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Abstract

This paper reconstructs infant and child sex ratios, the number of boys per hundred girls, in Europe circa 1880. Contrary to previous interpretations arguing that there is little evidence of gender discrimination resulting in excess female mortality in infancy and childhood, the results suggest that this issue was much more important than previously thought, especially in Southern Europe. The unbalanced sex ratios observed in some regions are not due to random noise, female miss-reporting or sex-specific migration. Likewise, although geography, climate and population density influenced sex ratios, these factors cannot explain away the patterns of gender discrimination reported here. The actual nature of discrimination, either female infanticide, the abandonment of young girls and/or the unequal allocation of resources within families, however, remains unclear and surely varied by region.

JEL Codes: I14, I15, J13, J16, N33

Keywords: Sex ratios, Infant and child mortality, Gender discrimination, Health

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1. Introduction

Gender discrimination, in the form of sex-selective abortion, female infanticide and the mortal neglect of young girls, constitutes a pervasive feature of many contemporary developing countries, especially in South and East Asia and Africa (Anderson and Ray 2010; Das Gupta 2017). Son preference stemmed from economic and cultural factors that have long influenced the perceived relative value of women in these regions and resulted in millions of "missing girls", an issue that has received a lot of attention both from the media and academia. The observed patterns of gender discrimination have been long practiced by families as a way to control the number and sex composition of their offspring (Das Gupta et al. 2003; Bhaskar and Gupta 2007; Gupta 2014). Although sex-selective abortion was not possible in the past, female infanticide and the mortal neglect of girls were prominent features of traditional societies, at least in India, China or Japan.

But, were there "missing girls" in historical Europe? Despite the journalistic buzz and the considerable research directed towards analysing the situation in developing economies today, the historical experience of European countries has received little attention. The conventional narrative argues that there is little evidence for this kind of gender discrimination. According to this view, the European household formation system, together with prevailing ethical and religious values, limited female infanticide and the mortal neglect of young girls (Derosas and Tsuya 2010; Lynch 2011).

Finding, however, sound evidence for this type of behaviour in historical Europe is riddled with problems. Several factors have indeed prevented researchers from unveiling hidden patterns of gender discrimination in infancy and childhood.

On the one hand, the lack of direct evidence on infanticide or other extreme forms of violence against girls (compared to South and East Asia) has made this issue less appealing, thus attracting less scholarly attention. However, although infanticide was possibly not prevalent in historical Europe (Lynch 2011), less extreme but perhaps more pervasive discriminatory practices may have had deleterious effects on the health of young girls. Several studies suggest that parents treated their sons and daughters differently in 19th-century Britain and continental Europe (Johansson 1984; Baten and Murray 2000; McNay et al. 2005; Horrell and Oxley 2016)[1]. An unequal allocation of food, care and/or workload negatively affected girls' nutritional status and morbidity, which translated in worsened heights and mortality rates.

On the other hand, due to their very nature, individuals and families tried to hide these practices and hence quantitative or anecdotal evidence is very scarce. Likewise, given that infant mortality was extremely high, it is difficult to distinguish natural deaths from those resulting from infanticide or the mortal neglect of young girls. Parents could actually disguise those practices as natural deaths and many infants died from smothering, suffocation, irregular feeding and exposure to cold (Derosas and Tsuya 2010, 158). Families could have also deliberately killed their newborns and report them as stillbirths (Hanlon 2016, 537). Sex-specific mortality rates are therefore likely to hide the effect of discriminatory practices. In addition, information to compute historical mortality rates by sex is often lacking, thus preventing a detailed analysis of gender differences across regions and over time.

Relying on secondary sex ratios obtained from population censuses and other sources allows overcoming some of these issues, a point that was also recently made by Hanlon (2016, 536) who considers this approach as "the new frontier". This article computes sex ratios at different age-groups for most European regions circa 1880 and is thus able to identify unexplained patterns of excess female mortality early in life, especially in Southern Europe. The unbalanced sex ratios observed in some regions are not due to random noise, female under-registration or sex-specific migratory flows. Likewise, although geography, climate and population density contributed shaping infant and child sex ratios due to their impact on the disease environment, these factors cannot explain away the patterns of gender discrimination reported here. The actual nature of discrimination, either female infanticide, the abandonment of young girls and/or the unequal allocation of resources within families, remains unclear and surely vary by region.

This article therefore challenges the conventional narrative that missing girls did not constitute a prevalent dimension of historical Europe, especially in some regions. In this regard, recent research provides suggestive evidence that gender discriminatory practices in infancy and childhood were present in 19th-century Spain (Beltrán Tapia and Gallego-Martínez 2018; 2019). Unbalanced sex ratios early in life were also present in some French and German regions during the 19th century (Knodel and de Vos 1980; Voland 1984; Bechtold 2006). Sparse evidence also indicates that these patterns could be rooted in the distant past: high child sex ratios have been found in some Italian and French regions between the 15th and 18th centuries (Hynes 2011; Hanlon 2016)[2]. Lastly, recent research using individual-level information suggests that Eastern Europe hosted extremely patriarchal societies with highly unbalanced child sex ratios (Gruber and Szoltysek 2016; Szołtysek et al. 2017).

This article also sheds more light on the evolution of sex-specific mortality rates in the past. Relying mostly on data for the United States, Goldin and Lleras-Muney (2018) show that the female advantage in life expectancy started to grow in the late 19th- and early 20th century and these authors argue that this process is primarily linked to the reduction in infectious diseases as a major cause of

[1] Harris (2009), however, argues that the evidence supporting a systematic gender bias in mortality rates in 19th-century Britain is not strong enough.

[2] There is also some evidence of eschewed sex ratios early in life in Medieval England (Reynolds 1979; Bardsley 2014).

death. The findings here nonetheless suggest that the female advantage was less visible in the 19th century because it was partly constrained by existing discriminatory practices in infancy and childhood. The gradual fading of these practices (or at least of its lethal effects as living standards increased) would have therefore contributed to explaining the expansion of the female advantage in the late 19th- and early 20th-century. The strength of this explanation obviously varies according to the previous importance of gender discrimination and this paper shows that gender-discriminatory practices had a significant effect on infant and child female mortality rates in Southern and (possibly) Eastern Europe circa 1880. In this regard, Beneito and García-Gómez (2019) show that the improvement in female labour opportunities reduced the relative mortality rates of female infants and girls in late-19th-century Spain.

Due to the negative link between gender inequality and economic development (Dilli et al. 2015; Carmichael et al. 2016), the evidence reported here opens up new research avenues aimed at understanding the different long-term developmental trajectories within Europe. The prevailing attitudes towards girls and their role in society is likely to have been related to historical variations in women's education, fertility rates or female participation in the labour market, among other dimensions[3]. However, given the problems measuring this kind of ingrained cultural values (especially from a historical perspective), the existing gender norms have been hardly explored when explaining differences on those dimensions in pre-industrial Europe. Consequently, unveiling forgotten patterns of gender discrimination, understanding the causes underlying this behaviour and assessing their effect on economic development becomes of paramount importance.

2. Reconstructing historical sex ratios in infancy and childhood

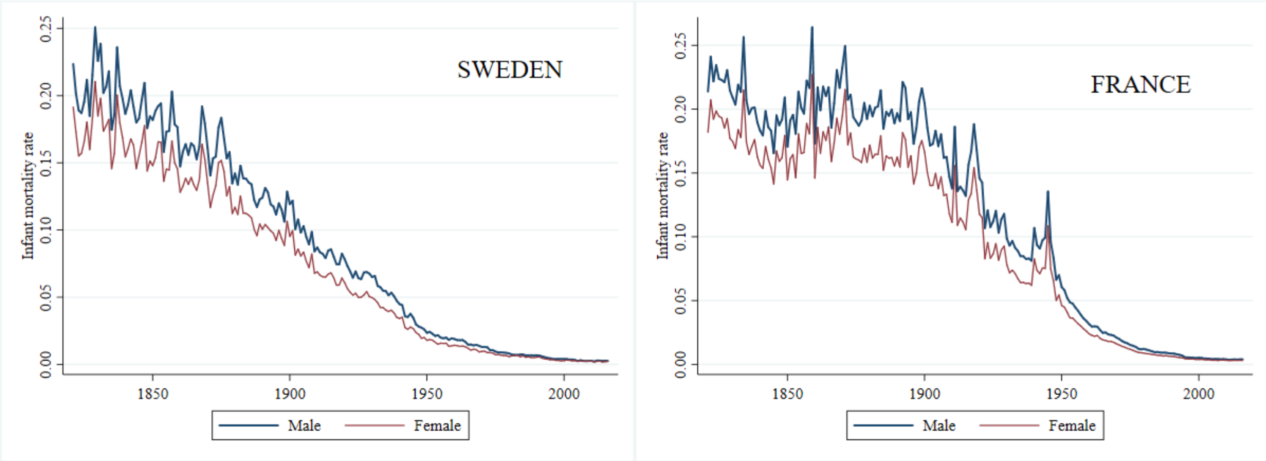
In the absence of gender discrimination, the number of boys per hundred girls in different age groups is remarkably regular, so comparing the observed figure to the expected (gender-neutral) sex ratio permits assessing the cumulative impact of gender bias in peri-natal, infant and child mortality and, consequently, the importance of potential discriminatory practices. This methodology allowed Amartya Sen (1990) to powerfully draw the world's attention towards the phenomenon of missing girls in the developing world. While non-discriminatory sex ratios at birth revolve around 105-106 boys per hundred girls in most developed countries today, China and India suffered figures well above 110 (World Bank 2004). Historical sex ratios, however, cannot be compared directly to modern ones. The lack of a benchmark for historical sex ratios in absence of discrimination has indeed prevented assessing the importance of gender biases in the past. If anything, observed historical sex ratios were lower than current (gender-neutral) sex ratios, so researchers have assumed that missing girls were not a feature of the European past[4].

Crucially, in recent research, we have shown that non-discriminatory infant and child sex ratios were much lower in the past, thus shaking up previous ideas of what historical sex ratios should look like (Beltrán Tapia and Gallego-Martínez 2017). The biological survival advantage of girls implies that male mortality rates are higher both in utero, at birth and during the first years of life[5]. This circumstance was more visible in the high-mortality environments that characterised pre-industrial Europe due to poor living conditions, lack of hygiene and the absence of public health systems. Take, for instance, the experience of France and Sweden, countries from which there are long series on sex-specific infant mortality (figure 1). Although present nowadays, the female biological survival advantage is negligible in absolute terms due to the extremely low number of

[3] Although these issues have received little attention from a historical perspective, a growing body of research has started to posit the key role that women, and the economic and social institutions that structured their status in society, had on economic development in pre-industrial Europe. See, for instance, De Moor and Van Zanden (2009), Foreman-Peck 2011; Humphries and Sarasúa (2012), Denison and Ogilvie (2014; 2016), Szoltysek and Poniat (2018), De Pleijt and Van Zanden (2018) or Baten and De Pleijt (2018), among others.
[4] See, for instance, Knodel and De Vos (1980) or Hanlon (2016).
[5] On the biological female survival advantage, see Waldron (1998), Drevebstedt et al. (2008) or Zarulli et al. (2018). See also Goldin and Lleras-Muney (2018).

deaths during the first year of life. As we move back in time, mortality rates increase and so does the absolute gap between male and female deaths.

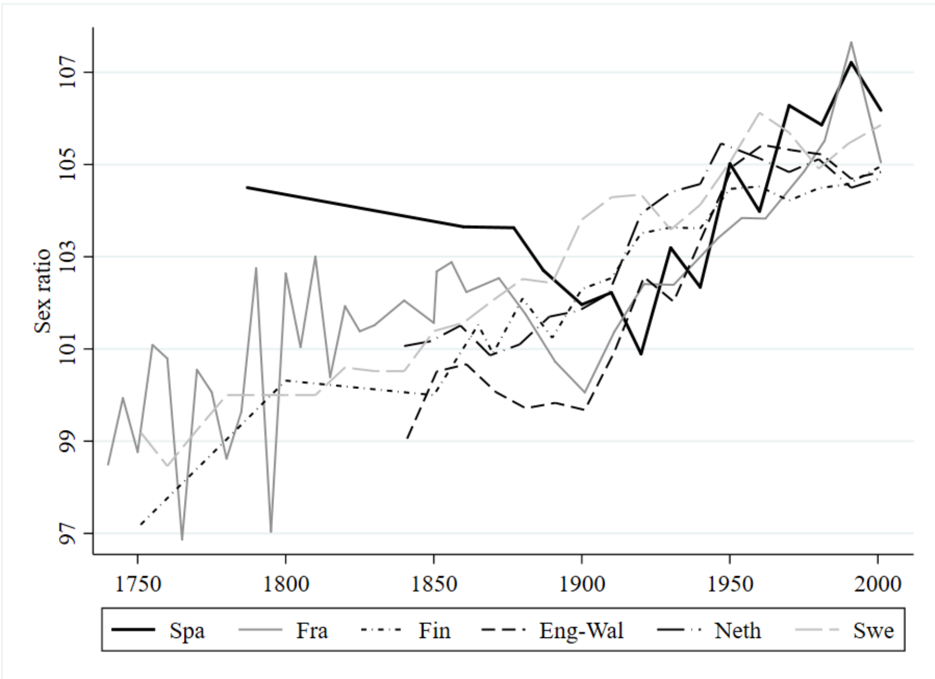
Fig. 1. Male and female infant mortality, 1821- 2011



Source: Human Mortality Database (downloaded in Sep 8, 2018).

In high-mortality environments, boys thus suffered significantly higher mortality rates both in utero and during infancy and childhood, hence lowering sex ratios early in life. Historical infant and child sex ratios were indeed relatively low, even in the presence of gender-discriminatory practices. This is depicted in figure 2 which plots sex ratios at the 0-4 age-group between 1750 and 2001. In France and the Nordic countries where we have information that goes back to the mid-18th century, child sex ratios were around 98-99 boys per hundred girls. This figure slowly increased during the 19th century and especially so after 1900 as living standards increased, a pattern that is shared across Western Europe.

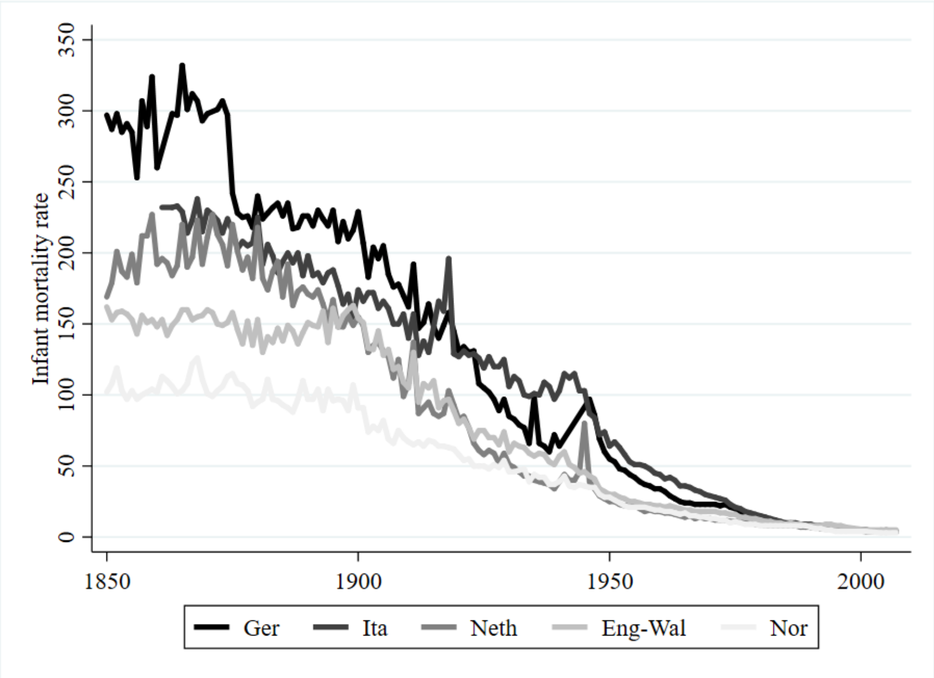
Fig. 2. Child sex ratios (aged 0-4) in Europe, 1750-2001



Source: Mitchell (2013).

Historical sex ratios nonetheless may reflect existing discriminatory practices, so they only provide an upper benchmark of how gender-neutral sex ratios looked like in the past. Moreover, the previous graph mixes together the experience of countries that experienced the demographic transition at a different pace. As explained before, higher infant mortality rates translate into lower child sex ratios, so this dimension should be taken into account when assessing how low historical sex ratios should be. In this regard, while around 100 infants per 1,000 live births did not survive their first birthday circa 1880 in Norway, this figure reached around 150 in England and Wales, 210 in Italy or Spain or even beyond 250 in Germany around the same date (Mitchell 2013). This is illustrated in figure 3 which traces the evolution of infant mortality rates across a sample of European countries between 1850 and 2001[6].

Fig. 3. Infant mortality rates in Europe, 1850-2001



Source: Mitchell (2013).

In order to take into account the changing disease environment, figure 4 plots the relationship between child sex ratios and infant mortality rates using information from 25 European countries between 1750 and 2001[7]. Given that countries in North-Western Europe seem to have experienced lower levels of gender discrimination, the fitting line is computed based on the information available for those regions. The "natural" child sex ratio is not a stable figure but depends on the existing mortality rates. In particular, while current child sex ratios fluctuate around 105-106 boys per hundred girls, the child sex ratio should have been around parity (100 boys per hundred girls) in societies where infant mortality rates were around 220 deaths (per 1,000 live births)[8]. Again, given that these predictions are based on information about countries that may have treated boys and girls

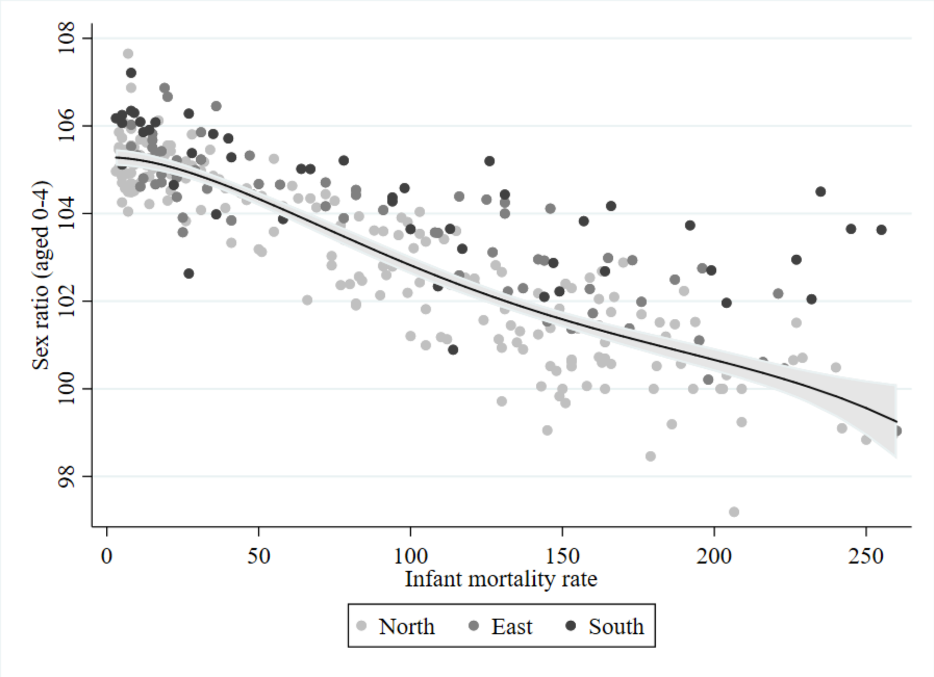
[6] On spatial inequalities in infant mortality in early-20th-century Europe, see Klüsener et al. (2014).

[7] Data coverage pairing infant mortality rates and child sex ratios decreases as we get back in time and varies by country: Austria (1869–2001), Belgium (1846–2001), Bulgaria (1892–2001), Czech (1921–1990), Denmark (1870–2001), East Germany (1946–1981), England & Wales (1841–2001), Finland (1751–2001), France (1830–2001), Germany (1880–2001), Greece (1928–2001), Hungary (1900–2001), Ireland (1871–2001), Italy (1861–2001), Netherlands (1840–2001), Norway (1855–2001), Poland (1921–2001), Portugal (1911–2001), Romania (1899–2001), Russia (1897–2001), Scotland (1861–2001), Spain (1787–2001), Sweden (1751–2001), Switzerland (1870–2001) and Yugoslavia (1890–1990).

[8] Relying on a sample of countries between 1983 and 1999, Klasen and Wink (2002) also find that lower life expectancy is related to lower sex ratios at birth. For more details, see Beltrán Tapia and Gallego-Martínez (2018).

differently, these figures should be considered as a conservative estimate: a gender-neutral sex ratio should have been even lower if gender-discriminatory practices were in place.

Fig. 4. Infant mortality rates and child sex ratios in Europe, 1750-2001



Source: Mitchell (2013), Louis and Yves (1975) and Statistics Finland (2014). The fitting line is based on a fractional polynomial regression. See footnote 7 for data coverage.

The finding that infant and sex ratios should have been lower in the past has opened the door to re-examine historical sex ratios from a completely new light. Compared to the benchmark depicted in the previous figure, child sex ratios in Southern and Eastern Europe tended to be abnormally high (see darker dots in Fig. 4), especially during the 19th- and early 20th-century, thus suggesting that some sort of gender discrimination was unduly increasing female mortality rates at those ages. Although the timing varies by country, this pattern mostly disappeared either in the late 19th century or the first decades of the 20th century.

3. Infant and child sex ratios in late-19th-century Europe

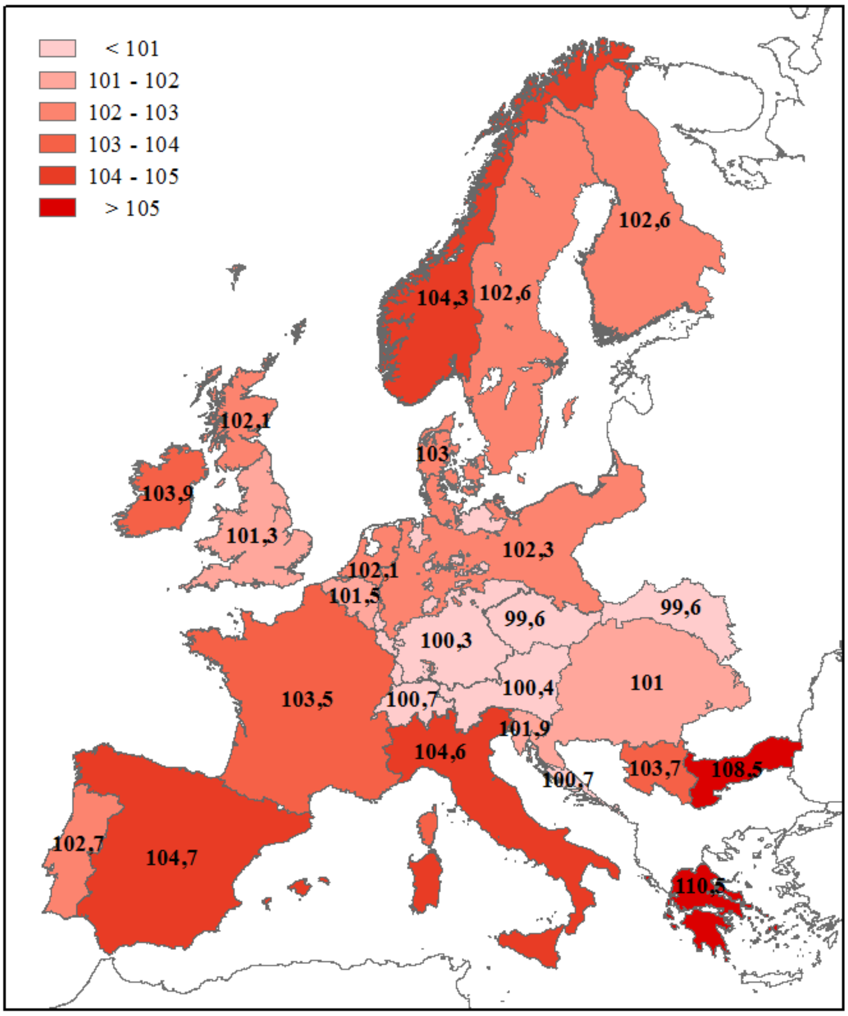
Detecting patterns of gender discrimination in infancy and childhood in historical Europe requires analysing information on as many countries as possible. Although most countries in Western Europe have already carried out population censuses by the middle of the 19th-century, this section relies on information published circa 1880 in order to be able to incorporate statistics from Greece, Bulgaria, Serbia and the Austro-Hungarian Empire[9]. Unfortunately, we do not have data on Russia and the regions still belonging to the Ottoman Empire. Information on the population censuses employed here is listed in table A1 in the Appendix. Summary statistics of sex ratios at different age-groups is provided in tables A2 and A3 in the Appendix.

Map 1 depicts the number of boys per hundred girls aged 0-1 in Europe around 1880. Infant sex ratios were comparatively high in Southern European countries such as Spain and Italy (or even France) and extremely unbalanced in Greece and Bulgaria. Norway and Ireland also show relatively high sex ratios but, as explained in the previous section, they can be explained by the lower infant mortality rates that these countries enjoyed. Moreover, our coverage of Eastern Europe, which

[9] The first Serbian population census including information on males and females by age is actually from 1890.

hosted extremely patriarchal societies (Szołtysek et al. 2017), is limited. A preliminary analysis of the Mosaic Project Database, an alternative source to the one reported here, suggests that unbalanced child sex ratios was not the exception but the norm in Eastern Europe: relying on data for 91 regions yields an average child sex ratio of 103.4 boys per hundred girls (Gruber and Szoltysek 2016, p. 149-150). Moreover, the distribution of sex ratios in Eastern Europe is skewed to the right and thus contains a large number of regions with extremely high figures. Note that, due to the female survival advantage, the high-mortality environments of poorer countries would result in more boys dying and thus translate into lower sex ratios (as illustrated in figure 3). Map 1 above, however, shows that less developed regions in Southern and possibly Eastern Europe had higher sex ratios, thus suggesting that discriminatory patterns were playing an important role there.

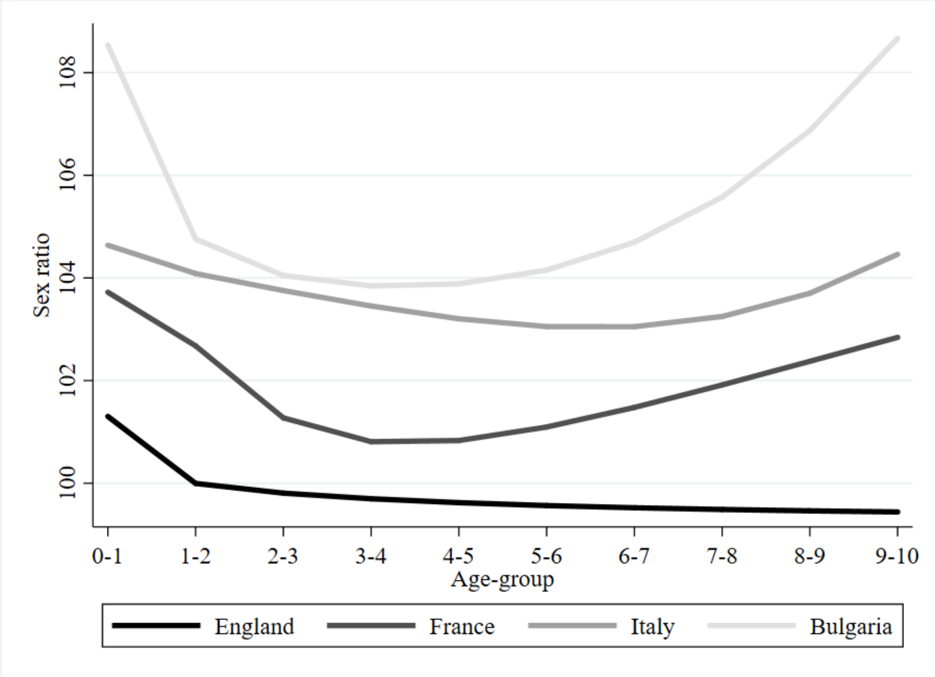
Map 1. Infant sex ratios (aged 0-1) in Europe, c.1880



Source: Population censuses (see table A1 in the Appendix). No data is available for the regions in blank.

Interestingly, the observed differences in infant sex ratios are also visible throughout childhood. In fact, the evolution of sex ratios by age shows stark disparities across countries. Fig. 5 shows how the number of boys per hundred girls changes as children get older for a sample of countries. The chosen countries illustrate the different existing patterns, not only in levels but also in the observed trends. In this regard, English sex ratios are not only relatively low, but they show a declining trend as age increases. This is expected, especially during the first years of life when mortality rates are higher: the biological female advantage results in more boys than girls dying "naturally", thus decreasing the sex ratio of the survivors. To a greater or lesser extent, the decline in sex ratios during the first years of life is common to all countries in our data set. Yet, the increase in sex ratios from the 3-4 age-cohort that is observed in some countries is more difficult to explain and suggests again that discriminatory practices against girls were increasing their mortality rates. The evolution of sex ratios for other regions is displayed in Fig. A1 in the Appendix[10].

Fig. 5. Sex ratios by age-group in Europe, c.1880



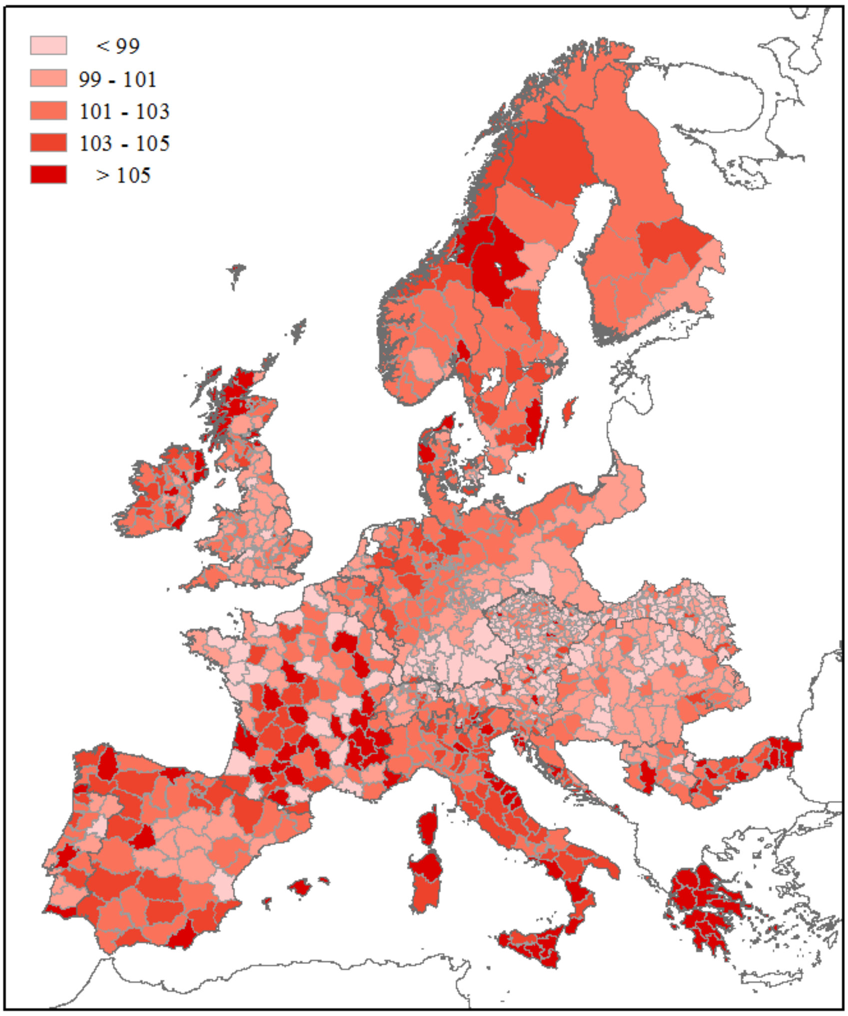
Source: Population censuses (see table A1 in the Appendix). The evolution of sex ratios in other regions is displayed in Fig. A1 in the Appendix.

As well as stark differences between countries, it is interesting to note that child sex ratios also widely varied within countries, thus stressing the need to go beyond national averages and identify which particular regions were more prone to exhibit unexplained patterns of female excess mortality in infancy and childhood. Map 2 illustrates the variation in sex ratios (aged 0-4) using the province as unit of analysis[11]. See summary statistics in tables A1 and A2 in the Appendix. Regarding Southern Europe, while Greek regions consistently report high figures, the Iberian Peninsula, France and Italy show significant differences between regions. Similarly, variation in child sex ratios within the British Isles, Germany and Scandinavia, where northern territories tend to exhibit higher child sex ratios, is also remarkable. The overall picture is markedly similar if we focus on an older age-group (Map A1 in the Appendix depicts sex ratios at age 5-9).

[10] It should be stressed that this article does follow the same cohort but it compares different ones extracted from the same population census. Notice also that the 1878 Portuguese census did not report the number of boys and girls for every age and the 1876 Norwegian census only for those between 0 and 4 years old.

[11] Own elaboration using historical boundaries. Leigh Shaw-Taylor and Alan Fernihough kindly shared shapefiles for the United Kingdom (Satchell et al. 2017a; 2017b) and Ireland (Fernihough and Ó Gráda 2018). Historical shapefiles of the Germany and Austria-Hungary can be found in Mosaic Project website (https://censusmosaic.demog.berkeley.edu). I also thank Siegfried Gruber for his assistance with those files and Gabriele Capelli for his with Italian maps.

Map 2. Child sex ratios (aged 0-4) in Europe, c.1880



Source: Population censuses (see Table A1 in the Appendix).

The regional disparities in sex ratios observed above may arise from multiple causes that have nothing to do with the presence of gender-discriminatory practices in infancy and childhood. The next two sections address these alternative explanations and confirm that infant and child sex ratios in Southern Europe were likely the result of discriminatory practices with lethal consequences for girls. Given that the coverage of Eastern Europe is limited, it is beyond the scope of this article to address these issues in those regions.

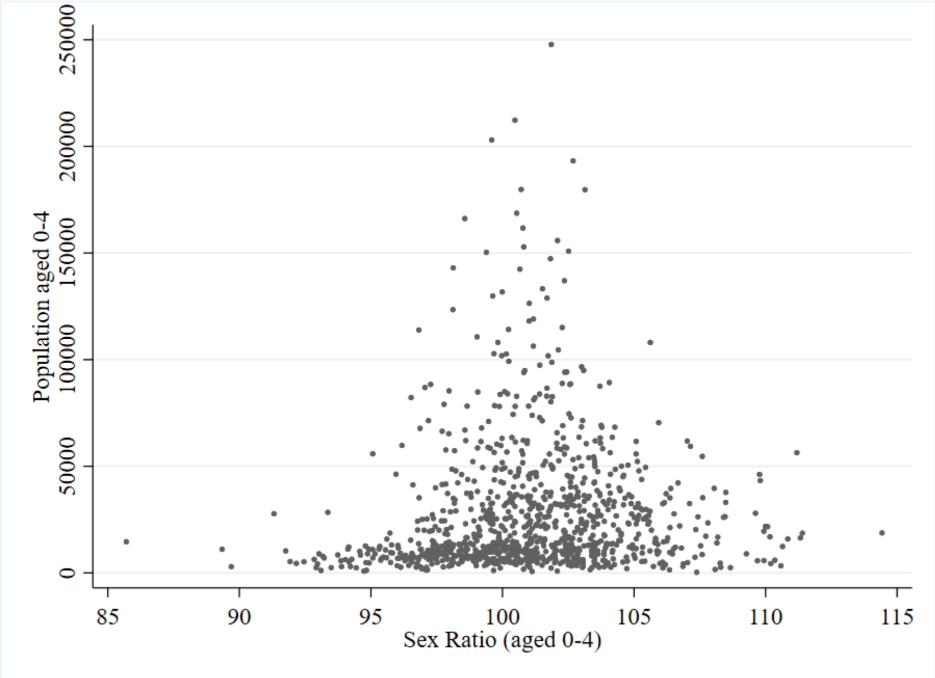
4. Random variation, female miss-reporting and sex-specific migration

(a) Random variation

Due to the law of large numbers, sex ratios tend to be quite homogenous at the societal level. Analysing smaller levels of aggregation is, however, subject to higher levels of random noise. This is clearly illustrated by figure 6 which displays the observed child sex ratios and the size of the population underlying those figures (the total number of children aged 0-4)[12]. Although some of these sub-national units are relatively small, it is very unlikely that the systematic patterns found above occurred by chance.

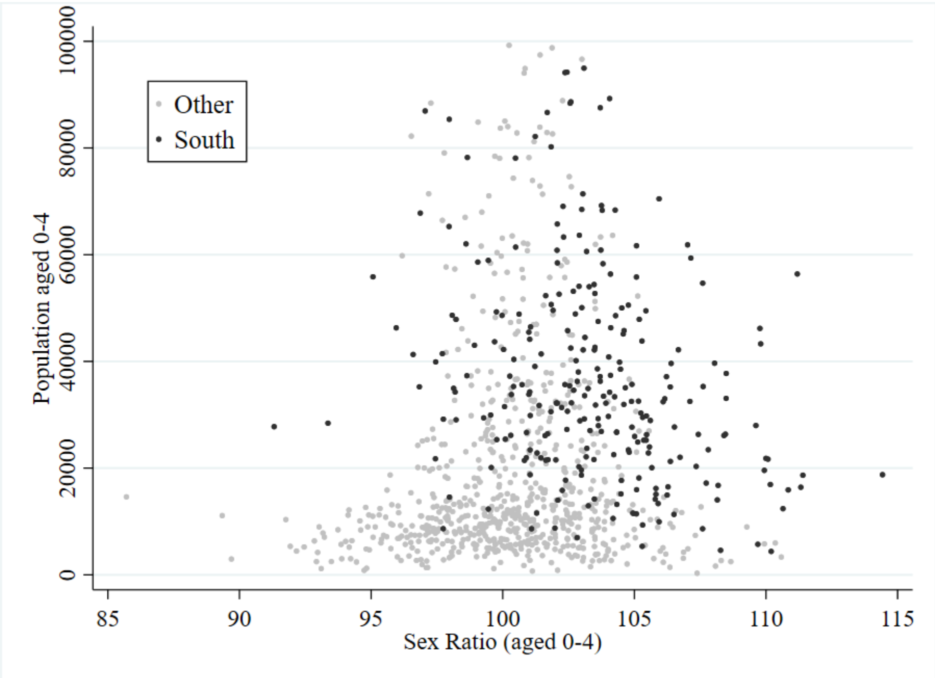
[12] In order to help the visualisation, the graph excludes those regions that report 250,000 children or more, namely Yorkshire (West Riding), Lancashire and London. Likewise, Neuhaus (belonging to the Austrian Empire) presents an extremely low child sex ratio (76.5), so it has also been excluded (probably a typo in the original source).

Fig. 6. Child sex ratios and number of children aged 0-4



The sample size underlying most of the observed sex ratios is actually quite large (see table A4-A5 and Map A2 in the Appendix). The average size of these regional units is almost 30,000 children aged 0-4 years old. In particular, the average province in Portugal, Italy, France or Spain is always above 33,000 children. Although Greek regions are somewhat smaller (15,168 children on average), that is still a sizeable dimension. In fact, only two regions in Greece slightly fall below 5,000 children (Artis and Zakinthos with 4,391 and 4,607 children aged 0-4, respectively). If anything, smaller sample sizes might be an issue in Switzerland and the Austrian Empire (as well as in Scotland and Wales). In fact, as figure 7 illustrates, it is not a smaller population size what is behind the higher sex ratios observed in Southern Europe.

Fig. 7. Child sex ratios and number of children aged 0-4



Note: The darker dots refer to provinces in Portugal, Spain, France, Italy, Greece and Bulgaria.

As discussed in Section 2, infant mortality rates in Southern Europe circa 1880 were quite high. In Italy or Spain, where there is data for that period, around 210 infants per 1,000 live births did not survive to celebrate their first birthday in 1877-1880. According to our estimates, these mortality levels would be consistent with child sex ratios around parity (100 boys per hundred girls) in the absence of gender discrimination. The distribution of boys around this figure is a random process that conforms to the binomial distribution and depends on sample size (Wilson and Hardy 2002)[13]. Table 1 below reports how the probability of observing child ratios above certain thresholds (assuming that the gender-neutral sex ratio is 100) depends on the underlying sample size from which those sex ratios are computed. Provinces in Italy and Spain had an average of 49,849 and 42,266 children aged 0-4, respectively, and that figure did not fall below 10,000 children for any of those. By contrast, 13 Spanish and 31 Italian provinces exhibited sex ratios above 104 boys per hundred of girls. As shown in the table, given the size of the units of analysis in those countries, the probability of obtaining those results by chance alone is extremely low.

Table 1. Probability of observing child sex ratios above certain thresholds (104, 106, 108 and 110) assuming the gender-neutral sex ratio is around 100 boys per hundred girls

Obs.	SR = 104	SR = 106	SR = 108	SR = 110
100	0.4602	0.4602	0.3822	0.3822
500	0.3437	0.2805	0.1977	0.1518
1,000	0.2740	0.1796	0.1210	0.0686
5,000	0.0851	0.0201	0.0034	0.0004
10,000	0.0256	0.0018	0.0000	0.0000
25,000	0.0010	0.0000	0.0000	0.0000
50,000	0.0000	0.0000	0.0000	0.0000

(b) Female miss-reporting

An important concern regarding the examination of sex ratios is related to data quality and the potential under-registration of girls in the censuses. If parents failed to record female babies more than males, the sex ratio would be overestimating the number of boys. Although an indicator of gender discrimination in itself, abnormal sex ratios would not then be a reflection of the mortal neglect of girls. The quality of historical censuses, especially the first ones carried out in each country, has always been a matter of concern (United Nations 1955). Under-registration may especially affect the 0-1 age-cohort because a high proportion of infant deaths went unreported, especially those who died in the first 24 hours of life (Dopico 1987). Given that we rely on the number of live children, this issue is probably less worrisome. Analysing the Spanish population censuses carried out between 1857 and 1887, Reher (2007, 254) argues that under-registration was an important issue, but he does not find that under-reporting varied by sex.

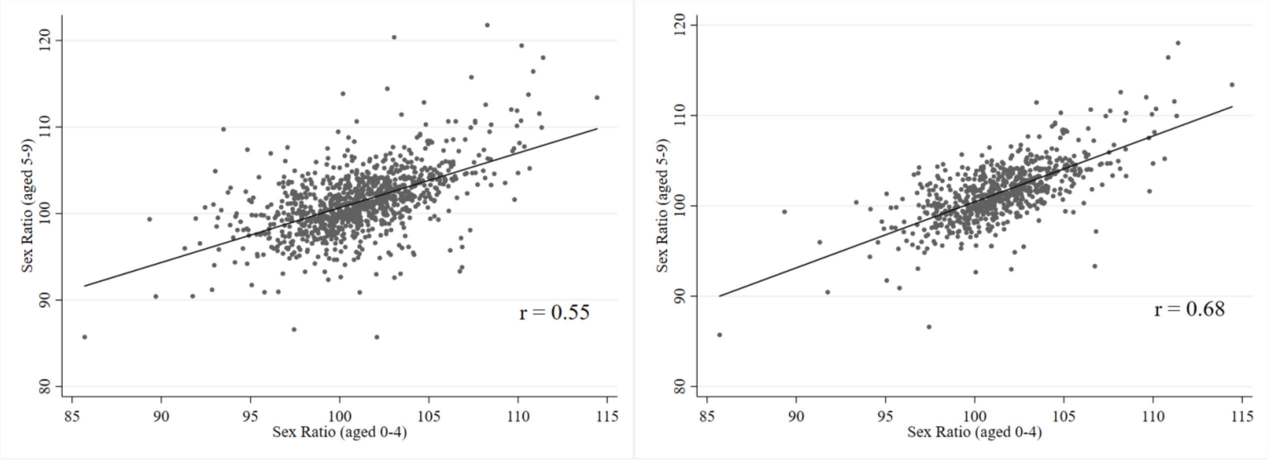
Even in the case that under-registration affected female babies to a greater extent, they should be visible in the censuses as they grow up, so older age-groups should be virtually free from this concern. Comparing sex ratios at different age-groups therefore allows identifying potential discrepancies and hence assessing the importance of this issue. In this regard, if under-reporting was a problem early in life, sex ratios should then not correlate well with sex ratios at later ages. Yet, this is not the case. Figure 8 shows that regions with high child sex ratios (aged 0-4) also tend to

[13] The corresponding variance equals $[p(1-p)]/n$ where p is the expected proportion of males and n is sample size.

exhibit high sex ratios in older children (aged 5-9). This is even clearer if we exclude the smallest regions from the analysis.

Fig. 8. Comparing sex ratios at age 0-4 and 5-9

All Sample | Excluding regions < 10,000 children aged 0-4



Rather than making European-wide comparisons, it is more helpful to study within-country variation. Table 2 reports the correlation coefficients for each of country in our dataset. This information is illuminating. In most of those countries that exhibited relatively high sex ratios (Italy, Greece or Spain), child sex ratios are correlated with those at older ages. The only exception is Bulgaria which shows a relatively low correlation (and not statistically significant at the 10 per cent level). Although this casts doubt on the underlying quality of the that census, we should bear in mind that the analysis is only based on 21 Bulgarian provinces. Although average child sex ratios in France are not as high as in Italy or Spain, some provinces exhibited extremely unbalanced figures for both the 0-4 and 5-9 age-groups, thus meriting further consideration.

Table 2. Correlation between sex ratios at age 0-4 and 5-9 (by country), c.1880

Country	Obs.	Corr. Coef.	p-value
Belgium	9	0,36	0,3442
Bulgaria	21	0,33	0,1443
Denmark	20	0,1	0,6717
Finland	8	0,06	0,8833
France	87	0,64	0,0000***
Germany	91	0,73	0,0000***
Greece	16	0,61	0,0123**
Hungary	71	0,35	0,0028***
Ireland	32	-0,16	0,3888
Italy	69	0,63	0,0000***
The Netherlands	11	0,48	0,1354
Norway	19	0,21	0,3805
Austrian Empire	333	0,29	0,0000***
Portugal	19	0,19	0,4266
Serbia	16	0,33	0,2108
Spain	49	0,52	0,0001***
Sweden	24	-0,18	0,4052

Switzerland	25	0,25	0,2324
United Kingdom	90	0,4	0,0001***

*, **, *** refer to the correlation coefficient being statistically significant at the 0.1, 0.05 and 0.01 level.

The lack of correlation in countries that exhibited low average sex ratios (especially in Scandinavia but also in Ireland, Switzerland or even Portugal) stresses the importance of random variation, therefore signalling the absence of discriminatory practices resulting in excess female mortality in those regions. The German case is especially striking: although the average sex ratio is not particularly high, the correlation coefficient is the highest of all countries, thus stressing the quality of the records. Given the wide variation in infant and child ratios within Germany, this case definitely deserves further attention, especially taking into account the extremely high infant mortality rates that Germany suffered in the 19th century[14]. Internal variations within the United Kingdom appear also to be correlated. Other cases are not so clear-cut. Although the correlation coefficients in Belgium and especially the Netherlands are not very low, they are not statistically significant probably due to the low number of observations. As it will be shown in the next section, part of the within-country differences in child sex ratios might be explained by geo-climatic differences and/or the rural-urban divide but I cannot completely rule out the possibility of unexplained female excess mortality also playing a role in some of these regions.

Moreover, we have not found anecdotal evidence explaining why parents may have been more likely to under-report girls. By contrast, the introduction to the Greek Population Census of 1879-81 noticed the excess of boys and warned that the enumeration was carried out under difficult circumstances (Greek Statistical Agency 1881). However, it adds that, given that one of the goals of the census was for recruiting, they would expect that boys would be hidden in many areas instead. Female under-reporting is thus not likely to explain away the extremely high sex ratios recorded in some regions in Southern Europe.

(c) Sex-specific migration

Another different explanation that may have affected the figures reported here is the possibility that boys and girls had different propensities to migrate, thus altering sex ratios. If, for instance, girls migrated in larger numbers, sex ratios would increase in origin and decrease in destination. There are, however, several reasons why this issue did surely not affect the patterns observed here. On the one hand, we could not expect children to migrate alone until they reach a certain age, so this issue would only concern older children. It is of course possible that fathers or mothers migrating alone could take only their sons and daughters with them but, again, this is less likely at young ages. On the other hand, a significant fraction of migration in pre-industrial Europe consisted on rural-urban flows. Given the unit of analysis, within-province migration would therefore not affect the figures observed here. Lastly, even when regional sex ratios may have been affected by these particular migratory flows, it is very unlikely that these movements took place internationally. Sex ratios at the national level would thus be unaffected and, as seen in section 3, Southern European countries definitely show unbalanced average sex ratios.

5. Geography, climate and urbanisation

Although random variability, female under-enumeration and sex-specific migration cannot explain the high sex ratios visible in some areas, the regional disparities may arise from other causes that do not imply the presence of a behavioural gender bias.

[14] According to figure 3, Germany suffered really high infant mortality rates before 1880 (around 300 deaths per 1,000 live births). The child sex ratio in absence of gender discrimination should therefore be really low (probably around 98-99), thus stressing the need to evaluate what was happening in regions exhibiting figures above 102-103 boys per hundred girls (child sex ratios in German regions ranged from 96.2 to 104.7 in 1880).

A different disease environment, for instance, may harm girls more than boys and may therefore explain the unbalanced sex ratios observed in Southern Europe. Climatic factors have been, for instance, put forward to explain part of the variation in sex ratios at birth. In particular, warm temperatures are apparently related to higher sex ratios in Scandinavian countries (Catalano et al. 2008; Helle et al. 2009). Likewise, Anderson and Ray (2010) argue that infectious, parasitic and respiratory diseases account for a significant fraction of excess female mortality during childhood in India, China and Sub-Saharan Africa. Moreover, pulmonary tuberculosis seems to have taken a greater toll on females aged 5-25 years, especially up to the early 20th century (Hinde 2015; Goldin and Lleras-Muney 2018). Infant mortality in Southern Europe was highest in summer due to the incidence of digestive diseases (Wrigley et al. 1998). Regional variation in mortality rates were indeed pronounced in Southern Europe and partly reflected diverse climatic conditions[15]. It is therefore plausible that high sex ratios in Southern Europe were not caused by gender discrimination but by a different disease environment.

In addition, rural areas tended to enjoy a healthier disease environment due to better access to animal calories and a lower incidence of respiratory and digestive diseases (the so-called 'urban penalty')[16]. Consequently, infant mortality rates tend to be lower there, thus resulting in higher child sex ratios (as explained in Section 2). Some studies however argue that rural-urban differences in mortality rates are mostly explained by the presence of public institutions that concentrate a large number of deaths such as hospitals, prisons, mental institutions and foundling hospitals (Ramiro-Fariñas 2007). Therefore, if cities were not subject to the urban penalty, lower sex ratios would point to the presence of mechanisms that would mitigate gender discriminatory practices in urban settings.

In order to test whether these factors explain the variation in infant and child sex ratios in 19th-century Europe, we have collected information on population and urbanisation patterns in Europe c.1880, as well as different geographical and climatic factors, such as temperature and rainfall (and their seasonal variability), altitude, ruggedness and distance to the coast[17]. Moderate temperatures in summer and abundant rainfall limited infectious diseases, especially digestive diseases that are so important for infant mortality (Dopico and Reher 1998; Ramiro-Fariñas and Sanz-Gimeno (2000). Apart from their incidence on temperature and rainfall, higher altitudes and a steeper terrain is related to the relative importance of agriculture and cattle rearing, therefore influencing potential diets. Similarly, being close to the sea also affects climatic conditions and the availability of fish. Table A6 in the Appendix reports summary statistics of these variables and Map A3 in the Appendix provide a visual description of the underlying data and its variability within Europe.

Table 3 reports the results of regressing child sex ratios on the set of variables explained above, as well as country fixed-effects. While columns (1) and (5) show that around 35 per cent of the variation in sex ratios at ages 0-4 and 5-9 is explained by country-specific features, columns (2) and (6) illustrate the effect of geography and climate, as well as population density and urbanisation. Although these factors have a lower explanatory power than the country dummy variables, the effect of temperature, ruggedness, distance to the coast and population density is statistically significant[18]. The effect of climate, however, is relatively small. For instance, the 6.2 °C difference in average annual temperatures between the Netherlands and Greece (more than two

[15] See, for instance, Dopico and Reher (1998) and Ramiro Fariñas and Sanz-Gimeno (2000) for an overview of these issues in Spain.

[16] On the urban penalty, see Reher (2001) and Dyson (2011).

[17] The History Database of the Global Environment provides gridded historical series of population at around 55-km resolution (Klein Goldewijk et al. 2011) (available here: https://themasites.pbl.nl/tridion/en/themasites/hyde/). Spatial climate data on average temperature and rainfall for the period 1960-1990 at 1-km. resolution can be found in Fick and Hijmans (2017) (available here: http://www.worldclim.org/). Similarly, altitude and its standard deviation as a proxy for ruggedness are obtained from the Copernicus Land Monitoring Service that provides spatial data at 25-m. resolution (https://land.copernicus.eu).

[18] The effect of ruggedness is not statistically significant for child sex ratios at older ages.

standard deviations in our dataset) implies an increase of 1.3 boys in the child sex ratio. This figure only explains one fourth of the difference in the average child sex ratio between these two countries (101.3 and 107.7 in the Netherlands and Greece, respectively). Although being close to the sea and a steeper terrain are also related with higher child sex ratios (probably due to better access to animal calories and the subsequent decrease in mortality rates), these characteristics are not a special feature of Southern Europe. Lastly, as expected, a higher population density is related to lower sex ratios[19]. As mentioned above, although this result may suggest that the economic dynamism of densely populated areas (including the wider availability of female labour opportunities) mitigated gender discrimination, cities tended to suffer higher mortality rates, thus negatively affecting boys more than girls (due to the female survival advantage). It is therefore difficult to disentangle which of these effects is playing a larger role (which may be context-specific).

Table 3. Geography, climate, population density and child sex ratios

	Dependent variable: Sex ratio							
	Aged 0-4				Aged 5-9			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country Fixed-Effects	YES	NO	YES	NO	YES	NO	YES	NO
Annual mean temperature (ºC)		0.21*** (0.07)	0.21 (0.21)	0.54 (0.45)		0.33*** (0.08)	0.17 (0.16)	0.20 (0.26)
Temperature seasonality (standard deviation)		-0.01 (0.02)	-0.02 (0.04)	0.02 (0.03)		-0.00 (0.03)	-0.01 (0.03)	0.05* (0.02)
Annual precipitation ('00 mm)		-0.13 (0.10)	-0.08 (0.08)	0.26 (0.18)		0.02 (0.09)	-0.02 (0.09)	0.13 (0.17)
Precipitation seasonality (CV)		-0.01 (0.02)	0.00 (0.02)	-0.02 (0.05)		0.01 (0.02)	0.00 (0.02)	0.02 (0.02)
Altitude ('00 mts.)		-0.17 (0.10)	0.06 (0.15)	0.21 (0.33)		-0.05 (0.11)	0.08 (0.12)	-0.01 (0.22)
Ruggedness (St. dev. of Altitude)		0.01*** (0.00)	0.00 (0.00)	0.00 (0.00)		0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Distance to coast ('00 kms)		-0.57*** (0.14)	-0.37** (0.16)	-0.29 (0.34)		-0.66*** (0.16)	-0.60*** (0.17)	-0.44* (0.15)
Population density (log)		-0.68*** (0.15)	-0.31 (0.19)	-0.31 (0.24)		-0.89*** (0.16)	-0.62*** (0.17)	-1.02** (0.31)
Urbanisation		-0.16 (0.63)	-0.05 (0.54)	3.04** (0.55)		-0.46 (0.69)	0.76 (0.58)	2.01 (3.26)
Observations	1,010	985	985	222	1,010	985	985	222
R-squared	0.355	0.297	0.375	0.101	0.346	0.287	0.374	0.094

Robust standard errors clustered at the country level; *** p<0.01, ** p<0.05, * p<0.1; For simplicity, the intercept is not reported. Columns (4) and (8) repeat the exercise but just focusing on provinces in South-Western Europe, namely Portugal, Spain, France and Italy.

As mentioned above, the direct effect of geo-climatic variables, such as temperature, only explains a small part of the variation in child sex ratios. Moreover, these factors are related to economic, social and cultural features, so their estimated coefficients are likely to partly capture the effect of these variables, thus masking the true extent of unexplained excess female mortality. A safer estimation of the effect of climate would then be much lower, thus supporting the idea that the mortal neglect of young girls was a real phenomenon in some parts of 19th-century Europe. Columns (3) and (6) therefore extend the model considering all these effects together with country fixed-effects in order to capture unobserved country characteristics. As evident there, the effect of temperature is no longer statistically significant, which further stresses that a warmer climate is not

[19] Although urbanisation is also negatively related to child sex ratios, its coefficient is not statistically significant. Urbanisation and population density are correlated (r=0.37), so multicollinearity may explain this result.

the main reason behind high sex ratios in Southern Europe. These results are robust to excluding those observations with less than 10,000 children, whose sex ratios therefore contain a higher degree of random variability (see Table A7 in the Appendix).

This conclusion is further reinforced by columns (4) and (8) that repeat the exercise but without country fixed-effects and focusing only on provinces in South-Western Europe. Although the internal variation in child sex ratios and environmental conditions within these countries is remarkable, none of the geo-climatic variables is significantly related with sex ratios at age 0-4 and only distance to coast shows a (weak) significant effect on sex ratios at age 5-9[20]. Lastly, the evolution of sex ratios over time also evidences that neither climate nor geography were that important. Although relatively high during the 19th century, child sex ratios in Italy, Greece or Spain began to resemble those of other European countries during the early 20th century[21].

5. Concluding remarks

This article maps the relative importance of gender discriminatory practices resulting in excess female mortality early in life in late-19th-century Europe. The evidence presented here shows that infant and child sex ratios circa 1880 were abnormally high in some regions, especially in Southern and (possibly) Eastern Europe. This finding is remarkable because, by 1880, many European regions had already undergone important changes in their demographic, social and economic conditions that are likely to have mitigated this kind of behaviour (or its effects). Discriminatory practices with lethal consequences for girls appear thus to have constituted a veiled feature of pre-industrial Europe, resulting in an important number of girls missing, that is, girls who died during infancy and childhood because of female infanticide and/or mortal neglect. Given the existing variation in other European countries, it is possible that this behaviour was also present in other regions, especially among deprived segments of the population. The macro approach adopted here, however, does not allow us to dig deeper into this possibility.

The nature of these practices is less clear and it surely varied across regions. Given the lack of anecdotal evidence on female infanticide, it is likely that the importance of this behaviour was limited or restricted to certain regions. Infant sex ratios (aged 0-1) in Greece and Bulgaria, for instance, are extremely high to just be the result of an unequal distribution of resources within families. The Greek sex ratio at birth in 1881 was actually 118.7 which dwarfs even those found in contemporary China or India. Child abandonment in Europe was widespread, so it is possible that girls suffered abandonment in higher numbers. Due to the extreme mortality rates that characterised foundling hospitals, this practice has been considered as a sort of surrogate infanticide. However, the existing evidence of gender selection of foundlings is mixed (Lynch 2011, 255), so perhaps some of these abandoned girls died before reaching the turning wheel. Lastly, the unexplained excess female mortality could probably arise from an unequal distribution of resources within the household. In high-mortality environments, discrimination in the way that girls were fed, treated when ill or the workload they were entrusted with was likely to have increased female mortality rates due to the combined effect of malnutrition and illness. The evolution of sex ratios as children grew older suggests that these practices were pervasive, at least in Southern Europe. This interpretation would therefore reconcile the apparent lack of evidence on female infanticide and other extreme versions of mistreatment of young girls in historical Europe with the evidence of unbalanced sex ratios reported here. This view is also compatible with a society where women and girls are discriminated in many dimensions.

What was behind these discriminatory practices? Although answering this question was beyond the scope of this article, the existing evidence suggests that, as in South East Asia, son preference is linked to economic, social and cultural dimensions that shaped the role of women in

[20] Contrary to what we would expect, urbanisation shows a positive effect on child sex ratios at age 0-4. The importance of agro-towns in Italy and Spain might be introducing an additional confounding factor here, thus making the interpretation of this coefficient difficult.
[21] The timing varies by country.

society, thus influencing the perceived relative value of girls (McNay et al. 2005; Beltrán Tapia and Gallego-Martínez 2019; Beneito and García-Gómez 2019). The existence of female labour opportunities, the different family structures, dowry and inheritance systems or the predominant cultural values are crucial factors. These practices also tend to get accentuated when poverty is widespread or in adverse economic circumstances.

There are still many unanswered questions and more research is needed. In particular, the availability of sex ratios at birth would allow us to assess the relative importance of female infanticide. Extending the data set, both backward and forward, in time is also of paramount importance in order to trace the evolution of the relative importance of these practices, as well as identifying when they disappeared and why. Likewise, collecting information on the factors that could explain these practices and carrying out case studies of particular countries is also a promising avenue of research. Lastly, analysing individual- or household-level information will also provide crucial insights on the type of families that were more likely involved in this kind of behaviour. Relying on micro-data is also key because subtle forms of gender discrimination are difficult to detect and probably only occurred among certain segments of the population. These practices are thus less visible using aggregate information as the one employed here, so focusing on certain socio-economic groups is an exciting research avenue in order to uncover patterns of gender discrimination in historical Europe.

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APPENDIX

Table A1. Population censuses in Europe, c.1880

Country	Year	Reference
Austrian Empire	1880	Oesterreichische Statistik (1882), Die Bevölkerung der im Reichsrathe Vertretenen Königreiche und Länder nach Alter und Stand vom 31 December 1880 (Wien 1882).
Belgium	1880	Statistique de la Belgique (1884), Population. Recensement Général (31 Décembre 1880) (Bruxelles).
Bulgaria	1881	Bureau de Statistique de la Principauté de Bulgarie (1890), Recensement de la Population le 1er Janvier 1881 (Sophia).
Denmark	1880	Danmarks Statistik (1883), Folkemængden i Kongeriget Danmark den 1ste Februar 1880 (Kjøbenhavn).
Finland	1880	Suomenmaan Virallinen Tilasto (1885), Suomenmaan väkiluku 31 p. Joulukuuta 1880 (Helsingissä).
France	1881	Population censuses from 1851 to 1921 are available here: https://www.insee.fr/fr/statistiques/2653233?sommaire=2591397
Germany	1880	Statistisches Jahrbuch für das Deutsche Reich (1880), Die Volkszählung im Deutschen Reich am 1. Dezember 1880 (Berlin).
Greece	1879/81	Greek Statistical Agency (1881), Population census of 1879 (Athens). An extension for the regions of Epirus and Thessalia was carried out in 1881. Both are available here: http://dlib.statistics.gr/portal/page/portal/ESYE/
Hungary	1881	Az Országos Magyar Kir. Statisztikai Hivatal (1882), Az 1881. év Elején vVégrehajtott Népszámlálás Eredményei Némely Hasznos Házi Állatok Kimutatásával Együtt (Budapest).
Ireland	1881	Census of Ireland for the year 1881 (Dublin). I am grateful to Alan Fernihough for sharing the data.
Italy	1881	Direzione Generale della Statistica (1883), Censimento della Popolazione del Regno d'Italia al 31 Dicembre 1881 (Roma).
Netherlands	1879	Population census from 1795 to 1971 available here: http://www.volkstellingen.nl/en/index.html
Norway	1876	Norges Officielle Statistik, Folketællingen i Norge i Januar 1876 (Kristiania 1879).
Portugal	1878	Estatistica de Portugal (1881), População no 1 de Janeiro 1878 (Lisboa)
Serbia	1890	Division de Statistique (1893), Recensement de la Population dans Le Royaume de Serbie le 31. Décembre 1890 (Belgrade).
Spain	1877	Dirección General del Instituto Geográfico y Estadístico (1883), Censo de la Población de Espana, 1877 (Madrid).
Sweden	1880	Information obtained from the IPUMS project. Several historical censuses available here: https://international.ipums.org/international/
Switzerland	1880	Statistischen Bureau (1883), Eidgenössische Volkszählung vom 1. Dezember 1880, Zweiter Band. Die Bevölkerung nach Alter, Geschlecht und Civilstand (Bern).
United Kingdom	1881	Information obtained from the IPUMS project. Several historical censuses available here: https://international.ipums.org/international/

Table A2. Infant and child sex ratios in Europe, c.1880 - Summary statistics

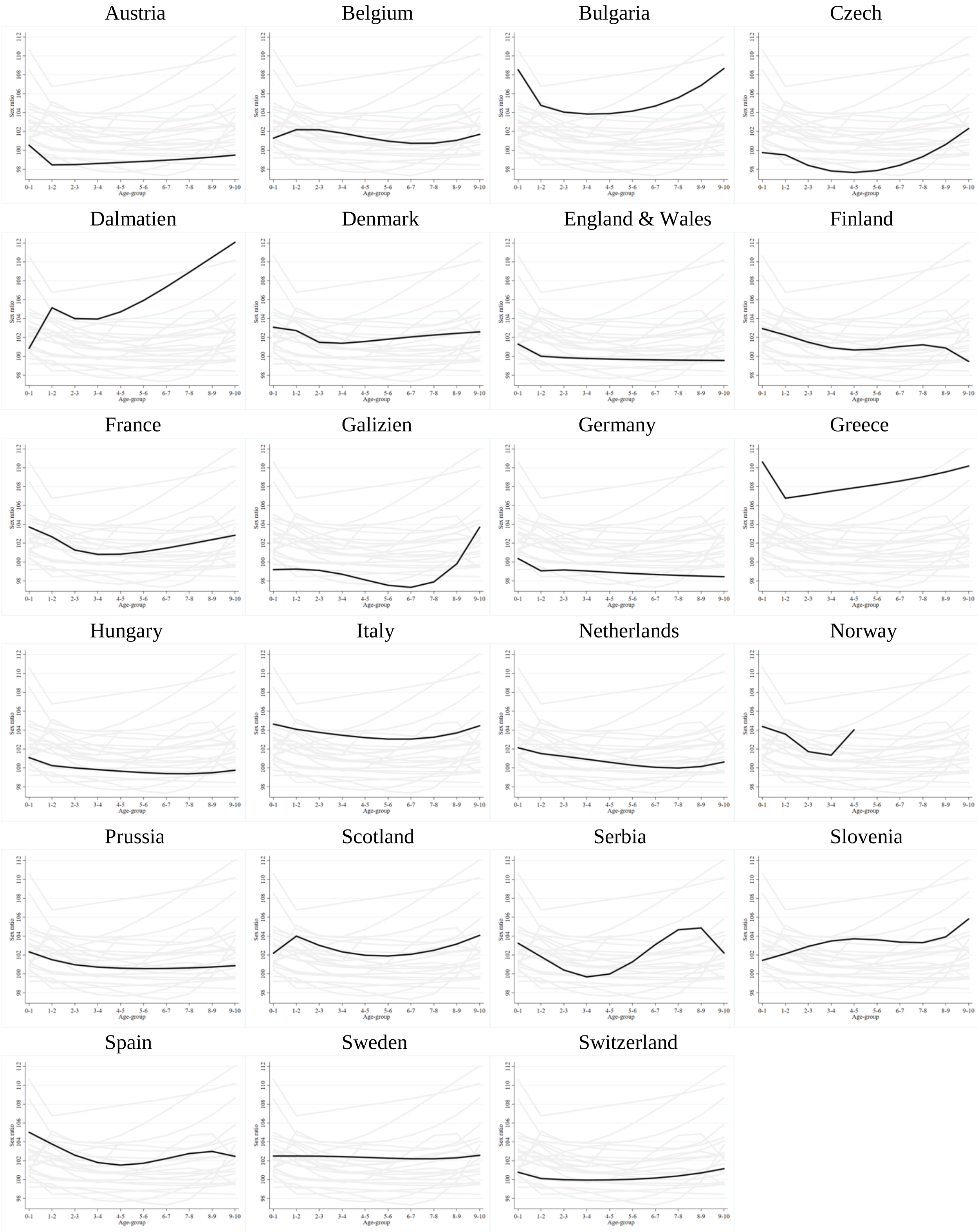
Age-group	Obs.	Mean	Std. Dev.	Min	Max
0-1	1009	102.4	4.1	67.4	126.5
0-4	1010	101.3	2.7	76.5	114.4
5-9	1010	101.2	3.0	85.7	121.8

Note: Statistics are weighted by the number of children in the corresponding age-groups. The 0-1 age group loses one observation because the original source provides lacks the information for each separate age-group in the province of Provadija.

Table A3. Sex ratios in Europe, c.1880 - Summary statistics (by country)

		Average sex ratio (by age-group)		
Country	Obs.	0-1	0-4	5-9
Belgium	9	101.5	101.4	101.3
Bulgaria	21	108.7	104.7	106.2
Denmark	20	103.1	102.1	102.0
Finland	8	102.7	101.7	100.6
France	87	103.7	101.7	101.8
Germany	91	101.6	100.5	99.8
Greece	16	110.7	107.7	108.9
Hungary	71	101.1	100.0	99.7
Ireland	32	103.9	103.0	102.4
Italy	69	104.6	103.7	103.5
Netherlands	11	102.1	101.3	100.2
Norway	19	104.4	103.0	102.8
Austrian Empire	333	100.1	98.9	99.7
Portugal	19	102.7	102.1	103.8
Serbia	16	103.8	101.3	102.8
Spain	49	104.8	102.7	102.7
Sweden	24	102.6	102.5	102.2
Switzerland	25	100.8	100.1	100.4
United Kingdom	90	101.4	100.5	99.9
Total	1010	102.4	101.3	101.2

Fig. A1. Sex ratios by age-group and country in Europe, c.1880



Source: Population censuses (see Table A1). The Censuses of Portugal (1878) and Ireland (1881) did not provide information for each age-group. The 1876 Norwegian census only did for those between 0-4 years old.

Map A1. Child sex ratios (aged 5-9) in Europe, c.1880

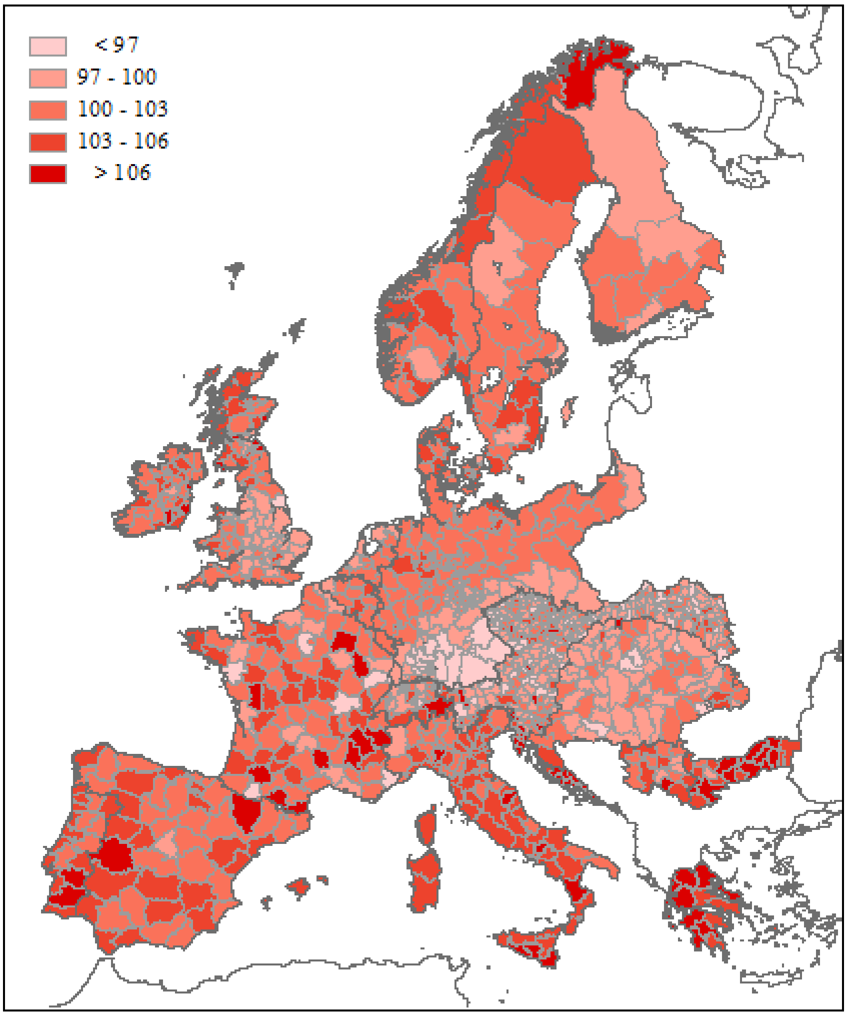


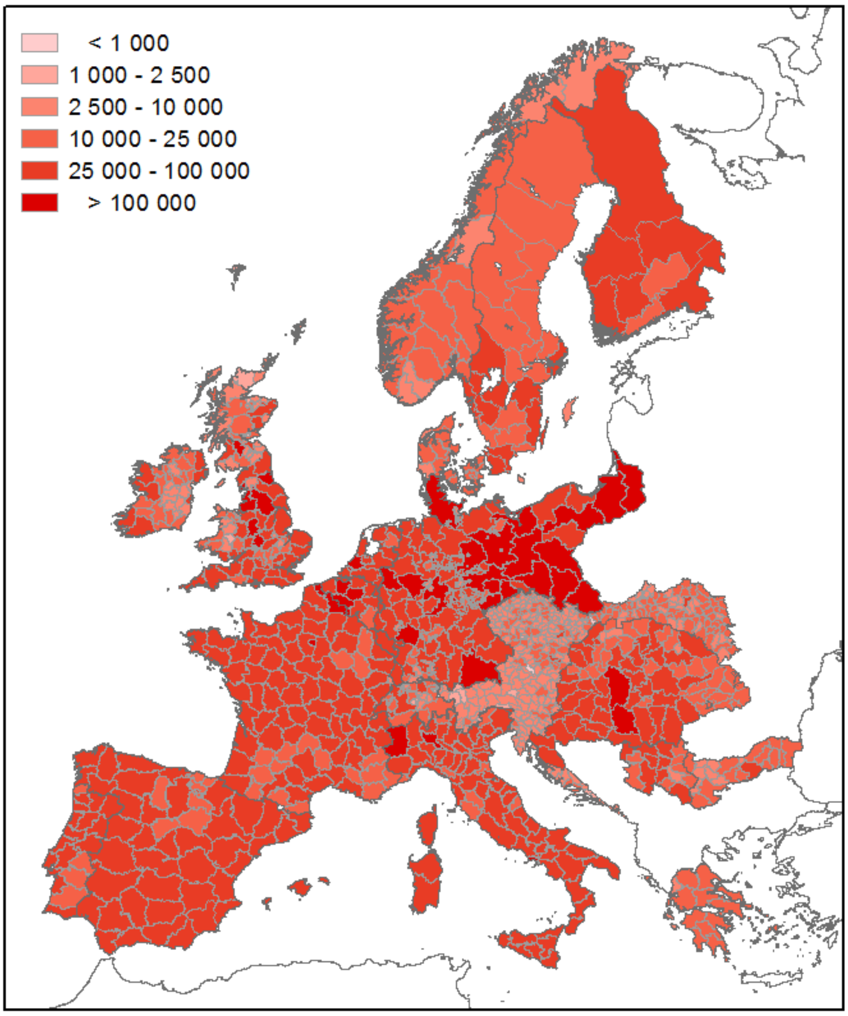
Table A4. Population aged 0-4 (by country)

Country	Obs.	Mean
Belgium	9	75 846
Bulgaria	21	13 834
Denmark	20	12 718
Finland	8	36 071
France	87	39 664
Germany	91	69 343
Greece	16	15 168
Hungary	71	30 897
Ireland	32	17 900
Italy	69	49 849
Netherlands	11	49 930
Norway	19	11 904
Austrian Empire	333	8 753
Portugal	19	33 365
Serbia	16	24 589
Spain	49	42 266
Sweden	24	23 495
Switzerland	25	13 624
United Kingdom	90	44 825
Total	1 010	29 161

Table A5. Population aged 0-4 if provinces smaller than 5,000 children (by country)

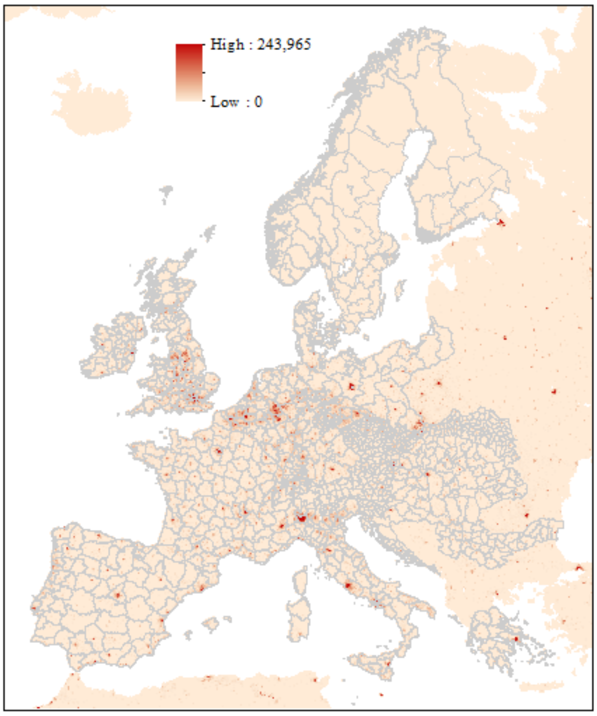
Country	Obs.	Mean
Denmark	2	2 934
Germany	2	4 807
Greece	2	4 499
Ireland	1	4 735
Norway	1	3 507
Austrian Empire	63	3 338
Serbia	1	2 701
Switzerland	7	2 747
United Kingdom	14	3 178
Total	93	3 328

Map A2. Population aged 0-4, c.1880

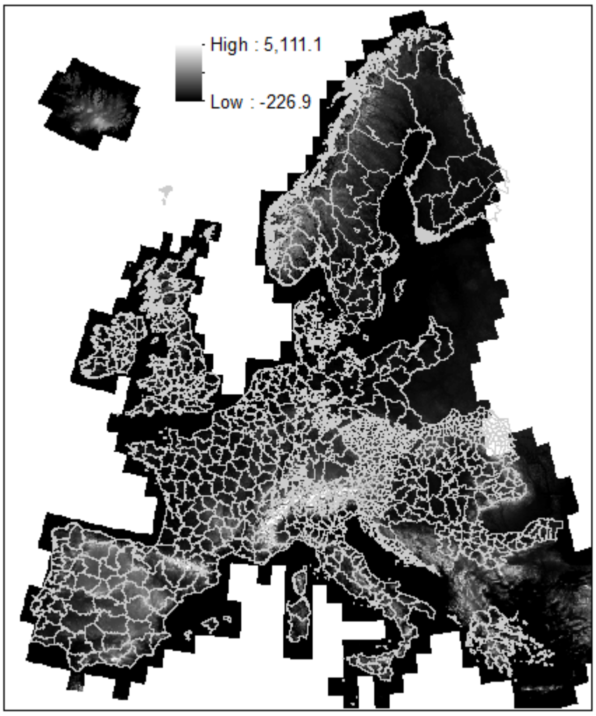


Maps A3. Geography, climate and Population

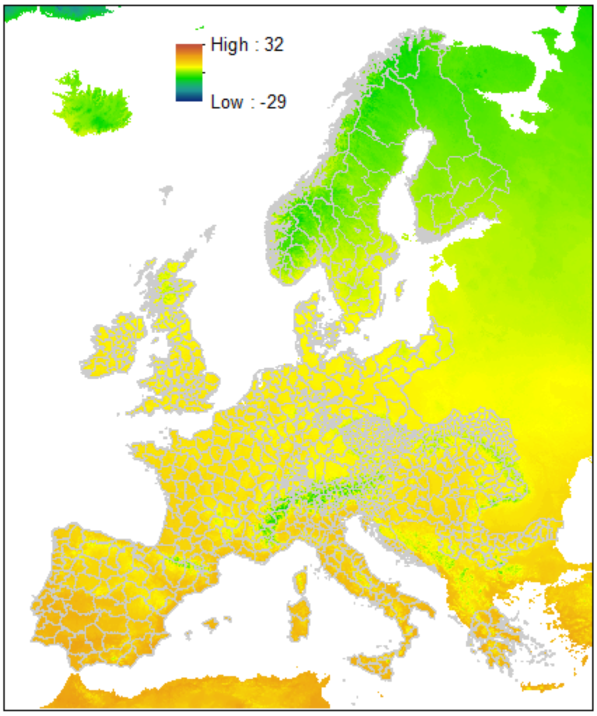
(a) Population in Europe, c.1880



(b) Altitude



(c) Temperature



(d) Rainfall

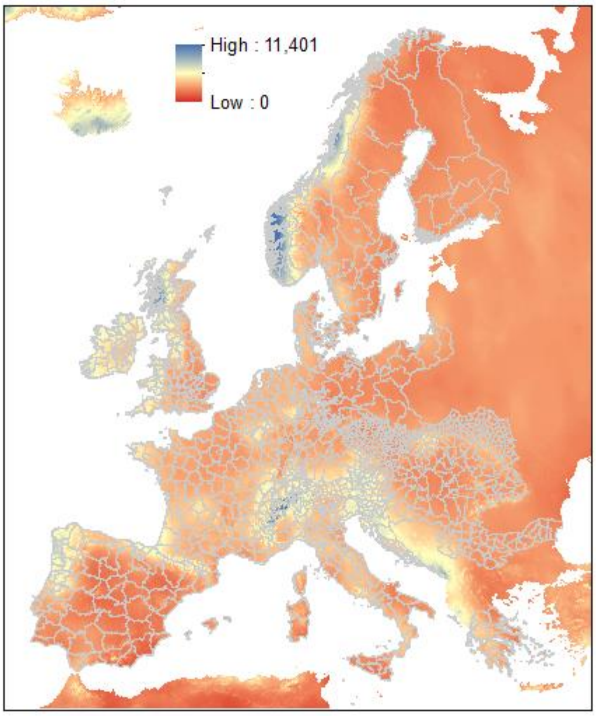


Table A6. Geography, climate and population density - Summary Statistics

	Obs.	Mean	St. Dev.	Min	Max
Sex ratio (aged 0-4)	1,010	101.1	3.423	76.47	114.4
Sex ratio (aged 5-9)	1,010	101.4	3.820	85.71	121.8
Annual mean temperature (ºC)	1,010	9.0	3.0	-2.6	18.4
Annual precipitation ('00 mm)	1,010	8.0	2.4	2.8	21.3
Precipitation seasonality (CV)	1,010	28.6	12.3	8	86
Temperature seasonality (Standard deviation)	1,010	63.7	12.0	26.6	95.9
Altitude ('00 mts.)	990	4.1	3.6	0	21.3
Ruggedness (St. dev. of Altitude)	990	176.3	158.5	1.9	940.4
Distance to coast ('00 kms)	1,010	2.12	1.80	0	6.49
Population density	1,005	89.7	195.0	0	3,687.4
Urbanisation	1,004	0.34	0.22	0	1

Table A7. Geography, climate, population density and child sex ratios - Excluding provinces < 10,000 children

	Dependent variable: Sex ratio							
	Aged 0-4				Aged 5-9			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country Fixed-Effects	YES	NO	YES	NO	YES	NO	YES	NO
Annual mean temperature (ºC)		0.23**	0.27	0.54		0.35***	0.25	0.20
		(0.09)	(0.25)	(0.45)		(0.10)	(0.18)	(0.26)
Temperature seasonality (standard deviation)		0.02	-0.01	0.02		0.03	-0.01	0.05*
		(0.02)	(0.04)	(0.03)		(0.02)	(0.03)	(0.02)
Annual precipitation ('00 mm)		-0.01	-0.02	0.26		0.10	0.03	0.13
		(0.08)	(0.10)	(0.18)		(0.09)	(0.11)	(0.17)
Precipitation seasonality (CV)		-0.01	-0.00	-0.02		-0.00	-0.01	0.02
		(0.02)	(0.02)	(0.05)		(0.02)	(0.02)	(0.02)
Altitude ('00 mts.)		0.01	0.17	0.21		0.19*	0.22	-0.01
		(0.10)	(0.19)	(0.33)		(0.11)	(0.13)	(0.22)
Ruggedness (St. dev. of Altitude)		0.00*	0.00	0.00		-0.00	-0.00	-0.00
		(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)
Distance to coast ('00 kms)		-0.75***	-0.39*	-0.29		-0.82***	-0.47**	-0.44*
		(0.14)	(0.19)	(0.34)		(0.15)	(0.21)	(0.15)
Population density (log)		-0.57***	-0.33**	-0.31		-0.79***	-0.76***	-1.02**
		(0.15)	(0.16)	(0.24)		(0.18)	(0.17)	(0.31)
Urbanisation		-0.17	0.40	3.04**		-0.22	1.40	2.01
		(0.87)	(0.77)	(0.55)		(1.13)	(1.32)	(3.26)
Observations	697	679	679	222	619	610	610	222
R-squared	0.394	0.337	0.417	0.101	0.397	0.333	0.436	0.094

Robust standard errors clustered at the country level; *** p<0.01, ** p<0.05, * p<0.1; For simplicity, the intercept is not reported. Columns (4) and (8) repeat the exercise but just focusing on provinces in South-Western Europe, namely Portugal, Spain, France and Italy.

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