the existing literature on feminization of migration of specific countries or regions, e.g. finding the higher mobility of women in Western European (Alonso-Villar and Río 2008; Camarero and Sampedro 2016; Eckhard and Stauder 2018; Kaberis and Koutsouris 2013; Kröhnert and Vollmer 2012), post-communist (Leibert 2016; Stecklov et al. 2010) or Nordic countries (Edlund 2005; Wessel and Turner 2020), as well as the higher mobility of men in sub-Saharan Africa (Menashe-Oren and Stecklov 2018).

Our findings set several paths for further research. The results show that sex-selective internal migration has been undervalued in comparison with the attention gained by the feminization of international migration and imbalanced SRB. The strong correlation of sex ratios with population density suggests similar correlation with economic, cultural and political variables. Further research on consequences of sex ratios and marriage markets must pay more attention to the geographical patterns, endogeneity and reversed causality.

Further studies should start with a more detailed static and dynamic description of the phenomenon in specific regions and countries. The dynamics of changes in SRYA could be studied in countries where historical age-sex population decomposition of local population is available. Local estimations of mortality by age and sex can help to explain to what extent exactly gender differences in mortality and internal and international migration influence local sex ratios and what are the causes of those processes. Moreover, microstates and, in particular, small islands deserve special attention. Our study suggests that many of them suffer from SRYA imbalances and volatility due to changing patterns of sex-selective migration.

Finally, our study should inform policy-makers. To our best knowledge, imbalanced SRYA and local marriage squeezes do not gain much public attention in nearly any country of the world, despite the fact that –as we find– most countries suffer from such phenomena, usually not due to the phenomenon of “missing girls.” Our decomposition shows that sex-selective internal and international migration should be at the centre of public policies tackling rural depopulation, but also –based on the literature dedicated to the consequences of sex ratios– lower fertility, demographic decline, violence and health.

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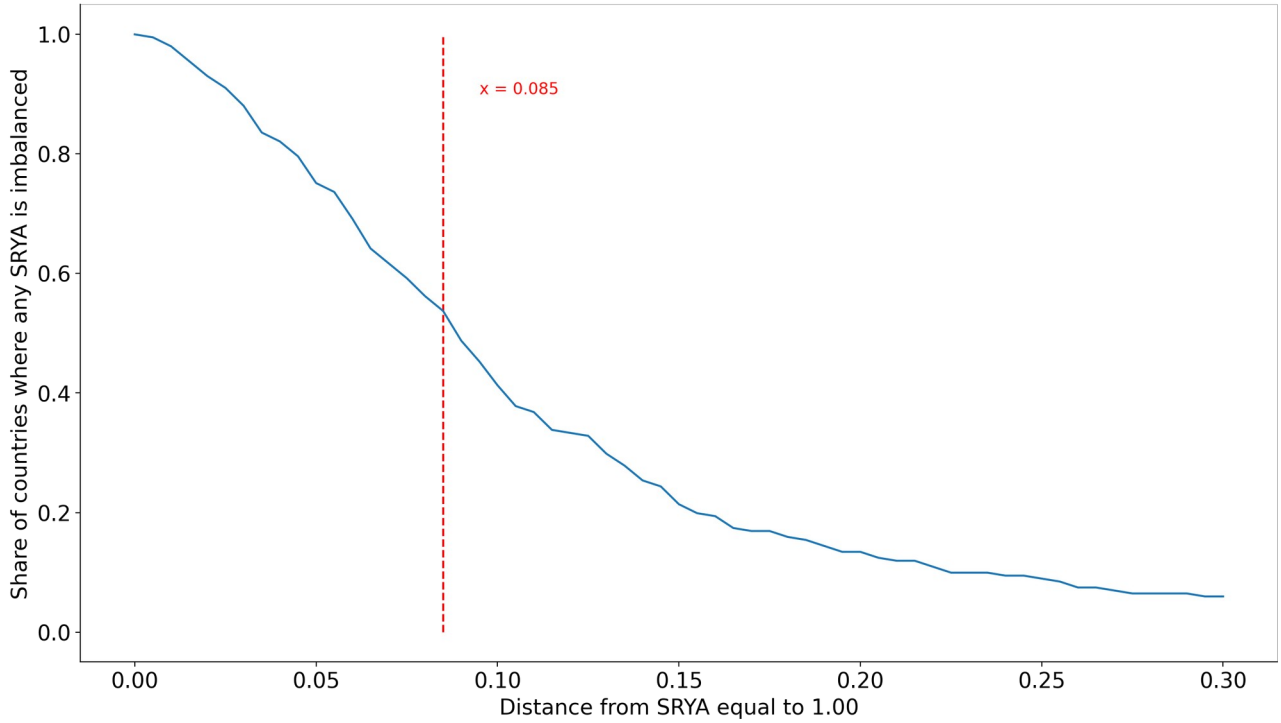
List of appendices

Appendices 1-5 are attached in the Excel file.

Appendix 6. Share of countries with imbalanced urban or rural SRYA in 2015 for different thresholds.



Data source: URPAS, own calculations.