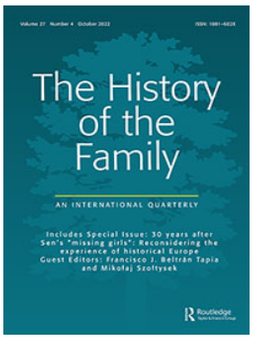

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Infant and child sex ratios in late Imperial Russia

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ABSTRACT

This article analyses infant and child sex ratios in late Imperial Russia relying on district-level information obtained from the 1897 Russian census (489 districts). The article shows that child sex ratios were, on average, relatively low (around 98 boys per hundred girls) due to the biological female advantage: the extremely high infant and child mortality rates took a greater toll on boys and pushed sex ratios down. These figures, however, hide significant geographical variation and the number of boys (relative to girls) was especially high in Southern, Western and Northern Russia. Apart from the direct impact that different mortality environments could have exerted on sex-specific mortality rates and therefore on the sex ratios of the surviving children, this article explores the potential role of economic, ethnic and religious factors and suggest that particular contexts shaped the perceived relative value of girls and resulted in discriminatory practices against girls. In particular, our results show the importance of different ethnic groups in explaining these patterns conditional on economic and religious factors. In addition, the residuals of our models show clear spatial patterns, thus suggesting that unobserved factors were playing an additional role in explaining son preference. Lastly, this article demonstrate a positive link between historical sex ratios and female discriminatory norms in modern societies and therefore points to persisting factors affecting gender imbalances.

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Sex ratios; gender discrimination; infant and child mortality; health

1. Introduction

The traditional Russian rural family has been generally depicted as composed of several generations, and their spouses, living together under the authority of the patriarchal head (Von Haxthausen, 1972; Czap, 1983; Hoch, 1986). Patrilocality, the dowry system and early (and nearly) universal marriage, as well as lineage customs and economic considerations that linked apportioned land and old-age insurance to married sons, played against women's status and fostered son preference (Avdeev et al., 2004; Engel, 1994; Evans Clements et al., 1991; Glickman et al., 1991; Moon, 1999; Semionova, 1973; Worobec, 1991). Although this depiction does not apply to the whole society and it surely varied widely throughout the territory (Dennison, 2011, p. 50), Imperial Russia

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was characterised by strong patriarchal institutions that subordinated women's status to that of their fathers and husbands. There is however hardly any attempt to assess whether female mortality rates were affected by discriminatory practices. This is puzzling because the patriarchal dimensions found in the Russian historical context are shared by contemporary developing societies that suffer from female abortion, infanticide and neglect throughout infancy and childhood. The Russian case is also especially interesting because, although it is usually depicted as highly patriarchal, the sheer scale of the empire implies that it contains very different societies, both in environmental, socioeconomic, ethno-linguistic, and institutional circumstances (Moon, 1999). The Tzar's authority indeed extended well beyond the areas mostly populated by ethnic Russians and thus provides a unique vantage point to study how son preference may have varied across different ethnic groups (and their associated family systems and cultural norms).

In order to fill this gap and explore whether parents treated their sons and daughters differently, this article analyses infant and child sex ratios in late Imperial Russia relying on district-level information obtained from the 1897 Russian census (489 districts).[1] In this regard, the number of boys (relative to girls) constitutes a cumulative measure of the impact that discriminatory practices around birth, infancy and childhood may have had on the survival of girls. As well as situating this case study within the larger literature on this topic in historical Europe (Beltrán Tapia, 2019; Szoltysek et al., 2022a), the contribution of this article is three-fold. Firstly, it shows that child sex ratios were, on average, relatively low (around 98 boys per hundred girls) due to the biological female advantage: the extremely high infant and child mortality rates took a greater toll on boys and pushed sex ratios down. This finding confirms recent work evidencing that child sex ratios in the past were relatively low due to harsh mortality environments. This is crucial because it therefore implies that the benchmark for assessing gender discrimination in infancy and childhood should be adjusted accordingly (Beltrán Tapia & Gallego-Martínez, 2017). In particular, infant mortality rates in some Russian regions were exceptionally high, well beyond 350 deaths per 1,000 live births, and these contexts are perfectly compatible with child sex ratios around 97 or even lower.

Secondly, although the average child sex ratio found in the 1897 Imperial Census suggests that gender discrimination did not affect sex-specific mortality rates in infancy and childhood, this figure hides significant geographical variation. The relative number of boys was especially high in Northern, Southern and Western Russia and these spatial patterns cannot be fully explained resorting to different mortality environments. This article therefore explores the potential role that economic, ethnic and religious factors could have had on the sex ratios of the surviving children. Although the lack of systematic information on particular dimensions prevent us from identifying direct correlates of child sex ratios, the residuals of our models show clear spatial patterns, thus implying that particular contexts are likely to have shaped the perceived relative value of girls and resulted in discriminatory practices against girls, such as neglect or abandonment right after birth and/or an unequal distribution of resources during infancy and childhood. This interpretation is supported by the fact that the importance of different ethnic groups is strongly correlated with child sex ratios, even after conditioning on religion and economic development, thus suggesting that family norms (linked to cultural values) contribute to

explaining the observed spatial patterns in child sex ratios. Szoltysek et al. (2022a, 2022b) not only shows that child sex ratios varied significantly within Eastern Europe, but that they are associated with the intensity of patriarchal features in those societies.

Thirdly, and in line with recent literature on the transmission of cultural traits (Giuliano & Nunn, 2021; Miho et al. 2020), this article argues that the gender inequalities captured here casted a long shadow and continue to shape these societies today. Our results indeed show that there is a significant link between the observed child sex ratios in the Imperial Census and discriminatory gender norms present in modern countries that previously belonged to the Russian Empire. In particular, we show that regions with higher historical child sex ratios have, on average, a higher proportion of people who refuse equal rights for women as a basic principle. This exercise not only supports the hypothesis that the unbalanced child sex ratios found in the late 19th century did indeed reflect son preference and discriminatory practices against girls, but it also shows that the values underlying this behavior can persist over time and affect social norms in present times.

To our knowledge, this is the first attempt to systematically explore how child sex ratios looked like in Russia at the end of the 19th century and therefore shed more light on whether parents treated sons and daughters differently. Apart from the obvious link to the recent literature on missing girls in historical Europe (Beltrán Tapia, 2019; Marco-Gracia & Beltrán Tapia 2021; Beltrán Tapia & Raftakis, 2022), this study contributes to our understanding of demographic and family-related behaviour in this region (Dennison, 2011; Glavatskaya et al. 2017; Bakharev & Glavatskaya, 2019; Natkhov & Vasilenok, 2020). Likewise, given the unequal gender norms found in some areas in the late 19th century are still visible today, these findings relate to the literature on cultural persistence and change (Giuliano & Nunn, 2021; Miho et al. 2022). Lastly, this article also connects to the burgeoning literature that is using Imperial Russia as a historical laboratory (Finkel et al., 2017; Castaneda Dower et al., 2018; Markevich & Zhuravskaya, 2018; Charnysh, 2011; Buggle & Nafziger, 2021; Gregg 2020; Gregg & Matiashvili 2022; Natkhov & Vasilenok 2020; Zhuravskaya et al., 2022).

2. Historical context

Imperial Russia suffered extremely low standards of living, at least in comparison to North-Western Europe.[2] Infant and child mortality rates were extremely high, probably the highest in Europe, due to mass poverty and inadequate child-rearing practices (Ransel et al., 1991; Ransel, 2001). Broadly speaking, only about half of the children survived to age five. Yet, this average hides significant regional differences (Patterson, 1995; Glavatskaya et al. 2018; Bakharev & Glavatskaya, 2019; Natkhov & Vasilenok, 2020). For instance, infant mortality in Perm's province in 1896–97 was as high as 437 deaths per thousand live births (Bakharev & Glavatskaya, 2019, p. 206).

There were virtually no trained midwives in rural areas until the early 20th century and peasant women gave birth either alone or with the help of a local woman with experience in delivering babies (Ramer, 1978, pp. 219–221). As well as lack of access to medical services and knowledge about childcare, the lower classes lived in highly unsanitary conditions and infectious diseases thrived. Contemporary medical reports widely complained that traditional attitudes and practices, including early weaning and the

engagement of mothers in field work, made things worse (Frieden, 1978; Natkhov & Vasilenok, 2020; Ransel et al., 1991). These practices nonetheless varied depending on religious denomination, thus significantly shaping infant mortality rates (Bonneuil & Fursa, 2017; Glavatskaya et al., 2017; Patterson, 1995). Orthodox Russians suffered by far the highest mortality rates followed by Catholics, protestants and Muslims (with similar levels), and by the Jews with the lowest rate (Natkhov & Vasilenok 2020).[3] Interestingly, peasants' resignation and fatalism about the fate of their offspring was enmeshed with beliefs about how many mouths they could actually feed (Frieden, 1978, p. 246).[4] Without referring to the sex of the children, different sources such as traditional lullabies and medical reports, referred to undernutrition and neglect as major causes of infant and child mortality (Dunn, 1974, p. 385; Frieden, 1978, p. 252; Hoch, 1986, p. 182; Worobec, 1991, pp. 207–209). Ransel et al. (1991, pp. 120–121) also argues that less valued children received much less attention in terms of shorter breastfeeding periods and of being turned over to old women or older siblings.

It is therefore plausible to hypothesise that, under such harsh circumstances, families treated their sons and daughters differently, especially considering the strong son preference that characterised the Russian society at that time. The traditional peasant family was composed of three or four generations living together, often also including lateral relatives such as nephews and cousins, but smaller and less complex families also existed in some regions and socio-economic groups (Czap, 1983; Hoch, 1986; Moon, 1999, p. 179; Kanitschev et al., 2004; Dennison, 2011). Early and nearly universal marriage for both sexes was common and it seems that the age difference between spouses was small (Avdeev et al., 2004; Czap 1978; Dennison, 2011; Hoch 1986). Strong patriarchal institutions however subordinated women to their fathers and husbands (Bushnell, 2017; Clements et al., 1991, pp. 5–7; Glickman et al., 1991, pp. 148–150; Ransel, 2001).[5]

Son preference was indeed apparent in many popular sayings and proverbs and was linked to a strong patrilocal system (Aldashev & Guirkinger 2012, 11; Ransel, 1988, pp. 130). Peasants especially celebrated the birth of a new son and it seems that fathers and grandparents did not express much regret if a baby girl died (Moon, 1999, pp. 184, 192; Semionova, 1973, pp. 8–9).[6] Getting a son married increased the land apportioned to the household (Von Haxthausen, 1972, p. 82; Hoch, 1986, p. 95; Engel, 1994, p. 8).[7] Grown sons were not only key to a prosperous family economy, but they also provided insurance for old age (Engel, 1994, p. 15). Likewise, lineage was traced through males and sons were in charge of interceding on behalf of their parents' soul according to (Russian) Orthodox tradition (Moon, 1999, p. 182; Worobec, 1991, p. 54).

Strict patrilocal rules, on the other hand, meant that female children were considered as the future members of another extended family, so marriage had therefore different connotations for men and women because most brides had to leave their households and join that of her groom (Avdeev et al., 2004). By joining their husbands' household, women drained resources away and the very few who remained unmarried in their parent's home constituted a burden. Popular proverbs stress how daughters represented a poor investment: 'Supporting my father is paying a debt; feeding my son is lending money; feeding my daughter is throwing it out of the window' (Worobec, 1991, pp. 62, 209).[8] A practical evaluation of the costs of raising girls and their potential labour contribution indeed

appeared to have acted against girls in poor families (Moon, 1999, p. 25; Ransel, 1988, p. 130). In this regard, it is worth stressing that the low status suffered by Russian women was evident to foreign observers (Lacroix 1854, p. 118).

Likewise, the evidence on infanticide and child abandonment also suggest the presence of son preference. Infanticide seems to have been common in pre-Petrine Russia both among children born out of wedlock or into extreme poverty (Levin, 1986). While illegitimate boys and girls would be equally unwelcomed, economic considerations implied that girls were perceived as of less value and a greater drain to the family resources. Studying the poorest families, Hellie (1982) argues that females were more likely to be the victims because they were less likely to bring income.[9] High sex ratios at baptisms in several locations throughout the 18th century seems to provide some support to this interpretation (Ransel, 1988, p. 131).[10] Although scattered data from the 1850s suggests that female infanticide was more common, information on violent deceases between 1875 and 1893 shows no clear differences between male and female infanticides (to the best of our knowledge, however, this data has not been analyzed systematically). Crime statistics, however, usually focus on single women and therefore only show the tip of the iceberg. Due to high infant mortality rates, it was very easy to conceal these crimes as natural deaths, especially among married couples. Not only was it very unlikely that they came to the attention of the authorities, but these offences only carried out a moderate penance (Levin, 1986, pp. 222–223).[11] After doing ethnographical field work in the Riazan province, Semionova (1973) argues that, while smothering and intentional overlaying was indeed widespread in the 1890s, local authorities rarely investigated these matters.[12]

Child abandonment constituted even a more visible phenomenon. Large foundling homes were established in Moscow and St. Petersburg in the late 18th century to deal with unwanted children in these cities and the surrounding countryside (Ransel, 1988). The flow of children entering these institutions increased steadily throughout the 19th century despite several reforms to discourage child abandonment. In the 1880s, the Moscow and St. Petersburg homes were annually admitting around 17,000 and 9,000 children, respectively, and these numbers do not account for those who never reached these institutions.[13] Although many of them were illegitimate, a large portion were the infants of poor married couples.[14] Interestingly, the number of female admissions markedly exceeded that of males in the late 18th century (Ransel, 1988, pp. 131–134). This gender gap declined over time but the preference for abandoning girls was still visible in the 1870s. Given that son preference is linked to legitimate children (Fuchs, 2005, p. 231; Ransel, 1988, p. 143), this pattern is probably associated to the restrictions that these foundling hospitals attempted to impose on married women throughout the 19th century. The abolition of secret reception in the 1891, intended to limit the number of admissions, also meant that only illegitimate children were admitted.[15] Although the new rule indeed reduced the number of entries by one-third (Ransel 1988, p. 196), it also probably increased the number of infanticides and/or informal abandonments among married couples.[16] In any case, we should bear in mind that these institutions only catered for unwanted children in Moscow, St. Petersburg and their neighbouring provinces, so the lack of similar institutions in other regions meant that parents probably resorted to other means of getting rid of their unwanted children.

Differential treatment by sex could also happen within families as children grew older. Such an impoverished and highly patriarchal society could have resulted in an unequal allocation of food, care and/or work between sons and daughters and therefore affected their relative chances of being undernourished, falling ill and even dying (Beltrán Tapia & Gallego-Martínez, 2017; Marco-Gracia and Beltrán Tapia 2021). The competition for scarce resources would therefore potentially affect the less-valued members of society, so son preference may have therefore put girls especially at risk. To the best of our knowledge, there is very little research done on this topic specifically. Contemporary Russian physicians stressed that women were often assigned to the most difficult and exhausting types of agricultural works, which led to the spread of specific diseases and reduction in female life expectancy (Bogdanov, 1889; Shingarev, 1899). Studying the Voronezh district in the Volga region, Fedjaevskij (1905) actually reported that boys received favorable status.

Women status did not improve during adulthood and life was especially harsh for Russian women. Female illiteracy was widespread, women were not allowed to vote or even speak at the village assembly and wife-beating was a common practice, especially in rural areas. The Russian Orthodox Church also stressed women's inferiority (Worobec, 1991, p. 186). It was the husbands' responsibility to control and 'instruct' their wives and peasant women were expected to endure ill-treatment in silence (Engel, 1994, pp. 23–25). Medical pamphlets indeed stressed the tyranny of husbands and the daily harshness of female peasants (Frieden, 1978, p. 248). Anthropometrical data, which measures biological living standards during growth years, also suggests that women experienced deprivation more frequently and more intensively than men, thus evidencing an unequal allocation of resources within households (B. Mironov, 2012, p. 126).[17] Interestingly, Stepniak (1888, pp. 468–469) argues that Orthodox women were especially subjugated and ill-treated. In this regard, anthropological and historical evidence suggests that German Russians, mostly protestants, had the most progressive gender norms (Miho et al., 2020, p. 12). Muslims, on the contrary, carried out highly discriminatory practices such as polygamy and arranged marriages.

Although this overview of the literature provides evidence suggesting that discriminatory practices probably inflated female mortality rates early in life, there are to the best of our knowledge no previous studies addressing this issue explicitly. By analyzing child sex ratios, the following sections therefore explore whether gender discrimination unduly affected the relative survival of boys and girls in late-19th-century Russia.

3. Data

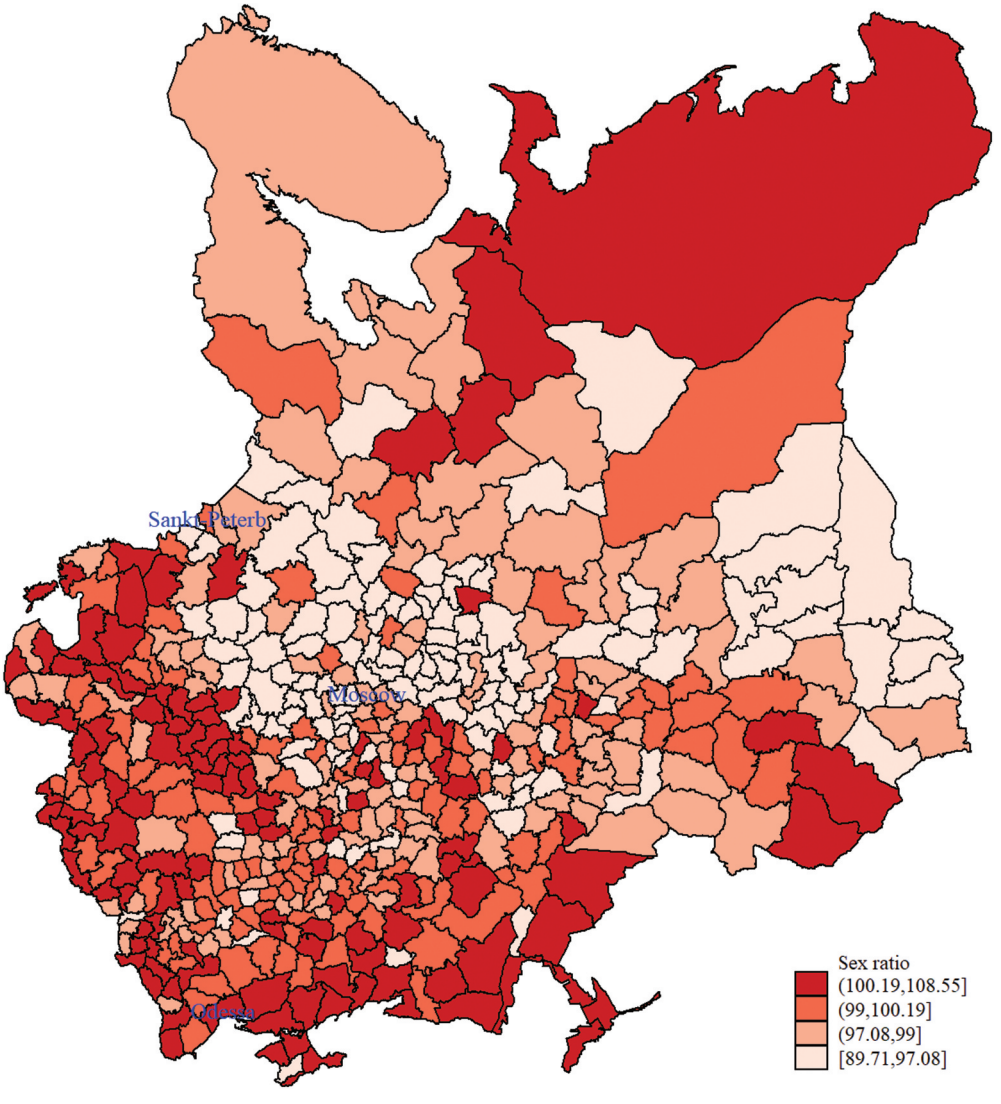
The primary data source is the first Imperial census conducted in 1897. This was an impressive achievement, covering around one-sixth of the earth surface and a total population of more than 125 million. Contrary to previous enumerations conducted for tax purposes, the 1897 Census was designed to fully register the size of the population and its socioeconomic and demographic characteristics (Bryukhanova & Ivanova, 2019; Rowney & Stockwell, 1978).[18] The enumerators, who had received secondary education, visited every household in each village and followed contemporary international statistical practices (Moon, 1999, pp. 10–11).

The census reports male and female cohorts born in different years and therefore allows computing sex ratios at different age-groups. In particular, the number of boys per hundred girls has been widely used to assess the cumulative impact of gender discriminatory practices affecting sex-specific mortality rates at birth, infancy and childhood. Relying on the population census has the added advantage of avoiding the limitations regarding the registration of demographic events (Adamets 2002, pp. 165–167). It should nonetheless be stressed that historical child sex ratios cannot be directly compared to contemporary ones (Beltrán Tapia & Gallego-Martínez, 2017). Due to the female survival advantage, harsher environments are especially deleterious to boys, which results in more boys than girls dying during the first years of life, thus lowering sex ratios in infancy and childhood. Beltrán Tapia (2019, p. 6) estimates that infant mortality rates around 250 deaths per thousand births, as those existing in 19th-century Russia, should translate into a child sex ratio of around 99.

Except for a few large cities, Russian population mostly lived in rural areas.[19] In order to facilitate a homogenous comparison, we have therefore computed child sex ratios focusing exclusively on the rural population. On average, the census reports 98.7 boys per hundred girls at the 0–4 age-group (born between 1893 and 1897; figure A1 in the Appendix depicts how sex ratios evolved across age cohorts). Although this sex ratio is much lower than the 105 figure that is typical of today's developed countries, it fits well with our expectations due to the high infant and child mortality rates prevalent in Russia at that time. The child sex ratio reported in the Imperial census therefore confirms that this figure was much lower in the past, regardless of the presence of gender-discriminatory practices (Beltrán Tapia, 2019; Szoltysek et al. 2022a).[20] Importantly, the quality of the records suggests that sex-specific under-registration is likely to be negligible. Although this issue might be more worrisome at young ages, children should appear in the census as they grew older. The child sex ratios at ages 5–9 is actually virtually identical (98.2) to the one computed using ages 0–4. Likewise, female under-registration does not seem to be an issue in previous enumerations either. Females serfs, for instance, outnumbered male serfs in 1859: the sex ratio (all ages) of *serfs* in European Russia was 94.4 in the so-called 10th National Census (Troinitskii, 1982).

The low average child sex ratio found in the 1897 Imperial Census therefore implies that gender discrimination did not affect sex-specific mortality rates in infancy and childhood. The same conclusion seems to arise when looking at the sex ratio at birth. All births happening in rural areas in the years 1896 and 1897 yield a sex ratio of 105.0 boys per hundred girls,[21] a figure that falls within what should be biologically expected (Chao et al. 2009). Discriminatory practices against girls are therefore not visible either in the census or in the vital statistics published around that year, at least at the aggregate level.

The national average, however, conceals a high degree of internal differences. Child sex ratios at the district level in European Russia range from 89.7 to 108.5 boys per hundred girls (489 observations).[22] The figures in the non-European part of the Empire were even higher and could reach 120.3 (73 districts). Compared to the average (as these figures already indicate), the distribution of child sex ratios at the district level is actually biased to the right (see Fig. A2 in the Appendix), thus suggesting that parents may have treated boys and girls differently in particular regions. Map 1 depicts this geographical variation in child sex ratios and shows that districts in the central part exhibited lower sex



Map 1. Child sex ratio, ages 0–4 (1897).
Source: 1897 Russian Census. The map depicts the location of Moscow, St. Petersburg and Odessa, the most important cities at the time.

ratios. This spatial pattern changes when moving toward the periphery: child sex ratios were higher in Northern, Southern and Western areas but showed particularly unbalanced values in the non-European part of the Empire. Using individual-level information from a limited number of locations, Szoltysek et al. (2022a) also find unbalanced child sex ratios in parts of Western Russia (especially near the Urals) and Ukraine.

This district-level information further reinforces the quality of the records and the argument that sex-specific under-registration is likely to be negligible. As mentioned before, although the census probably under-enumerated infants and toddlers, this issue is less important as children grew older. Reassuringly, districts with high sex ratios at age 0–4 also tend to exhibit high sex ratios at age 5–9, thus suggesting that

this issue was not affecting the relative number of boys and girls (r = 0.43[23]; see Figure A4 in the Appendix comparing sex ratios in both age-groups). This correlation coefficient aligns almost perfectly with what has been found in other censuses in Western Europe ca. 1880 (Beltrán Tapia, 2019, p. 12), thus further supporting the quality of the data. Using provinces as the unit of analysis yields a correlation coefficient of 0.61 and 0.63 for France and Italy, respectively. Only Germany shows a higher figure (0.73) but the higher level of aggregation plays a role here by reducing random noise. In fact, if Russian districts are aggregated into provinces (50 observations), the correlation coefficient between sex ratios at ages 0–4 and 5–9 jumps to 0.90, thus further supporting that regional patterns are not likely affected by potential under-registration at early ages. Child sex ratios at the district level also correlate quite well with sex ratios at birth (r = 0.37; figure A5), especially considering the small sample size of some of the districts.

Part of this variation can be explained by both random noise and differences in the mortality environment. On one hand, the size of the underlying population from which sex ratios are computed crucially influences the range of expected variation. Sex ratios tend to be very stable in large populations but units of analysis containing a relatively small number of children can exhibit high or low sex child sex ratios just out of chance. The Russian districts studied here are relatively large (almost 33,000 children in the 0–4 age-group, on average) but this feature might still be playing a role on the smallest districts (see Figure A3 in the Appendix). There is nonetheless a significant fraction of districts that show extremely high child sex ratios regardless of the number of underlying children. On the other hand, as mentioned above, the male biological vulnerability would result in a higher/lower proportion of surviving boys in low/high mortality environments. Infant and child mortality rates were extremely high in the central regions, reaching more than 350 or 400 infant deaths per 1000 live births in some cases (Bakharev & Glavatskaya, 2019; Natkhov & Vasilenok, 2020), and this probably contributes to partly explain the lower sex ratios observed in those areas.

The Vital Statistics published during this period allows formally testing this relationship.[24] Unfortunately, this source only provides the number of deceased children in European Russia. Given that the quality of the 1897 census is probably lower in the more remote part of the Empire, restricting our analysis to the European districts (489 observations) probably improves the accuracy of this exercise. Figure 1 plots infant mortality rates and child sex ratios and confirms that a negative correlation between these two variables is clearly visible in our data (r = −0.64). Male vulnerability naturally translated into a larger number of boys dying in those regions where infant mortality rates were high, thus reducing child sex ratios. This finding is crucial because it confirms that child sex ratios were naturally low in the high-mortality environments existing in the past and therefore implies that the benchmark for assessing gender discrimination in infancy and childhood should be adjusted accordingly (Beltrán Tapia & Gallego-Martínez, 2017; Beltrán Tapia, 2019). As mentioned above, infant mortality rates in some Russian regions were exceptionally high, well beyond 350 deaths per 1,000 live births, and these contexts are perfectly compatible with child sex ratios around 97 or even lower.[25]

We can therefore estimate what the child sex ratio should look like according to the underlying mortality environment and compare it with the observed value. Map 2 depicts the residuals, that is, the difference between the predicted values resulting from this

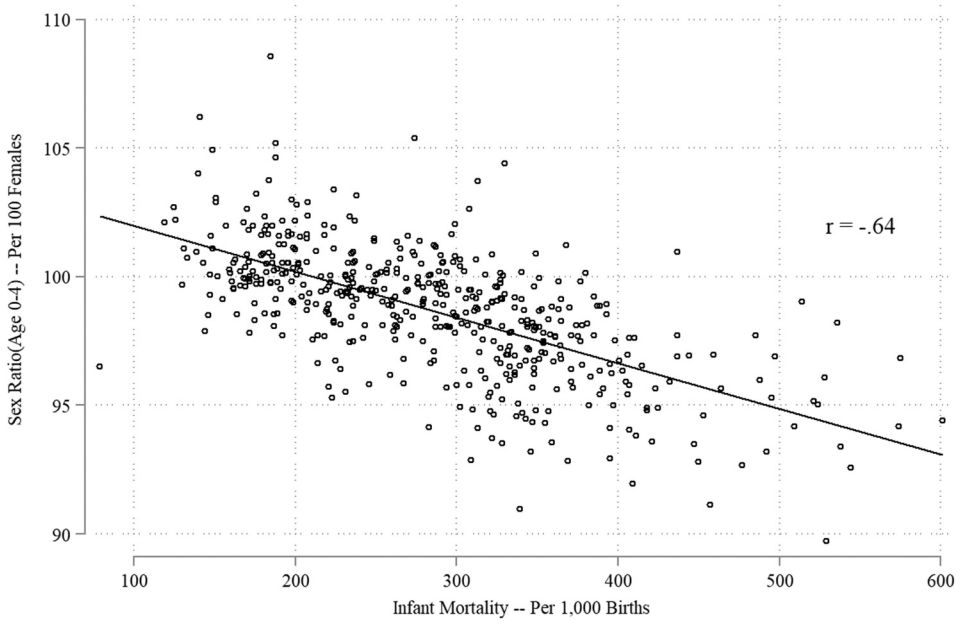


Figure 1. Infant mortality and child sex ratios (ages 0–4). Source: 1897 Russian Census and 1888/97 Vital Statistics.

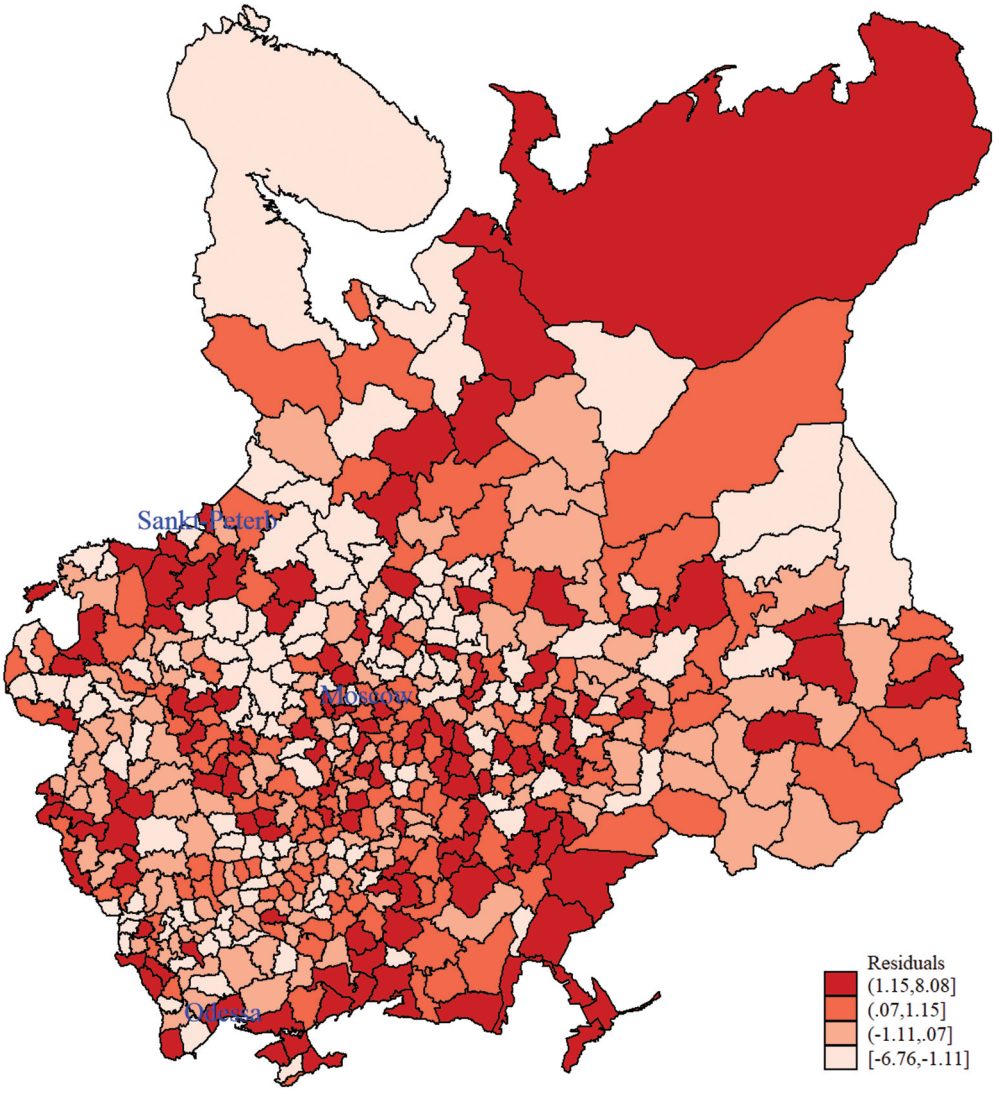
exercise and the observed child sex ratio (Table A2 in the Appendix reports the details of the maximum-likelihood regression that is behind this analysis). Interestingly, the residuals are spatially correlated,[26] thus suggesting that local factors, other than infant mortality rates, are shaping the relative number of boys and girls. Some districts, especially in Central Russia, exhibited lower sex ratios than what would be expected according to their mortality levels. By contrast, other regions presented excessively high values, especially in the periphery and other hotspots scattered across European Russia. The aim of next section is to assess whether specific factors can be linked to the spatial patterns depicted here.

4. What is behind the unexplained variation in child sex ratios?

4.1. Methodology

Although differences in mortality rates during infancy and childhood (as well as in random noise arising from the size of the children population) account for a significant fraction of the variation in child sex ratios, the values observed in some districts depart from what should be expected. These deviations in the relative number of boys and girls can arise either from enumeration problems or from discriminatory practices affecting the sex-specific mortality rates. This section therefore explores different dimensions that might be behind the deviations in the relative number of boys and girls according to the following econometric specification:

$$Y_i = \alpha + \beta\, X_i + \ \varepsilon_i$$



Map 2. Differences between observed and predicted sex ratio, ages 0–4.
Source: Own calculations using the 1897 Russian Census and the 1896/97 Vital Statistics. The map depicts the location of Moscow, St. Petersburg and Odessa, the most important cities at the time.

where the dependent variable is the child sex ratio (ages 0–4) in each district. Given that infants are more prone to registration issues, the model will be estimated for the 1–4 age-group as well so as to mitigate the possibility that female under-registration is biasing our baseline specification. In addition, given that sex-specific age-heaping around age 5 might affect sex ratios, we also replicate our exercise using the 1–6 age-group.[27] Moreover, relying on the cohorts born in 1896 and 1897, sex ratios at birth are also employed so as to distinguish whether discrimination may happen right after birth or during infancy and childhood.

The right-hand side of the equation refers to a set of explanatory variables described below. It should be noted that although some variables account for factors specifically linked to enumeration problems or gender discriminatory practices, others will probably capture both dimensions simultaneously, making interpretation more difficult. As well as being based on previous literature identifying which factors are more likely to result in gender discrimination in infancy and childhood (Beltrán Tapia, 2019; Beltrán Tapia & Gallego-Martínez, 2020; McNay et al., 2005), the choice of variables also reflects the peculiarities of the Russian context, especially the multicultural and ethnic composition of Imperial Russia, which was especially important in some areas. This exercise is nonetheless constrained by the information available in the 1897 Census. It should be stressed though that this model does not seek to estimate causal effects but simply to reveal general patterns behind the data.

Firstly, given the importance of the mortality environment in shaping the relative number of boys and girls, the model employs infant mortality rates to capture this feature. As explained above regarding the spatial availability of vital statistics, this implies that we are restricting the analysis to European Russia and, as a by-product, adopting a conservative research strategy: child sex ratios were higher in the non-European parts of the empire, so excluding them from the analysis makes it more difficult to find gender-discriminatory patterns. Moreover, the quality of the data is probably higher in the European districts, which were closer to the most important administrative centers.

Secondly, the Russian Empire was populated by numerous ethnicities representing different linguistic and cultural groups. In fact, the share of ethnic Russians only exceeded half of the population in 60% of the district we analyse. In order to explore the importance of ethnic features on explaining child sex ratios, we compute the share that each of these groups represented over the district population using the information contained in the 1897 Census. There are however some issues that should be borne in mind when analyzing this information (Anderson and Silver, 1986). On the one hand, the census interviewers did not ask a direct question about nationality, but question about *mother tongue*. Given that some people often declare the language of another nationality as native language, the census data under-represents the size of those ethnic groups that were experiencing linguistic russification, such as the Votyaks (Udmurts), Mordvinians, and Zyryans (Komi) and therefore over-represented the number of Russians in the population.[28] On the other hand, subjects often reported the language of their village or town as their native language, making it difficult to allocate the population according to standard linguistic categories. Such problem, however, was mostly confined to Southern regions in Caucasus, which are excluded from our sample and therefore does not affect our analysis. Lastly, given that the number of such groups exceeds 100, we only consider those whose maximum share in a district population exceeds 0.05. In order to facilitate the analysis, we have aggregated some of them into several broader linguistic groups: Slavic (except Russian), Baltic, Turkish, Finnic (including northern ethnic minorities) and Uralic (groups concentrated in the region of Ural Mountains) (See Map A2 in the Appendix). We perform our analysis with both aggregated and disaggregated groups, using *Russians* as reference category as they represented the majority of the population in more than half of the 489 districts.

Thirdly, we explore whether particular economic conditions could have fostered discriminatory practices against females. The testing hypothesis is that child sex ratios would be higher in contexts where there were limited economic opportunities for women, which translates into their perceived relative value and therefore may have nurtured discriminatory practices against girls. Girls, for instance, were a valuable resource in areas where cottage industry was important (Ransel, 1988, p. 140). In this regard, we consider the importance of urban population and manufacturing, as well as the literacy rate, to capture the district's level of development. We also add information on the share of local residents (people born in the district) to account for migratory patterns.

In addition, we evaluate the importance of religious dimensions using the share of population belonging to different religious groups. Although the Orthodox Church dominated, it coexisted with other religious traditions and they could actually constitute the majority of the population in particular regions. The most important of these minorities were Muslims, Catholics, Protestants and Old-Believers (a conservative ramification of the Orthodox Church).[29] Map A3 in the Appendix provides a visual inspection of this information.

Likewise, we have augmented our dataset by constructing various geographical measures that can have an independent effect on sex ratio imbalances: latitude, longitude, ruggedness and the distances from the district's centroid to a navigable river, coastline, and capitals (Moscow and Sankt-Petersburg).[30] It should be noted that the variable infant mortality already captures environmental features that translated into different mortality environments. Some of these dimensions, however, can also directly affect the perceived relative value of girls by shaping the economic or social structure. It is argued, for instance, that pastoralism favoured the adoption of customs that restricted women's freedom of mobility and sexual behaviour (Becker, 2019). Likewise, in order to control for unobserved heterogeneity, we account for province fixed-effects, which capture any regional difference (i.e. culture, history, geography and/or climate) that could further affect sex ratios.[31] In addition, child sex ratios exhibit a clear geographical pattern, so we cluster standard errors at province level.

Lastly, as mentioned above, random variability may have also played a role in determining the observed child sex ratios, especially in the smallest districts. In order to check whether our results are robust to this issue, we replicate our analysis taking into account that the sample size underlying each sex ratio (the number of children in the corresponding age-group) is not uniform across our observations (Beltrán Tapia & Gallego-Martínez, 2020). This generalised linear model, which relies on maximum-likelihood methods that assume a binomial distribution and a logit function, can therefore predict the relative number of boys that would be compatible with the infant mortality rates while accounting for the varying role that chance plays in determining the child sex ratio in each district.[32]

4.2. Results

Table 1 reports the results of regressing child sex ratios (aged 0–4) on the set of variables explained above. While the first column only tests the relationship between our dependent variable and infant mortality rates, the remaining columns extend the model to sequentially include environmental, ethnic, religious and socio-economic factors, as well

as province fixed-effects (columns 2, 3, 4, 5 and 6, respectively). These results strongly confirm the importance of the mortality environment on shaping the relative number of boys and girls. Those districts suffering higher infant mortality rates end up with lower child sex ratios due to the male biological disadvantage. This variable alone explains 41.4% of the variation in child sex ratios in the 1897 Imperial census. The environmental variables, on the other hand, hardly show any clear relationship with the relative number of boys and girls. Only distance to river and ruggedness seem to have a statistically significant link to child sex ratios and these results are difficult to interpret.

Adding socio-economic, religious and ethnic factors increase the model's explanatory power, even though most of these variables are not statistically significant. The coefficients, however, of particular ethnic groups exhibit a strong and significant association with child sex ratios (the size of confidence intervals suggests considerable heterogeneity even within disaggregated ethnic groups; see, Figure 2 and Figure A6 in the Appendix). Moreover, they form specific patterns (e.g., Slavic & Baltic, Turkish language groups) that correspond to spatial patterns in the residuals depicted on the Maps 2–3. It is nonetheless difficult to interpret these coefficients. Some of them indeed may indicate the presence of strong patriarchal norms such as those defined as Turkish, Belarussian and Baltic, Greek, and Kalmyk. These results go in line with previous studies that argue that girls indeed suffered inflated mortality rates in these regions (Szoltysek et al., 2022b; Beltrán Tapia & Raftakis 2022). Other ethnic minorities showing a positive coefficient (Jewish, Germans), however, probably reflect a healthier environment for boys, which is not captured by the official infant mortality statistics and results in relatively higher child sex ratios. Interestingly, the groups of indigenous people settled in northern Russian and the Ural Mountains reveal a somewhat mixed picture: a positive coefficient for Mari, Udmurt and Samodeic people and a negative coefficient on Komi-Permyak people. Including provincial fixed-effects (Table 1, column 6) obviously improves the fit of the model because they capture other dimensions that our model has not been able to incorporate due to the lack of information (i.e., marriage patterns). The coefficients on most variables remain nonetheless virtually unchanged. The fact that some coefficients lose statistical significance is probably due to the lack of within-province variation.

As mentioned above, child sex ratios could be biased if the quality of registration varied by sex. In this regard, not only infants were generally more subject to under-registration, but age-heaping around age 5 could also be an issue. We have therefore estimated equation 1 relying on the 1–4 and 1–6 age-groups (instead of those aged 0–4), which are arguably less subject to these issues. The explanatory power of the model using those children aged 1–6 is indeed higher (instead of 58, the full specification with province fixed effects explains 65% of the variation in child sex ratios), which suggests that the quality of the underlying data is better. In any case, the estimated coefficients remain generally stable (see table A1 and Figure A6 in the Appendix), thus confirming that female under-registration is not likely to play an important role in the results reported here. Likewise, these results are not driven by the different role that random variability may have played in determining the observed child sex ratios. Table A2 in the Appendix reports the results of replicating the analysis using the GLM explained above. By taking into account the number of children in each district, this model effectively rules out that our results are driven by chance. In this regard, not only the coefficients obtained using this model mimic those obtained in the baseline specification (Table 1), but also the residuals from both models are highly correlated.[33]

Table 1. Correlates of child sex ratios (aged 0–4).

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Dep Var: Sex Ratio 0–4					
Infant Mortality	−0.643***	−0.577***	−0.525***	−0.527***	−0.528***	−0.434***
	(0.039)	(0.079)	(0.087)	(0.089)	(0.089)	(0.122)
Ln Dist. from coast		−0.020	0.029	0.078	0.058	0.036
		(0.105)	(0.114)	(0.119)	(0.128)	(0.262)
Ln Dist. from Moscow		0.018	−0.029	−0.024	−0.099	0.154
		(0.098)	(0.109)	(0.108)	(0.128)	(0.209)
Ln Dist. from river		0.079**	0.087**	0.088**	0.088**	0.081**
		(0.038)	(0.038)	(0.039)	(0.038)	(0.040)
Ln Ruggedness		−0.136	−0.138	−0.116	−0.118	−0.246**
		(0.094)	(0.115)	(0.112)	(0.110)	(0.122)
Ln Caloric index		−0.296*	−0.270	−0.446**	−0.340	−0.053
		(0.158)	(0.182)	(0.196)	(0.206)	(0.294)
Share Slavic			0.060	0.054	0.061	0.170
			(0.085)	(0.082)	(0.081)	(0.161)
Share Baltic			0.051	−0.038	−0.041	−0.115
			(0.046)	(0.061)	(0.061)	(0.084)
Share Finnic			0.012	−0.085	−0.068	−0.129**
			(0.043)	(0.056)	(0.060)	(0.060)
Share Uralic			−0.010	0.007	−0.014	−0.015
			(0.026)	(0.029)	(0.034)	(0.045)
Share Turk			0.051	0.107***	0.079**	0.127
			(0.046)	(0.035)	(0.035)	(0.080)
Share Kalmyk			0.060***	0.055***	0.043**	0.034
			(0.016)	(0.017)	(0.018)	(0.022)
Share Armenian			0.042***	0.045***	0.043***	0.041***
			(0.012)	(0.012)	(0.012)	(0.013)
Share German			0.004	−0.030	−0.028	0.070
			(0.018)	(0.021)	(0.024)	(0.045)
Share Greek			0.130***	0.139***	0.145***	0.168***
			(0.044)	(0.037)	(0.032)	(0.023)
Share Jewish			0.074**	0.086***	0.088***	0.119***
			(0.029)	(0.029)	(0.030)	(0.043)
Share Romanian			0.031	0.029	0.023	0.006
			(0.030)	(0.028)	(0.027)	(0.036)
Share Old Believers 1897				−0.017	−0.012	0.000
				(0.032)	(0.029)	(0.038)
Share Catholics 1897				0.038	0.083	0.133*
				(0.047)	(0.061)	(0.075)
Share Protestants 1897				0.168**	0.278***	−0.068
				(0.064)	(0.103)	(0.209)
Share Muslims 1897				−0.083*	−0.070	−0.074
				(0.045)	(0.044)	(0.053)
Share Industry 1897					−0.016	0.040
					(0.040)	(0.057)
Share Urban Pop 1897					0.020	−0.059
					(0.063)	(0.096)
Share Serfs 1858					−0.034	−0.027
					(0.046)	(0.065)
Share Literate 1897					−0.186*	−0.128
					(0.108)	(0.145)
Share Local-Born 1897					−0.063	−0.150
					(0.066)	(0.108)
Province FE	No	No	No	No	No	Yes
Observations	488	488	488	488	488	488
R-squared	0.414	0.460	0.485	0.493	0.498	0.583

Table shows standardized regression coefficients (dependent and explanatory variables have zero mean and standard deviation equals one). The sample includes districts belonging to European part of the Russian Empire. One district «Izmailskij» is excluded from the final sample as it was merged to Russian Empire after 1867 – some of the control variables are missed there. Several ethnicities are grouped into broader categories (Finnic, Turk, Blatic, Uralic and Slavic languages). Other controls include latitude, longitude, distance from Moscow (in logarithms), average temperature and precipitation levels. Standard errors are clustered at province level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

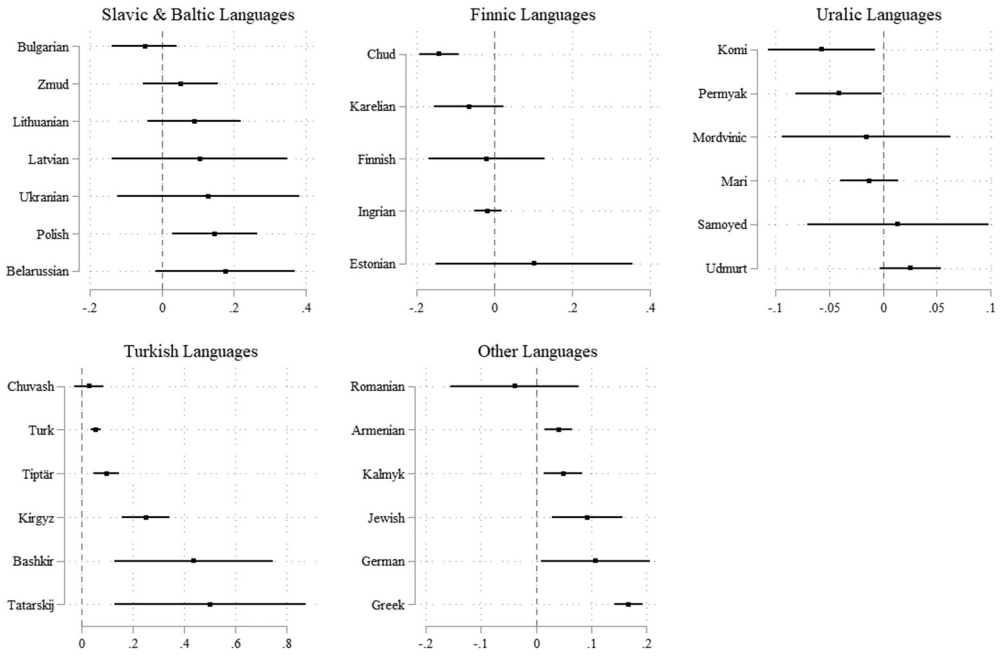


Figure 2. Ethnic Groups and Sex Ratios - Age 0-4 (regressions coefficients). Figure depicts standardized regression coefficients (dependent and explanatory variables have zero mean and standard deviation equals one) and corresponding 90% confidence intervals (regression specification includes environmental, economic controls, religious denominations (Shares of Muslims, Old-Believers, Protestants and Catholics) and province fixed effects).

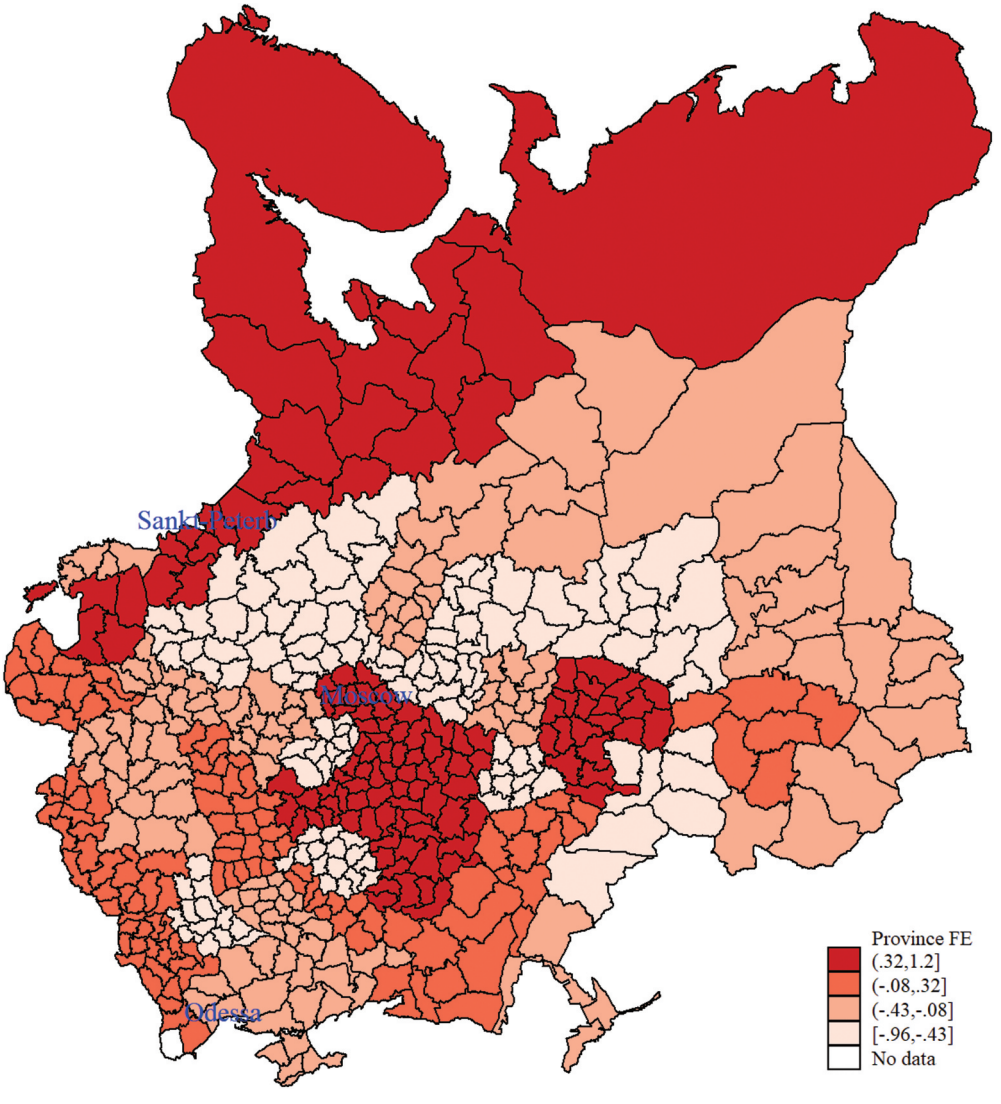
Analysing sex ratios at birth reported in the official birth statistics provides further insights (results are reported in Tables A1 and A2, columns 1–2 and 1, respectively). Despite that child sex ratios and sex ratios at birth correlate quite well (see figure A5), the explanatory power of the model (R-square) drops significantly from 0.6 to just 0.35 (specification with province dummies) either because sex ratios at birth at the district level tend to be quite random or because the worse quality of the vital statistics. It is true however that this result may also suggest that, if anything, discriminatory practices against girls were not happening right after birth but during infancy and childhood. The importance of most ethnic groups shows hardly any statistical relationship with sex ratios at birth, thus further supporting this interpretation. Interestingly, only the presence of minorities of Greek origin appear to significantly increase the relative number of male births, a finding that goes in line with previous research evidencing that female babies were neglected in Greece at least during the 19th and early 20th century (Beltrán Tapia & Raftakis 2022).

However, due to the lack of information, the econometric analysis does not account for several dimensions that may have played a role in explaining the variability in child sex ratios, such as the presence of different marriage patterns or the importance of conflict, among others. This is important because our results cannot therefore be wholly encompassing, but also because they might also be subject to omitted variable bias. In this regard, complex, large families have been

usually linked to strong patriarchal systems because having married sons living in the household was supposed to increase the land apportioned to the head of the household (Czap, 1983; Von Haxthausen, 1972, p. 82). Interestingly, although dowries were found in most rural areas, bride-price dominated in others (Engel, 1994, p. 77, p. 118; Hoch, 1986, pp. 95–105). This is important because it crucially affects the relative value of girls and therefore the incentives to discriminate them.[34] Dowering daughters was indeed becoming increasingly expensive: in the 1890s, correspondents to the Tver' zemstvo complained that the need to provide a dowry was driving peasants into debt. Bride-price, by contrast, appear to have been more important in the villages of industrial regions and where the repartional land commune existed. In these areas, grooms paid the bride's parents substantial sums to compensate the household for the loss of her earning power. The amount of bride-price was therefore a measure of woman's worth (Hoch, 1986, pp. 100–101). Marriage systems also shaped female age at marriage and post-marital residency, dimensions that contributed to women's status. Son preference, on the other hand, may have been accentuated in conflict-prone areas because it is argued that, while males were seen as useful defenders, females were considered liabilities based on the perception that they needed to be protected (Mavisakalyan & Minasyan, 2018; Sng & Zhong 2018).

Systematic information about the regional variability of these dimensions is however lacking, an issue that prevents a direct assessment of their role. Their effect, as well as other unobserved variability, is captured by the provincial dummies, whose inclusion significantly increase the explanatory power of our model (Table 1, column 6). Map 3, which depicts the spatial illustration of these effects (after controlling for all the other variables in our model), shows that regional clusters still exhibited high child sex ratios and therefore suggests that unobserved regional factors played a role on shaping the relative survival of boys and girls. The range of these unexplained effects is however smaller than when conditioning on infant mortality alone (see Map A4 in the Appendix), which means that ethnic features indeed constitute an important dimension in explaining child sex ratios in Imperial Russia.[35]

It should be also stressed that the regression analysis implemented here only focuses on the European part of the Russian empire because the lack of data on infant mortality in the other districts. The excluded districts, mostly in the Caucasus, between the Black Sea and the Caspian Sea, reported more than 4.2 more boys per hundred girls than the regions in the rest of the Russian Empire, what indicates that son preference could be especially strong there, a feature that seems to be still visible today (Mavisakalyan & Minasyan, 2018). In addition, not only average child sex ratios were higher in the 73 districts excluded, but some of them exhibited extremely unbalanced figures (Table 2). This analysis therefore does not exploit potentially relevant information and therefore may miss important patterns.



Map 3. Unobserved heterogeneity in Child sex ratios, ages 0–4.
Estimations obtained from the coefficients of the provincial dummies conditional on infant mortality, economic development, ethnic and religious minorities.

Table 2. Child sex ratios in the non-European part of the Russian Empire.

Region	Obs.	Mean	St. Dev.	Min	Max
European	488	98.7	2.5	89.7	108.6
Non-european	73	103.4	5.2	95.2	120.3

5. Long-term persistence of gender values

The previous analysis clearly suggests that socio-cultural dimensions influenced the way that parents perceived the relative value of boys and girls in the Russian Empire during the late 19th century. Given that cultural values, including gender norms, tend to persist over time (Giuliano & Nunn, 2021; Miho et al., 2020), testing whether the observed child sex ratios in the Imperial Census are associated with discriminatory gender norms today would further substantiate the claim that unbalanced child sex ratios did indeed reflect son preference and discriminatory practices against girls. This section therefore explores the possibility that these cultural traits were transmitted across generations and are still visible today by linking historical child sex ratios to contemporary measures of gender equality.

In order to do so, we rely on individual survey data. In particular, the Life in Transition Survey III[36] (LiTS) allows us to construct contemporary measures of gender equality for the same regions we have analysed using the 1897 Imperial Census. In this regard, the EBRD, in collaboration with the World Bank, has carried out three such surveys: one in 2006, one in 2010 and one in 2016. The most recent polled 51,000 households in 34 countries, mainly 'transition countries' in central and eastern Europe as well as Turkey and also, for the sake of comparison, with more prosperous western neighbours (Germany and Italy). The LiTS data therefore allows assessing differences in gender norms in modern countries that belonged to the Russian Empire in the past: Russia, Ukraine, Belorussia, Lithuania, Latvia, Estonia, Georgia, Armenia, and Azerbaijan. Using this survey information, we construct the following binary indicators:

(1) whether an individual agrees that equal rights for women as citizens are important for the country;
(2) whether an individual disagrees that a woman should do most of the household chores even if the husband is not working;
(3) whether an individual agrees on the importance of educating daughters.

This modern survey data is linked to the information contained in the Imperial Census,[37] which allows estimating whether there is a relationship between the contemporary individual-level outcome (individual's attitude towards gender equality) and the child sex ratios existing in 1897, while controlling for age, gender and household size, as well as district-level control variables (geography, mortality, historical economic development). This analysis therefore explores the potential long-term persistence of the factors explaining the residual variation in child sex ratios (after conditioning on mortality environment and geographical factors).

Table 3 presents the results of this regression analysis showing that areas with historically higher child sex ratios exhibit a relatively higher share of people who refuse to accept equal rights for women as a basic principle of society. The effect is quite sizeable: increasing the number of boys per 100 girls by one unit decreases the individual's probability of accepting equal rights for women by 2 percentage points. This link is also visible when assessing opinions about the importance of educating daughters and the role of women as housewives. These results are robust to employing different sets of control variables, as well as restricting the sample by excluding the non-European

Table 3. Child sex ratios and gender norms in the modern countries – former parts of the Russian Empire.

	(1) Female equal rights	(2) Female equal rights	(3) Female equal rights	(4) Female equal rights	(5) Equal house duties	(6) Daughter educ	(7) Female equal rights	(8) Female equal rights
Sex Ratio, Age 0–4	−0.006**	−0.017***	−0.015***					
	(0.003)	(0.005)	(0.004)					
Sex Ratio, Age 1–4				−0.014***	−0.007*	−0.004	−0.013**	−0.013**
				(0.004)	(0.004)	(0.004)	(0.006)	(0.006)
Infant Mortality								0.000
								(0.001)
Outcome mean	0.88	0.88	0.88	0.88	0.43	0.89	0.89	0.89
Outcome SD	0.32	0.32	0.32	0.32	0.50	0.32	0.31	0.31
Sample	Europe + Caucasus	Europe + Caucasus	Europe + Caucasus	Europe + Caucasus	Europe + Caucasus	Europe + Caucasus	Europe	Europe
Individ. controls	yes	yes	yes	yes	yes	yes	yes	yes
Country FE	yes							
Region FE		yes	yes	yes	yes	yes	yes	yes
Observations	5,409	5,409	5,409	5,409	5,330	4,803	3,540	3,540
R-squared	0.118	0.222	0.232	0.232	0.394	0.148	0.256	0.256

Mean Sex ratio Age 0–4 = 104.41, SD = 4.35. Mean Sex ratio Age 1–4 = 101.66, SD = 4.28. Sample includes countries that belonged to the Russian Empire in 1897. LiTS data is restricted to rural inhabitants since we focus on gender-specific norms that could affect historical sex ratios in rural areas and persist over time. Individual controls include indicators of age, gender and household size. District-level controls include Soil Caloric Index (Galor & Ozak, 2016), latitude, longitude, average temperature and precipitation, ruggedness (Puga, 2012), distances to Moscow, nearest coastline and navigable river (in logarithms), the share of industrial workers, the share of literate population and local-born residents by 1897.

districts. The estimated coefficient on historical sex ratio remains stable and statistically significant. In addition, using the child sex ratio at age 1–6 as a robustness check does not change the results either (Table A3).

Even though these findings cannot be interpreted in a causal sense, they suggest that the observed spatial patterns in child sex ratios (that are not explained by environmental and economic factors) indeed reflect deep cultural norms that can be linked to particular social and cultural values present in these different societies.

6. Concluding remarks

Child sex ratios were 'naturally' lower in the past. Males are biologically weaker and this translates into a relatively lower number of boys surviving through infancy and childhood in high-mortality environments. The relative low child sex ratios, well below 100 boys per hundred girls aged 0–4, observed in the 1897 Imperial Census therefore reflect the fact that Russia suffered one of the highest infant and child mortality rates in Europe. This link is not only visible at the country level, but also when analyzing differences within Russia: our regression results confirm the importance of the mortality environment on shaping child sex ratios at the district level, even after controlling for a wide range of socio-economic variables. In particular, our estimates indicate that going from 150 to 250 infant

deaths (per thousand live births) implies a reduction of between 1.3 and 2.1 boys in the child sex ratio (aged 0–4), depending on the specification. These results are in line with other models that link the evolution of infant mortality rates and child sex ratios over time (Beltrán Tapia & Gallego-Martínez, 2017; Beltrán Tapia, 2019; Szoltysek et al. 2022a).

The mortality environment, however, is not able to fully explain the variation in child sex ratios observed in the Russian empire at the end of the 19th century. Although the set of economic dimensions analysed here do not show any significant association with child sex ratios, spatial patterns in the unobserved variability suggest that particular contexts may have been more deleterious to girls. There are regional clusters of high child sex ratios in different parts of the empire, even after controlling for the level of development and geographical factors. This unexplained regional variation can be partially explained by the presence of particular ethnic minorities (Polish, Belarussians, Jewish, Greek, Turkish and Baltic language groups, among other groups). It is important to note that the role of these groups holds even after controlling for religious factors. However, it is unclear whether their importance is driven by particular family norms and/or cultural values. Our analysis is indeed silent about the role that more patriarchal family types and marriage systems may have played in fostering gender discrimination (Szoltysek et al. 2022b). Belarus and northern Ukraine, for instance, seem to have exhibited strong patriarchal features during 18th and the 19th centuries (Szoltysek, 2015, pp. 780–781). Similarly, Szoltysek and Gruber (2018) also shows that the indigenous population inhabiting the northernmost areas of Russia also constituted highly patriarchal contexts well into the early 20th century. Likewise, this article has not explored the possibility that conflict-ridden areas may have also put more value on sons, an issue that has resurfaced in recent times in some of these regions (Mavisakalyan & Minasyan, 2018).

Further research is therefore needed to better substantiate the dimensions that are behind the large variation in the relative number of boys and girls documented in the 1897 Imperial census. Our research nonetheless also suggests that the cultural values behind the discriminatory patterns detected here can persist over a long period of time. Contemporary surveys show that individuals living in areas that suffered high child sex ratios in the late 19th century are less gender equal today, even after controlling for a host of potential confounders. This exercise further supports the claim that the unbalanced child sex ratios observed in the 1997 Imperial Census did indeed reflect son preference and discriminatory practices against girls. Although the evidence provided here is mostly descriptive, these results shed light on the important question of whether those factors explaining historical sex ratios can persist over time and affect gender norms in modern societies. Additional research is however needed to properly identify the exact mechanisms that explain the persistent long-run effects of historical child sex ratios.

Likewise, more efforts are required to detect whether discriminatory practices happened around birth and/or during infancy and childhood. Recent research on Southern Europe shows that, while a fraction of girls could have been neglected right after birth (Beltrán Tapia & Marco-Gracia 2021; Beltrán Tapia & Raftakis, 2022), the lion's share of the missing girls' phenomenon in the Mediterranean was probably linked to an unequal allocation of food and care as children grew older (Beltrán Tapia & Cappelli 2022; Marco-Gracia & Beltrán Tapia 2021). The fact that sex ratios at birth and at older ages correlate quite well at the district level suggest that both mechanisms might be playing a role. It is true nonetheless that the econometric analysis is not able to find clear links between local

factors and sex ratios at birth, thus suggesting that female neglect around birth was probably less important than during infancy and childhood. Given that parish registers usually allow following children from birth to death, analyzing these sources is especially promising in order to be more precise about the kind of discriminatory practices that were actually in place. Similarly, although we have some information on the sex-specific patterns in child abandonment in Moscow and St. Petersburgh (Ransel, 1988), we know very little about child abandonment in rural areas, a phenomenon that could actually be quite important, quantitatively speaking.

As well as having a more informed picture of the situation around the 1897 Imperial Census, future research should attempt to elucidate what may have happened in earlier periods. If anything, the intensity of patriarchal values declined throughout the 19th century (Moon, 1999; Worobec, 1991), so the patterns observed here may have been stronger as we moved back in time (see, also Ransel, 1988, pp. 131–134). Not only the sheer scale of the empire and its large internal differences makes the Russian case-study especially interesting, but also the institutional changes that were implemented during the 18th and 19th centuries (such as the abolition of serfdom or the military reforms, among others) may have had an important impact on the relative value of boys and girls and therefore on how parents treated their children.

Notes

1. In contrast to provinces, which are larger units, districts here refers to *uezd*, the second administrative division of the Russian Empire.
2. In 1875, life expectancy was about 30 and 33 years for males and females, respectively (Adamets 2002, 162; Hoch, 1998). Apart from cyclical fluctuations due to epidemics and poor harvests, average mortality rates did in fact not change much between 1867 and 1909 (Adamets 2000, p. 162). Although the view that living standards were stagnant in late Imperial Russia has been recently challenged (see, for instance, Hoch, 1994; B. Mironov, 2012; Markevich & Zhuravskaya, 2018 or Natkhov & Vasilenok, 2020), Russian peasants nonetheless lived at the verge of subsistence as infant mortality rates and the impact of the 1891–92 Famine show (see, also Dennison & Nafziger, 2012).
3. It seems that Muslim women not only breastfed for a longer period, but they also played a different role in the household and did not perform heavy tasks outside the home, thus allowing them to be closer to their infants (Ransel et al., 1991, pp. 124–125). In this regard, it seems that, the reproductive role of Muslim women was prioritised over more economic functions (p. 129).
4. Sayings and proverbs also stress these fatalistic attitudes and how little value was attached to infants: 'It's a good day when a child dies' or 'It's better to lose an egg than a chicken' (Ransel, 1988, p. 273; Ransel et al., 1991, p. 120). Also in Semionova (1973, p. 100): 'when a poor family's child dies, people say: "Thank goodness, the Lord thought better of it"'.
5. The head of the household was the patriarch and he remained in this role until his death. Russian peasant households practiced a strict division between sexes, affecting working roles, eating arrangements, and property and inheritance customs (Tovrov, 1978, p. 17; Glickman et al., 1991). See, Worobec (1991, pp. 175–216) and Engel (1994, pp. 8–25) for more details on the Russian patriarchal system.
6. Semionova's (1973, pp. 9–10) ethnographical account even mentions an apparently 'well-established custom' that encouraged friends and acquaintances of the father whose first-born is a girl to beat him. The thrashing takes place while the male group stresses how a bad idea it was to have a daughter. See, also Fedjaevskij (1905).

7. The communal land property regime was widely spread in 19th century Russia. The entire communal land was a subject of re-distributions based on the number of adult males in families. Accordingly, having more boys could benefit a family at the time of land redistribution. Women's status within the household and the community improved as she bore and raised children, especially sons (Worobec, 1991, p. 204; Engel, 1994, p. 14).
8. More examples in Worobec (1991, p. 62): 'A daughter is someone else's booty.' 'A daughter is someone's else labourer.' 'Feed a son and he will be of use to you; feed a daughter and you [will have] to give her to someone else.'
9. Although this interpretation has not remained unquestioned (Mironov, 1984), Levin (1986) sides with Hellie (1982) arguing that female infanticide was more likely among the poorest segments of the population.
10. Ransel (1988, p. 131) is nonetheless cautious due to the potential role of female under-registration.
11. It is interesting to note that village women believed that the fewer people who knew about the birth, the safer it would be for mother and child (Ransel et al., 1991, p. 116), thus facilitating the disposal of babies claiming that they were stillbirths. In opposition to those dictated by economic hardship, the Church and society were much less sympathetic of infanticide when it was associated with sexual misconduct. Similar considerations were in place during the 19th century. Infanticide constituted a continuous concern in medical and legal circles but, contrary to abortion which was legally considered premeditated, infanticide was more excusable and less reprehensible form of murder because the mother was presumed to have acted impulsively under the pressure of an abnormal physical and mental state (Engelstein et al., 1991, pp. 186–188).
12. Commenting on her writings, David Ransel indicates that 'there is no reason to doubt their accuracy' (Semionova, 1973, p. 95).
13. The practice of 'baby carting', sometimes over more than a hundred kilometres under extreme weather conditions, was as deadly as the foundling hospitals themselves (Ransel, 1988, p. 86).
14. Contemporaries estimated that around 25–50% of the admission were legitimate children (Ransel, 1988, p. 111).
15. For more details, see, Ransel (1988, pp. 106–111, p. 119).
16. Contemporaries were well aware of the possibility that removing the open-admission policy would lead to more infanticides (Ransel, 1988, pp. 88, 93). Desertion of children in the streets did indeed increase (122). The exclusion of legitimate infants also meant that an indeterminate share of children from neighbouring regions remained now in those provinces (p. 126).
17. Studying Tambov in the 1850s, Hoch (1986, p. 67) estimates that males enjoyed a significantly higher life expectancy.
18. The 1897 census was organized by the Ministry of the Interior (MVD) and the instructions contained explicit questions dealing with both the scientific and administrative challenges that the enumeration could face (Cadiot, 2005). Over 150,000 census takers carried out the enumeration, which as well as civil status and occupation, also reported language, religion, and *soslovie*, among other questions, which were supposed to capture the sociocultural profile of the Empire. See, also Clem (1986). By contrast, the main purpose of the household tax census of 1678 and the ten poll tax censuses held between 1719 and 1858 was to count 'male souls' in order to calculate how much tax they had to pay (Moon, 1999, p. 20).
19. According to the 1897 Census, approximately 15% of the population in European Russia (excluding Poland and Finland) and Caucasus resided in urban areas.
20. Sample populations from Poland and Lithuania from the 18th century to the early 20th century also exhibit child sex ratios revolving around 100 boys per hundred girls (Szoltysek, 2015, p. 893).
21. Data on vital statistics was not published between 1891 and 1895.
22. This number refers to European part of the Empire. Districts here refer to 'uezd', the second administrative division of the Russian Empire (provinces were the first unit).

23. We remove 3 outlier districts to obtain this number, the correlation coefficient in unrestricted sample equals 0.48.
24. The statistical volumes were prepared by the Central Statistical Committee.
25. Figure A5 in the Appendix compares the Russian data to the long-term European experience (1750–2016). Although the Russian data only refers to one point in time (1897), the underlying patterns are exactly the same. Notice also that, compared to country-level info, the Russian districts are smaller, thus exhibiting a higher degree of random variability.
26. Moran's I = 0.1; statistically significant at the 99% level. The value of this statistic increases to 0.18 when we use the 1–6 age-group, which is probably less affected by registration issues.
27. Although mostly focusing on adults, Rowney and Stockwell (1978, p. 223) argue that the main source of inaccuracies in the 1897 census concerns the age records, an issue that seems to have especially affected illiterate females. However, children are less likely to be affected by this issue because their ages are easier to remember. These authors indeed show that age-heaping markedly increased with age and that female age-heaping is hardly visible in the 8–17 age-group (pp. 224–225).
28. Several 'corrections' were implemented to improve the reliability of native language as an indicator of nationality (Silver 1986). For example, the information gathered on the estates (sosloviya) and on religion often contained information on nationality, information that was then used to derive better estimates of the ethnic makeup of the population of certain regions. As a result of these corrections, reported native language is not derived solely from the direct census responses to the question on native language.
29. See, Glavatskaya et al. (2017, p. 241). Persecuted by the State, they escaped to remote areas in the Russian North and Siberia. They also seem to belong to the upper segments of the population.
30. As a measure of exogenous soil productivity we use Caloric Suitability Index (Galor & Özak, 2016). Climate data is provided by GAEZ, the computation of the distances are based on the Russian Empire shape file provided by Kessler, Gijs, 2017, 'Maps', https://hdl.handle.net/10622/DN9QDM, IISH Data Collection, V2. Ruggedness data is provided by D. Puga https://diegopuga.org/data/rugged/.
31. For example, the regional differences (between provinces) in climate and economic conditions could strengthen male survival bias that would result in lower sex ratios among older cohorts. Our specification is designed to capture these differences.
32. Another advantage of this method is that it deals with the bounded nature of sex ratios (for more details, see Wilson & Hardy, 2002). Note that this method estimates the number of boys depending on the total number of children in each district, so it requires re-computing the new (predicted) sex ratios.
33. The correlation between the residuals arising from column 6 Table 1 and column 2 Table A2 in both models is 0.89.
34. See, for instance, the role of dowries in driving female neglect in Modern Greece (Beltrán Tapia & Raftakis, 2022).
35. Comparing the spatial patterns depicted in Maps 3 and A4 with the distribution of particular ethnic groups (Map A2) indeed suggest some correspondence between the province fixed effects and the regression coefficients on these groups from Figure 2 and Figure A6. This implies that at least part of the unobserved factors (e.g., marriage patterns, prevalence of patriarchal norms and disadvantaged labor status of women) captured by province fixed effects can be connected to particular ethnic groups where such factors could be particularly strong.
36. Source: https://www.ebrd.com/what-we-do/economic-research-and-data/data/lits.html. LiTS data has been used in many prominent research papers (i.e. Buggle & Nafziger, 2021; Grosfeld et al., 2013).
37. We compute distances from each municipality in LiTS data to the nearest 1897 district. Accordingly, we use this information for linkage.

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