

DISCUSSION PAPER SERIES

DP17416

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ECONOMIC HISTORY

CEPR

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Discussion Paper DP17416

Published 30 June 2022

Submitted 29 June 2022

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www.cepr.org

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Abstract

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JEL Classification: N3, J16, I12

Keywords: Gender Discrimination, Sex ratios, mortality, neglect, Italy

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Abstract

By relying on the relative number of boys per hundred girls as a cumulative measure of differential mortality during birth, infancy and childhood, this paper shows that Italian average child sex ratios (aged 0-4) were very high between 1861 and 1921. Our estimations indicate that unexplained female mortality could have resulted in around 2-3 per cent of “missing girls” during this period. Likewise, by constructing a new dataset on child sex ratios at the provincial level during the same period (roughly 69 provinces x 6 census years), this article shows that child sex ratios tended to be higher in Southern Italy, a geographical cleavage that became stronger as time went by. Crucially, the results reported here, both at the national and the province levels, cannot be explained by registration issues because (1) the analysis holds if we focus on the child sex ratios of older children (aged 5-9) and (2) female excess mortality is also visible using death registers. Lastly, this article shows that unexplained female mortality early in life disappeared from the 1920s onwards, thus suggesting that either discriminatory practices gradually vanished and/or that they no longer translated into higher mortality rates due to increasing living standards.

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1. Introduction

While the social and economic status of women in Italy has improved in recent decades, Italian women still have one of the lowest labour-force participation rates in the OECD and their work is poorly remunerated, especially compared to other countries in the European Union (OECD 2017; Mancini 2018). Likewise, significant gender gaps are visible in managerial ranks and the political arena (Bozzano 2014). There are however striking regional disparities and women's relative status is particularly impaired in Southern Italy (Bozzano 2017, 29). Although ethnographic and anthropological accounts stress the continuities and changes that took place after World War II (Cornelisen 1976; Schneider and Schneider 1996), inherited cultural norms, especially those arising from religious values, have played a crucial role in limiting the involvement of women in Italian society (Bozzano 2017). In this regard, using a collection of family monographs from the 1930s, Mancini (2020) finds a rigid division of labour by sex. As Mancini (2018) argues, however, we know very little about the long-term evolution and regional disparities in the status of women in Italy.

This article focuses on the possibility that gender-discriminatory practices affected female mortality rates early in life. Female neglect tends to go hand by hand with a marked preference for sons, especially in agricultural societies. There is indeed some evidence indicating that sons were more valued than daughters in 19th- and early-20th-century Italy due to their higher economic utility¹. Between 1819 and 1859, sharecroppers in Casalguidi (Tuscany) tended to favour large families in order to secure male labour and especially a male heir (Mandredini et al. 2016). Qualitative evidence compiled in rural areas in the 1930s sometimes indicated that newborn girls were not welcome because, while they consumed household resources, their labour was employed somewhere else when they married (Mancini 2020). Indeed, patrilocal arrangements, found in many Italian regions, also meant that daughters were not expected to take care of their parents in old age. Likewise, the pervasive dowry system meant that daughters imposed an additional burden to family resources (Kertzner 1991, 9)².

Accounts of son preference linked to patriarchal dimensions are also present in the ethnographic and anthropological literature written on Italy. Studying a small town in central Italy after the Second World War, for instance, Silverman (1975, 186) reports that, while news of a boy were greeted with jubilation, a girls' birth brought a more subdued response³. Similarly, parents in Southern Italy did not consider daughters as children but as burdens both because of the dowry and because the longer they remained unmarried the more concern about their potential lost virginity and the consequent damage to family honor (Schneider and Schneider 1976, 89-90; Galt 1991, 312). Even more extreme is the following Sicilian proverb: "Blessed is the door out of which goes a dead daughter" (Chapman 1971, 30).

These arguments very much resemble those present in developing countries today (Das Gupta et al. 2003). It is indeed puzzling that these issues have received little attention despite the fact that many regions in Southern Europe exhibit patriarchal features that have been associated with the phenomenon of missing girls in Southeast Asia such as patrilocality, dowry systems, strong kin ties and rigid gender segregation, among others. A recent wave of studies has nonetheless suggested that the inferior status of women in other Southern European countries resulted in female neglect during infancy and childhood and unduly increased female

¹ Illegitimate boys had considerable higher chances of being legally recognized later, at least until the early 1900s (Pinelli and Mancini 1997, 84).

² On the dowry system in Italy, see Brettel (1991).

³ Also in Berkowitz (1984, 88). Proverbs also convey similar attitudes: "Boy: one builds a house, girl: the house falls down" (in Galt 1992, 44).

mortality early in life (Beltrán Tapia and Gallego-Martínez 2017; Beltrán Tapia 2019; see also Szoltysek et al. 2022)⁴. Gender discrimination seem to have occurred both right after birth and as soon as infants were weaned and started competing for familial resources (Beltrán Tapia and Marco-Gracia 2021; Marco-Gracia and Beltrán Tapia 2021). These results are more visible at large parities and in resource-constrained families, thus suggesting that, in patriarchal societies, economic considerations played an important role in activating female neglect early in life. The Greek case, where perhaps more than five per cent of girls went “missing” between 1861 and 1920, is especially dramatic (Beltrán Tapia and Raftakis 2021).

Despite the abundant material suggesting that Italian parents may have treated their sons and daughters differently, the hypothesis that Italian girls suffered from an inflated mortality around birth, infancy and/or early childhood has hardly been explored explicitly⁵. Interestingly, analyses of large samples of birth and death records from different locations in northern Italy during the 19th and early-20th century do not find significant sex differences in the probability of dying during the first months of life (Breschi et al. 2000, 473–484; Scalone et al. 2017, 35; Minello et al. 2021, 204-206)⁶. Although the authors do not tackle the issue, their results clearly clash with the well-known fact that more boys than girls normally die during infancy due to the male biological vulnerability (Drevenstedt 2008; Zarulli et al. 2018). In addition, the fact that female excess mortality at ages 1-4 is clearly visible both in the country-level statistics and in studies using large individual-level samples is not usually addressed despite the fact that the biological advantage of females should continue during early childhood (Alter et al. 2004, 334; Oris et al. 2004, 366; Dalla-Zuanna et al. 2017, 66-67). The above results therefore suggest that gender-discriminatory practices might have been at play. Pinelli and Mancini (1997) indeed tentatively argue that an unequal allocation of care and nutrition played a crucial role in explaining sex-specific mortality differences early in life, at least until the 1920s. According to these authors, deep structural transformations improved women’s status from then onwards which, in turn, led to changes in socio-cultural practices that benefited girls’ overall living conditions⁷.

Recent research has nonetheless started to pay attention to these issues. Baptismal records and status animarum suggest that female infanticide could have been relatively prevalent in Italy during the 16-18th centuries, especially under difficult circumstances (Hynes 2011; Hanlon 2015). Relying on child sex ratios as a cumulative measure of female neglect during infancy and childhood, Beltrán Tapia (2019) shows that Italy exhibited an excess of males in the late 19th-century. Micro-level analyses also seem to point out similar results. Derosas (2012), for instance, suggests that infanticide and/or mortal neglect affected girls more than boys in mid-19th century Venice, an issue that was particularly prominent in resource-

⁴ These studies challenge the notion that there were no missing girls in historical Europe (Lynch 2011). These works build on previous research by Tabutin (1978), Johansson (1984), Tabutin and Willems (1998) or McNay et al. 2005). A related strand of the literature that uses heights or household expenditures also argue that girls were discriminated in the allocation of resources within families (Baten and Murray 2000; Horrell and Oxley 2016). Other studies, however, do not find such patterns (Harris 2009; Saaritsa 2017).

⁵ Although data from baptismal records, population counts and cemeteries point to an excess of males in Medieval Italy, the nature of the sources does not allow deriving strong conclusions about whether women invisibility is due to under-registration or neglect (Herlihy and Klapisch-Zuber 1985; Barbiera 2008; Dalla-Zuanna et al. 2012; Barbiera et al. 2017).

⁶ Minello et al. (2017, 66) also notice that, compared to other European countries, the male disadvantage during infancy in their area of study (Veneto, 1815-1870) is very small.

⁷ Recently, Mancini (2020) shows that women worked as much (or even more) as men but commanded a lower share of total household income in the 1930s. An analysis of household nutrition and expenditures suggest that perhaps young girls were somewhat discriminated in the allocation of household resources, but the analysis is not conclusive. As well as issues of how representative these biographies are from the rural population and especially the bottom part of the population, it should be acknowledged that the South is under-represented (Mancini 2020).

constrained families. Similarly, complex families seem to have been especially detrimental to girls' health during the first years of life (Manfredini et al. 2017). The patrilocal and patrilineal nature of these families, many under sharecropping contracts that strongly relied on male labour, decreased female survival chances, especially in early childhood. Lastly, it is well known that some Italian regions abandoned more girls than boys, especially before 1850 and in areas where foundling homes allowed abandoning legitimate children (Corsini 1991; Hunecke 1991; Kertzer 1993, 110-112).⁸

Relying on population census, this article stresses the existence of an excess of male children in the second half of the 19th century and the early 20th century. Child sex ratios provide a cumulative measure of neonatal, infant and child mortality and therefore allow detecting patterns of female neglect. According to our estimations, around 2-3 per cent of girls went “missing” during this period. Crucially, female excess mortality is also visible using death statistics and thus rules out the possibility that our results are driven by registration issues with the censuses. While female under-registration would bias child sex ratios upwards, it would also underestimate female mortality rates. Our results are consistent regardless we rely on population censuses or vital statistics and therefore indicate that female under-registration does not explain our findings. Lastly, this article also uncovers significant regional patterns, both in levels and in their trajectories over time. In this regard, while female excess mortality declined in the Northern provinces during the period of study, child sex ratios in the South remained relatively high at least until 1921.

Apart from shedding more light on the issue of missing girls in historical Europe (Beltrán Tapia and Gallego-Martínez 2017; Beltrán Tapia 2019; Echavarrí 2022; Beltrán Tapia and Marco-Gracia 2022; Szoltysek et al. 2022; Beltrán Tapia and Raftakis 2022), these results imply that the relative changes in male and female mortality rates during infancy and childhood that took place during the epidemiological transition are partly explained by changes in parental practices⁹. While the increase in the female advantage in life expectancy that started in the late 19th and early 20th century has been associated with the reduction in infectious diseases as a major cause of death (Hinde 2015; Goldin and Lleras Muney 2019), our research suggests that the biological female advantage was less visible in the 19th century because it was constrained by existing discriminatory practices in infancy and childhood. The gradual fading of these practices would have therefore contributed to explaining the improvements in female health in regions where son preference penalised girls. The experience of Southern Europe fits this pattern as the improvement in female labour opportunities (and subsequently the status of girls) during this period has been linked to a reduction in the relative mortality rates of female infants and girls (Pinnelli and Mancini 1997; Beneito and García-Gómez 2022).

Likewise, this article also contributes to capture the influence of socio-cultural factors on infant and child mortality in Italy. As Breschi et al. (2004, 212) acknowledge, this mechanism is often mentioned but rarely measured. Recent research however has started filling this gap. Analyzing, for instance, the life histories of almost 34,000 births in the Veneto region between 1816 and 1865, Minello et al. (2021) show that the number of given names is positively associated with the probability of surviving the first months of life. The authors argue that this measure captures the investments that parents intend to make in the child and the relative level of attention and care given to them. Similarly, Derosas (2012) argues that parental neglect contributes to partly explain the extremely high mortality rates during birth, infancy and childhood observed in some Italian regions. Our article follows this trend by considering the

⁸ Son preference also seems to apply to the likelihood of adopting those foundlings later on (Kertzer 1993, 112).

⁹ On differences between male and female mortality rates early in life, see also Waldron (1998), Sawyer (2012) and Costa (2017).

possibility that gender-discriminatory practices, reflecting the perceived relative value of boys and girls, influenced their respective survival chances.

Lastly, our findings are not only important because they bring to light veiled patterns of gender discrimination but also because they open up the possibility of further linking gender inequality and Italian economic development. According to recent literature, the prevailing attitudes towards girls have historically affected women's education, fertility rates and female participation in the labour market (Dilli et al. 2015; Carmichael et al. 2016)¹⁰. Other authors also stress how gender inequality may even influence social stability and crime rates (Hesketh and Xing 2006; Edlund et al. 2013). Although several features have been linked to the long-term evolution of Italian economic development, both in terms of its relative decline compared to other advanced economies and the persistent of a clear regional divide¹¹, the potential role played by gender inequality has been mostly neglected. Interestingly, female labor-market participation rates show diverging regional trends (Mancini 2017, 2018), a feature that is likely to have limited labour productivity in some regions (Cappelli et al. 2019). Given that the importance of gender inequality can be proxied by the intensity of female neglect, the trajectories depicted here using child sex ratios, both at the national and regional level, may carry important implications for the analysis of Italian economic development over the long run.

2. Sex ratios at birth, infancy, and childhood in Italy

The potential effect of gender discriminatory practices on the relative mortality of males and females should theoretically be visible in the relative number of boys and girls observed in birth statistics and population censuses (Sen 1990; Das Gupta et al. 2003; Klasen and Wink 2003; Jayachandran 2017). However, a comprehensive analysis of this index has not yet been carried out for Liberal Italy (1861 – 1921).¹² This section analyses the sex ratios at birth, infancy, and childhood in Italy from the Unification to the beginning of the 21st century to investigate if – and to what extent – discriminatory practices linked to gender were taking place and how they varied across regions and over time.

Sex ratios at birth

The relative number of male and female births is relatively regular, at least in large populations. In most developed countries today, the sex ratio at birth revolves around 105-106 boys per hundred girls (Hesketh and Xing 2006; Chao et al. 2019). Figure 1 compares the Italian sex ratios at birth to those of other European countries between 1750 and 2015. While the Italian experience mostly conforms to the general international pattern, the figures in the second half

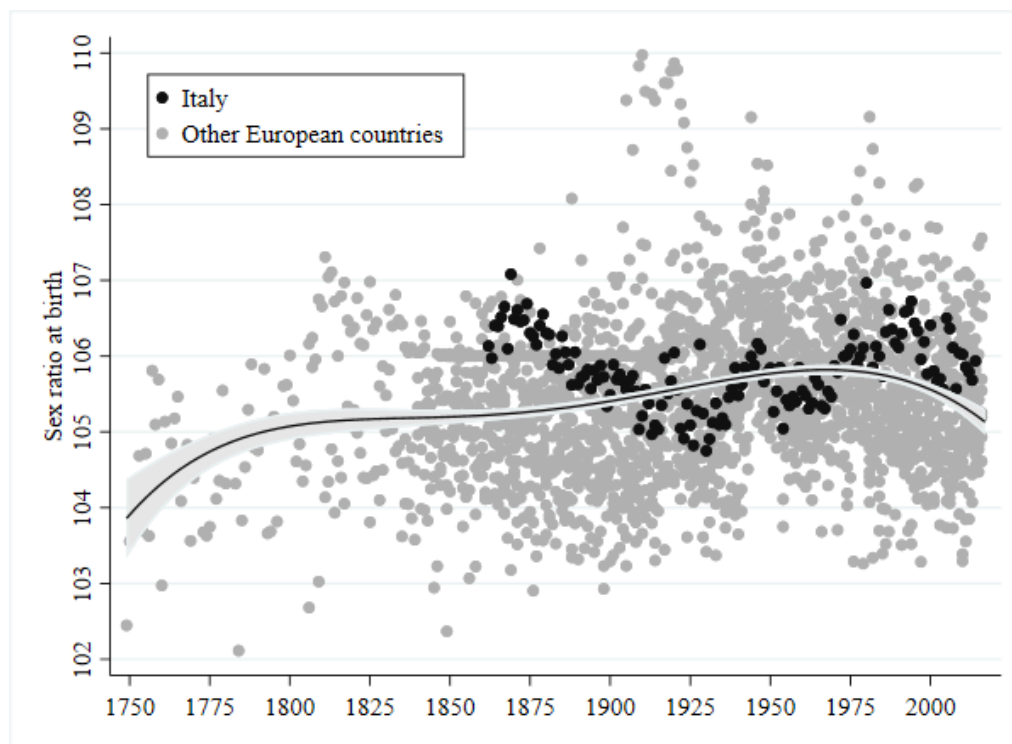
¹⁰ See also De Moor and Van Zanden (2009), Foreman-Peck (2011); Humphries and Sarasúa (2012), Denison and Ogilvie (2014; 2016), Szoltysek and Poniat (2018), De Pleijt and Van Zanden (2021) or Baten and De Pleijt (2018), among others.

¹¹ While one strand of the literature stresses that social and institutional features did not promote human capital, innovation, and technological progress (Felice and Vasta 2015; Colli and Rinaldi 2015; Nuvolari and Vasta 2015, 2017; Cappelli 2016; Federico et al. 2019; Cappelli and Vasta 2020), other contributions focus on the role played by geography and market access (A'Hearn and Venables 2013; Basile and Ciccarelli 2018; Missiaia 2019). Scholars have also stressed the importance of informal institutions, including social capital and generalized trust, on limiting economic performance (Felice 2012; Di Martino et al. 2020).

¹² Although A'Hearn and Ciccarelli (2021) show the existence of a North-South gradient on child sex ratios (aged 0-4) in 1911, these authors do not explore the nature of these regional differences.

of the 19th century were slightly elevated, averaging 106.3 boys per hundred girls between 1862 and 1890 (with a maximum of 107.1 in 1869)¹³.

Fig. 1 Sex ratios at birth in Italy and Europe, 1750–2015



Source: Human Mortality Database (HMD).

Although not excessively distorted, these numbers suggest the possibility that a small fraction of girls could have been neglected around birth during the second half of the 19th century. Notice also that although the literature routinely uses the 105-106 as the expected sex ratio at birth, we have very little evidence of what the historical figure in absence of human manipulation should be (Visaria 1967; Chahnazarian 1988; Beltrán Tapia and Marco-Gracia 2021). Nevertheless, we know that the probability of miscarriages is high in the high-mortality environments existing in the past (Woods 2009) and males are biologically more vulnerable than females to strenuous contexts (Di Renzo et al. 2007; Dipietro and Voegtline 2017)¹⁴. This hypothesis is indeed clearly visible in the Italian case: while number of male stillbirths significantly exceeded that of females during the first decades of the 20th century, this gap declined over time, and especially so from the 1950s onwards (Rettaroli and Scalone 2021)¹⁵. If more male fetuses were dying before birth, the expected sex ratio at birth should therefore be lower in the past compared to today. The exercise plotted in figure 1 indeed suggest

¹³ See also Rettaroli and Scalone (2021), who analyse the evolution of Italian sex ratios at birth from 1910 onwards.

¹⁴ The mechanisms behind the higher vulnerability of male foetuses are still largely unknown (Dipietro and Voegtline 2017). As well as in perinatal and neonatal mortality, the female biological advantage continues through infancy and childhood (Waldron 1998; Drevenstedt et al. 2008; Peacock et al. 2012; Peelen et al. 2017; Zarulli et al. 2018).

¹⁵ Regression analyses further confirm that late fetal mortality, associated with a higher proportion of males among stillborns, is negatively linked to the sex ratio at birth (Rettaroli and Scalone 2021, 184).

that this was the case, thus further suggesting that the relatively high sex ratios at birth observed in 19th-century Italy definitely depart from what should be expected.¹⁶

We should nonetheless be cautious about the reliability of this early demographic reports (Breschi et al. 2012). Although the new Italian state started to systematically collect birth, death and marriage statistics in the early 1860s, the new institutional setting might have temporarily produced some errors in the vital statistics since counting and revisions happened locally and were therefore prone to suffer from the administrators' low skills, particularly in remote rural and southern Italy (Favero 2001; *Ministero di Agricoltura, Industria e Commercio* 1864: viii)¹⁷. These errors became marginal from 1883 onwards, when all the revision procedures were centralized (*Ministero di Agricoltura, Industria e Commercio* 1884: v). Likewise, there was some confusion regarding the definition of live births, which probably led to an overestimation of stillbirths before 1910 (Pozzi 2000). As discussed above, however, the male vulnerability implies that the sex ratio at birth should have been even higher if these stillbirths had been counted as live births. There is therefore room to hypothesize that Italian families could have neglected a small fraction of female infants.

Population censuses offer an alternative way of looking at this issue. On the one hand, it is a completely different source, so the registration process is different and, therefore, it does not necessarily suffer from the limitations of vital statistics. On the other hand, by analyzing the number of surviving boys and girls at different ages not only allows testing the accuracy of sex ratios at birth, but also assessing whether discriminatory practices may have unduly affected female mortality rates during infancy and childhood.

Child sex ratios

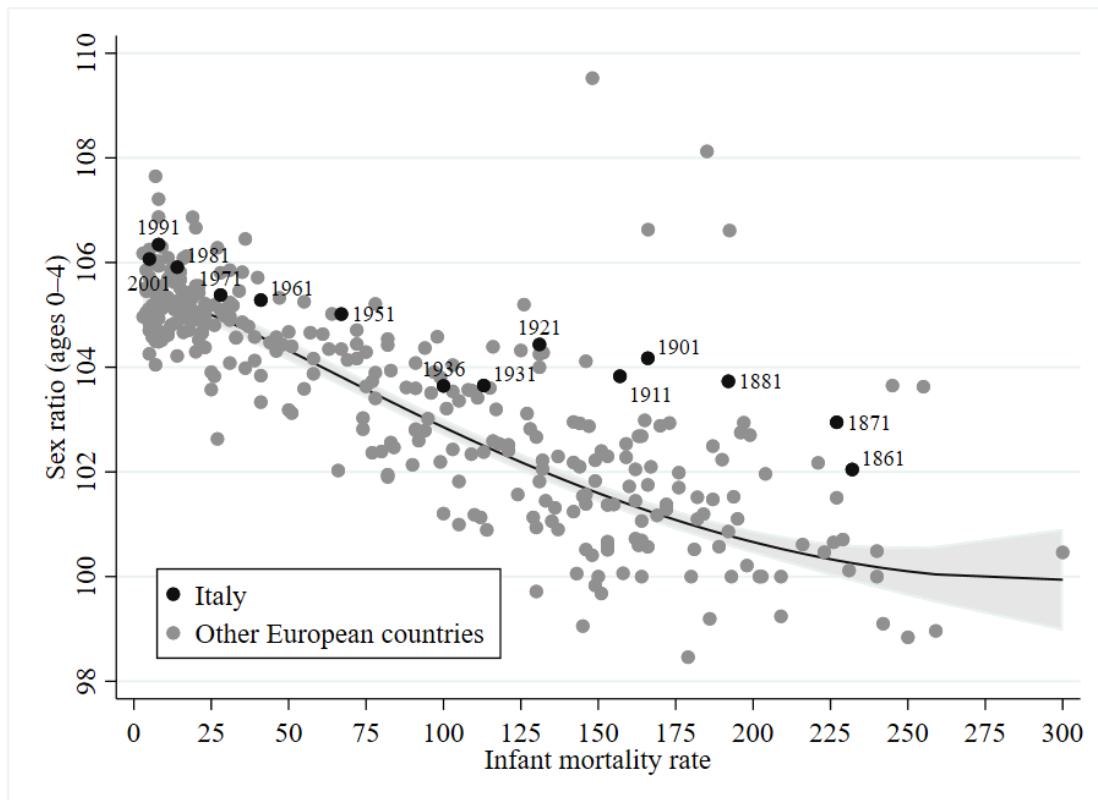
As already discussed regarding sex ratios at birth, it is key to note that child sex ratios in the past cannot be directly compared to contemporary ones. The number of surviving children at different ages is fundamentally affected by the prevailing mortality rates. Due to the male vulnerability, harsher environments are especially damaging to boys which result in more boys than girls dying, especially during the first year of life (Drevenstedt et al. 2008). High-mortality environments therefore automatically translate into lower sex ratios in infancy and childhood. Figure 2 follows the estimation carried out in Beltrán Tapia (2019) and plots infant mortality rates and child sex ratios (ages 0–4) in Europe between 1750 and 2001. This exercise clearly confirms that child sex ratios were lower in the past. In particular, infant mortality rates around 200 deaths per 1,000 live birth or higher, as those existing in Italy during most part of the 19th

¹⁶ The average sex ratios at birth plotted in figure 1 should be considered a maximum threshold of what this figure should look like in the past because it is based on what it is observed, thus potentially including observations from countries where female infants were actually being neglected (Beltrán Tapia and Marco-Gracia 2022; Beltrán Tapia and Raftakis 2021; Beltrán Tapia et al. 2021). It is true nonetheless that this estimation is based on a limited number of countries before 1850. Studying Scandinavian countries, Fellman and Eriksson (2012) indeed show that sex ratios at birth were lower during the second half of the 18th century and the early 19th century and rose steadily between then and the 1950s.

¹⁷ The local authorities in charge of collecting vital-statistics data varied among regions, from priests to mayors (*Ministero di Agricoltura, Industria e Commercio* 1864: VIII). In 1866, the procedures were eventually harmonized among all pre-unification states, including the recently annexed Veneto (but still excluding Rome and Lazio). From then onwards, in every municipality, the mayor was in charge of collecting and sending vital statistics to the central statistical office, although no revision from the central authority was carried out at that time (*Ministero di Agricoltura, Industria e Commercio* 1866: VIII). The civil registry (*anagrafe*), supposedly in charge of residence-related data, was yet to be fully established in the 1860s. Therefore, vital statistics kept being labelled *Movimento dello stato civile*, instead of *Movimento della popolazione*, since reliable residence and migration figures could not be published.

century (see table 1)¹⁸, would be compatible with child sex ratios around 100-101 boys per hundred girls. Compared to the benchmark depicted in figure 2, the relative numbers of surviving boys and girls reported in the Italian population censuses is much higher than expected, at least until 1921. Although these figures are not as extreme as those found in Greece during the same period (Beltrán Tapia and Raftakis 2021), they nonetheless suggest that female excess mortality was higher than it should have been.

Fig. 2 Child sex ratios (ages 0–4) in Italy and Europe 1750–2015



Source: Beltrán Tapia (2019) and Mitchell (2013).

Note: Child sex ratios tend to be higher in Southern and Eastern Europe (Beltrán Tapia 2019). The most extreme figures are found in Greece (Beltrán Tapia and Raftakis 2021).

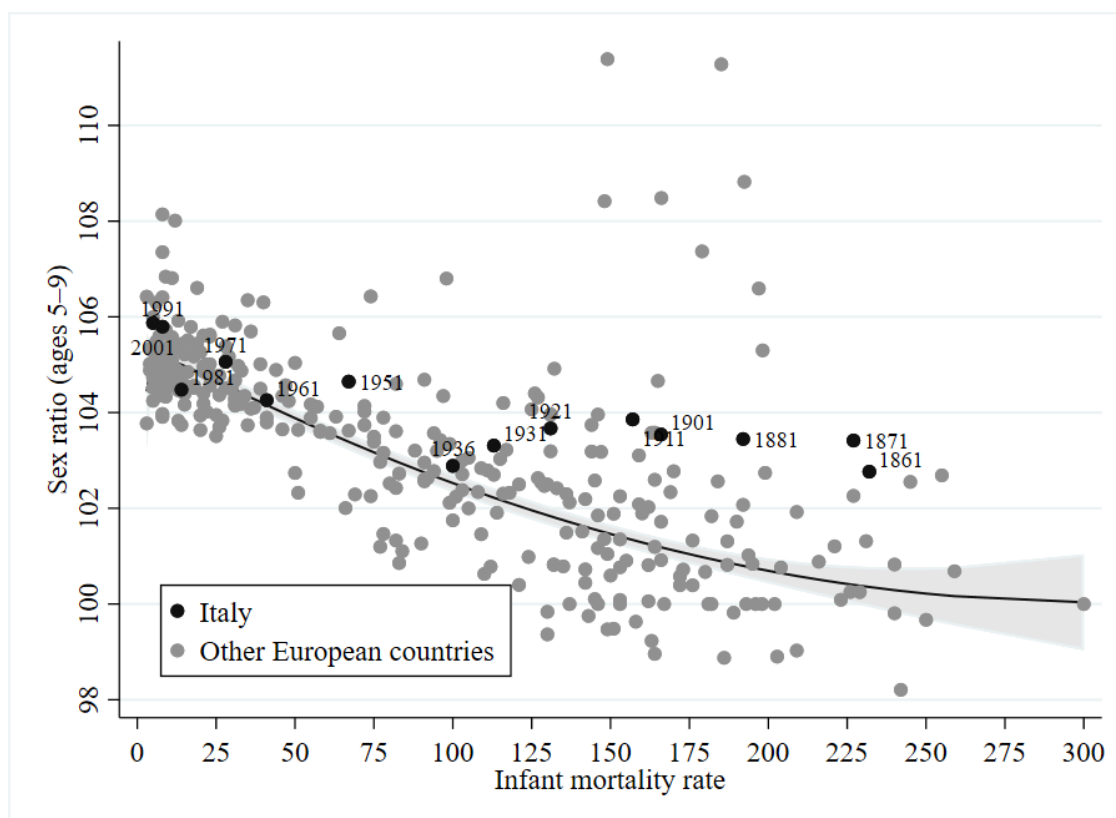
Female under-registration may nonetheless explain the relatively high child sex ratios. In this regard, infants sometimes tended to be under-enumerated in historical censuses and it is therefore plausible that female were more likely to be omitted given the prevailing attitudes towards women and girls, as we discussed in the introduction. Yet, it should be mentioned that there were no particular incentives to under-register girls¹⁹. The enumeration was carried out by local committees that visited each household and collected information on all individuals living there. The administrative procedures followed to collect census data from households

¹⁸ On Italian infant and child mortality during the period of study, see Del Panta (1997), Pinelli and Mancini (1997), Breschi et al. (2000).

¹⁹ In fact, it can be argued that families had more incentives to under-register boys, so they were not conscripted later on. On the attitudes towards conscription in Italy during this period, see Rovinello (2014).

during the 19th and early 20th century were not so different from today's ones.²⁰ Moreover, it is worth noting that, although census figures before 1881 might have suffered from some (minor) measurement bias, the centralization of the enumeration procedures which started then brought about a growing role of the central statistical offices, thus reducing the chance of errors introduced in the data-gathering process carried out by the municipalities (Gallo and Paluzzi 2012). Moreover, under-registration mostly affected infants so, even if more female infants escaped enumeration, they should appear in the censuses as they grew up. Older age-groups should therefore be less prone to this issue and lower sex ratios would then be expected. Replicating the previous plot using the relative number of boys and girls at the 5–9 age-group hardly alters the picture provided using the 0–4 age-group (figure 3). If anything, sex ratios at ages 5–9 were actually higher in the first two censuses whose quality might be arguably of inferior quality than later ones.

Fig. 3 Child sex ratios (ages 5–9) in Italy and Europe 1750–2015



Source: Beltrán Tapia (2019) and Mitchell (2013).

Focusing on the 5–9 age-group not only allows mitigating potential issues arising from sex-specific under-registration, but it also provides a cumulative measure of female excess mortality during birth, infancy and childhood. Computing the difference between the observed sex ratios and what should be expected according to the mortality environment therefore allows estimating the importance of the “missing girls” phenomenon. According to our results (see

²⁰ Likewise, the period prior 1922 did not suffer from top-down control for propaganda purposes that characterized the subsequent Fascist period during Mussolini's rule (Gallo and Paluzzi 2012: 40 – 47).

Table 1), discriminatory practices resulted in around 2.4–3.0 per cent of girls gone “missing” between 1861 and 1911. Although the estimated figure for 1921 is lower (1.8 per cent), it is still sizable. As evident in figures 2 and 3 themselves, the child sex ratios found in Italian censuses from then onwards do not fundamentally deviate from our expectations, so it appears that either (1) discriminatory behaviour gradually disappeared from 1911 onwards and/or that (2) it no longer translated into higher female mortality rates due to the increase in living standards.

Table 1. Missing girls in Italy, 1861–2001

Year	Infant Mortality	Observed Sex Ratios		Predicted Sex Ratios		Missing Girls	
		Age 0–4	Age 5–9	Age 0–4	Age 5–9	Age 0–4	Age 5–9
1861	232	102,0	102,8	100,3	100,3	1,8	2,4
1871	227	102,9	103,4	100,3	100,4	2,6	3,0
1881	192	103,7	103,4	100,8	100,8	2,9	2,6
1901	166	104,2	103,5	101,3	101,2	2,9	2,4
1911	157	103,8	103,9	101,4	101,3	2,4	2,5
1921	131	104,4	103,7	102,0	101,8	2,4	1,8
1931	113	103,7	103,3	102,5	102,2	1,2	1,1
1936	100	103,6	102,9	102,9	102,5	0,8	0,4
1951	67	105,0	104,6	103,8	103,4	1,2	1,3
1961	41	105,3	104,3	104,6	104,2	0,7	0,1
1971	28	105,4	105,1	104,9	104,6	0,5	0,5
1981	14	105,9	104,5	105,2	105,0	0,7	-0,5
1991	8	106,3	105,8	105,2	105,1	1,1	0,7
2001	5	106,1	105,9	105,2	105,0	0,9	0,9

Note: Sex ratios refer the number of boys per hundred girls. The predicted sex ratios are based on the prevailing infant mortality rates (infant deaths per thousand live births). The missing girls are computed as the difference between observed and predicted sex ratios in each age-group and can therefore interpreted as the percentage of girls that are "missing". The relative number of boys and girls, together with infant mortality rates are taken from Mitchell (2013).

The fact that our computations in table 1 are robust to either using sex ratios at ages 0–4 or 5–9 suggests that female under-registration is not driving our results. However, in order to further test that child sex ratios are not suffering from this issue, we now turn to sex-specific mortality rates obtained from death statistics. These registers may be less reliable than population censuses because deaths could be under-reported, especially at early ages. Again, this under-registration may also especially affect females. However, compared to female under-registration in census records, this potential bias now acts in the opposite direction: if female deaths were under-reported, we would be under-estimating girls’ mortality rates, so the observe figures only provide a minimum estimation of the gender mortality gap.

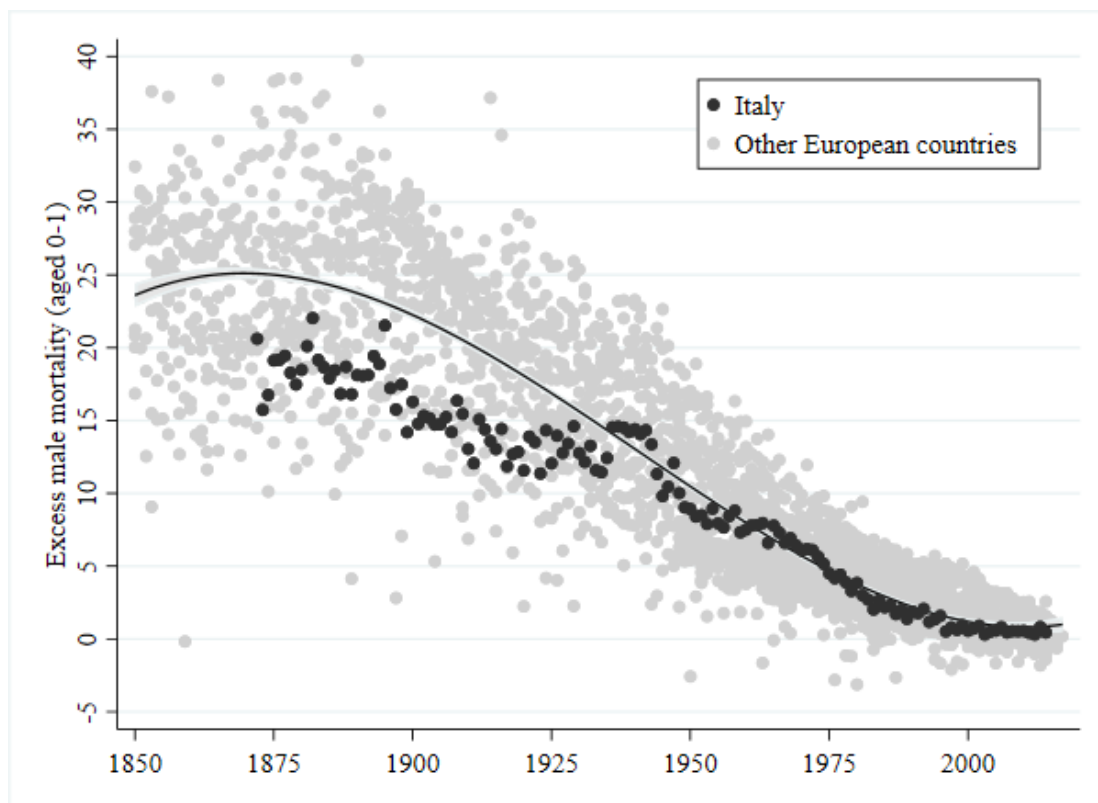
4. Infant and child mortality rates

The Human Mortality Database (HMD) provides yearly infant (ages 0–1) and early childhood (ages 1–5) mortality rates for boys and girls for a large sample of countries going back to the

18th century. The temporal coverage varies by country and there are only a few countries that provide information before 1850. This information allows tracing how excess male mortality early in life has evolved in Italy and other European countries between 1850 and 2015.

Focusing first on what happened during infancy, figure 4 shows how the female biological advantage was especially visible during the second half of the 19th century: on average, around 24 more boys than girls were dying (per 1,000 live births) during the first year of life in Europe at that time²¹. The gender gap declined as overall mortality levels were reduced over time. Excess male mortality, however, was lower in Italy than the European average: more girls (or less boys) were dying up to the 1920s, when the Italian experience began to converge with that of their European counterparts.

Fig. 4 Excess male mortality in Italy and Europe (ages 0–1), 1850–2015



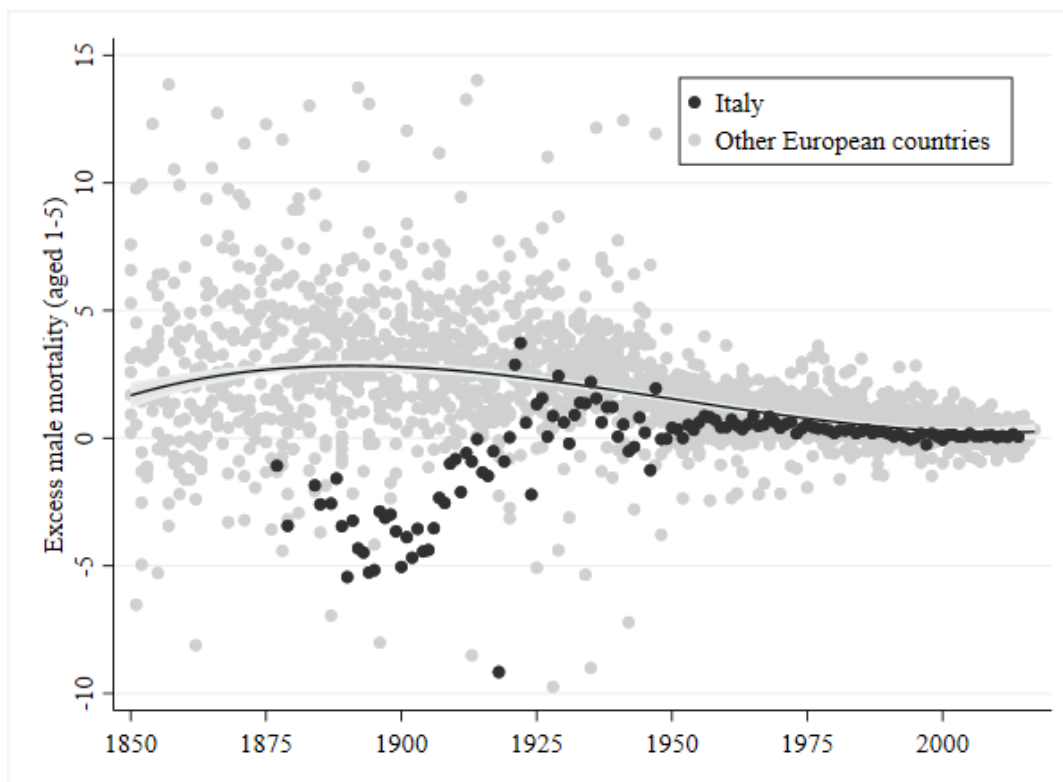
Source: HMD.

The same exercise can be performed but focusing now on early childhood (Figure 5). Although the gender gap in child mortality (ages 1–5) is significantly lower than during infancy, it still tends to favour girls: on average, around 2.5 more boys than girls (per 1,000 live births) were dying in Europe before 1920. The Italian case, however, was again different since the opposite pattern is observed: girls were suffering a higher mortality rate than boys until the 1920s. The Italian gender gap in mortality from then onwards is nonetheless virtually identical to that of other European countries. As discussed above, the evolution of the mortality gap is directly affected by the existing level of mortality. Linking excess male mortality during infancy (age 0–1) and early childhood (1–5) to the corresponding mortality rates nonetheless

²¹ This male frailty automatically translated into lower “natural” child sex ratios as shown in the previous section and in previous studies (Beltrán Tapia and Gallego-Martínez 2017; Beltrán Tapia 2019; Szoltysek et al. 2022).

provides a very similar picture (see Figures A1 and A2 in the Supplementary Material). More girls (or less boys) were dying in Italy than in other European countries when infant and child mortality rates were high.

Fig. 5 Excess male mortality in Italy and Europe (ages 1–5), 1850–2015



Source: HMD.

Taken together, the evidence presented here strongly suggest that discriminatory practices arising from son preference were negatively affecting female mortality rates during infancy and childhood. The fact that these results point in the same direction regardless of whether we are relying on population censuses or death registers confirms that female under-reporting is not likely to be behind these patterns. The relatively high child sex ratios found in Italy until the first decades of the 20th century are associated with a relatively high female mortality early in life, thus suggesting that discriminatory practices were at play. The previous discussion is nonetheless based on national averages and these figures hide a significant regional variation, an issue that is especially important in Italy where North-South differences have been repeatedly stressed as a crucial dimension for understanding these societies.

5. Analyzing regional variation, 1861-1921

In order to shed more light on the issues discussed before, we have collected information on sex ratios at infancy and childhood, as well as infant and early childhood mortality rates, at the province level between 1861 and 1921. It should be noted that, although provincial child sex ratios can be computed for each census year between these two dates, mortality rates at the

province level are only available for the years 1871, 1881 and 1921²². This section therefore describes the underlying regional patterns and their evolution over time.

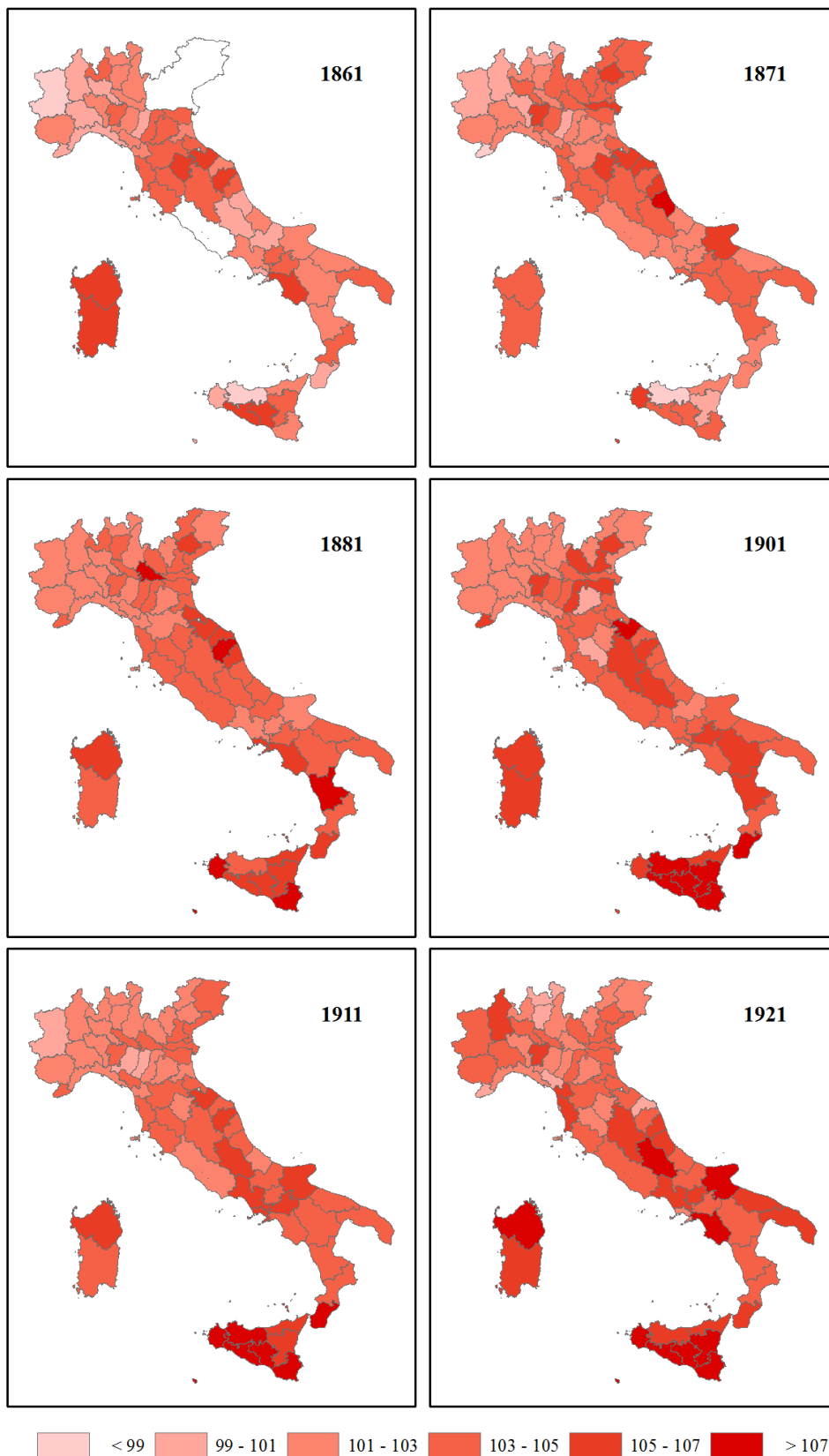
Splicing the analysis into smaller units introduces more noise in the analysis because sex ratios constitute a very random outcome in itself (Beltrán Tapia and Gallego-Martínez 2020; Szoltysek et al. 2022). Italian provinces are however rather large (most of them have more than 30,000 children aged 0–4 and the smallest ones never fall short of 15,000 children), so this is not likely to be an issue (see table A1 reporting summary statistics in the Appendix). Although the previous sections show that female under-reporting does not constitute a problem at the national level, this might to be necessarily the case for particular provinces. As mentioned above, however, under-registration especially affects the youngest children, so older age groups should be virtually free of this concern because they would show up in the statistics as they grow up. Province sex ratios at age 0–4 actually correlate quite well with those at age 5–9 (see figure A3 in the Appendix), thus confirming that potential under-registration does not affect the results reported here.

Figure 6 depicts the relative number of boys and girls (ages 0–4) in Italian provinces between 1861 and 1921. Interestingly, province child sex ratios correlate very well between censuses (particular provinces systematically exhibit higher figures; see figure A4 in the Appendix), so these spatial patterns persisted over time²³. Apart from clear regional patterns, these maps shows that the geography of child sex ratios also evolved over time. While relatively high figures could be found all over the country in the earlier censuses, the South seems to concentrate the highest child sex ratios at times went by. This geographical evolution resembles that of gender inequalities in literacy rates: although differences in male and female literacy were higher in the north at the end of the Napoleonic War, this gap declined dramatically over the course of the 19th century, a patter that was not followed in the rest of the country later on (Ciccarelli and Weisdorf 2019).

²² Aggregates at a higher regional level (17 regions) are nonetheless available and provide virtually the same results as those reported using provinces as units of analysis.

²³ The correlation coefficient is somewhat lower between the years 1871 and 1881 but this might be arising from the quality of those particular censuses (of from particular provinces). As mentioned before, the growing role of the central statistical offices in the data-gathering process which started in 1881 increased the quality of the subsequent enumerations (Gallo and Paluzzi 2012).

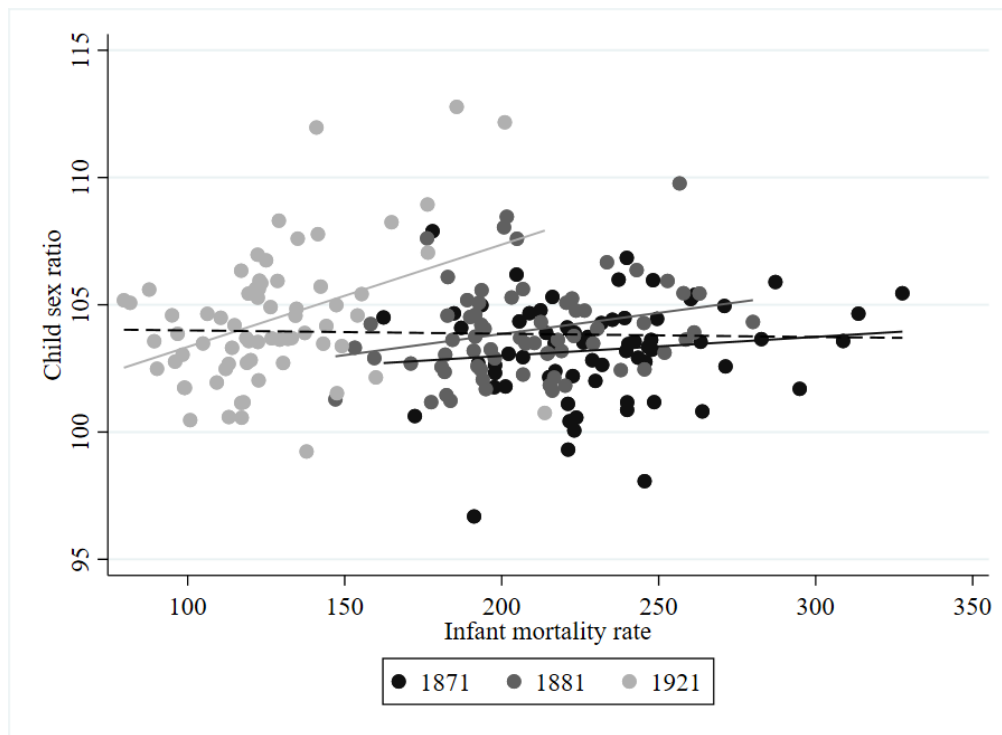
Fig. 6. Child sex ratios (ages 0–4) in Italy, 1861-1921



Source: Population Censuses.

Part of the temporal and geographical variation observed here could be explained by differences in the mortality environments (Beltrán Tapia 2019; Szoltysek et al. 2022). Due to the biological female advantage, more boys are expected to die during the first years of life in those provinces and/or periods suffering especially harsh conditions. Child sex ratios should therefore be lower where infant mortality was higher. Although this is somewhat true for the whole period studied here, analyzing each census year separately yields the opposite pattern. Figure 7 shows that those provinces with higher infant mortality rates exhibited higher child sex ratios, thus suggesting that something else was going on (the same picture holds if under-5 mortality is employed instead of infant mortality; see fig. A5 in the Appendix)²⁴. Interestingly, this positive relationship got stronger over time suggesting that behavioral factors leading to female neglect were more widespread across the Italian territory during the 19th century but became geographically concentrated in the less developed regions since the late-19th and early-20th century.

Fig. 7. Child sex ratios (ages 0–4) and infant mortality in Italy, 1871, 1881 and 1921



Note: while the dash line depicts the fitting line using all observations, the colored lines estimate the relationship separately for each census year.

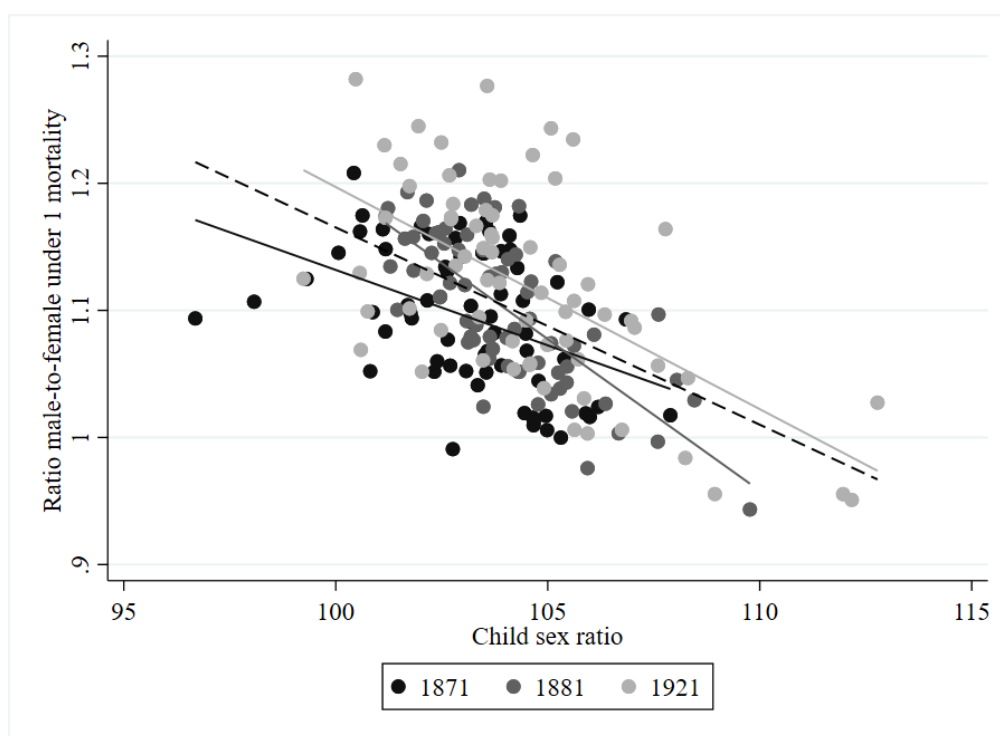
Analyzing now the male-to-female mortality ratio during infancy and childhood further supports the hypothesis that female neglect was reducing girls' survival chances, especially in particular regions. Figure 8 shows that high child sex ratios during the period of study were associated with more girls (or less boys) dying during infancy and childhood²⁵. As already

²⁴ In order to mitigate unexplained year-to-year variation, we have average mortality rates over two consecutive years (the results however do not change if only one year or mortality is used).

²⁵ Figure A6 in the Appendix reports the results using under-5 mortality rates. Moreover, the results reported here are virtually identical if the ratio of male-to-female mortality is computed using only the raw number of male and female deaths in order to eliminate potential registration issues coming from the birth figures that are employed to compute mortality rates.

discussed in the previous section, this pattern is crucial because it rules out the possibility that our results are driven by registration issues. If female under-registration in the censuses were increasing the relative number of surviving boys and girls (child sex ratios), under-registration of female deaths would increase the mortality gap during infancy and childhood. We observe exactly the opposite pattern: excess male mortality is lower when child sex ratios are higher, thus confirming that both sources, population censuses and vital statistics, provide a congruent picture. As mentioned above, figures 7 and 8 only use information around 1871, 1881 and 1921 because Italian vital statistics did not provide the number of deaths at the province level between 1890 and 1911. Information at a wider level of aggregation is however available for all census years between 1861 and 1921. Reassuringly, the results are virtually identical if regions are used as unit of analysis (see figures A7 and A8 in the Appendix).

Fig. 8. Child sex ratios (ages 0–4) and infant mortality in Italy, 1871-1921



Note: while the dash line depicts the fitting line using all observations, the colored lines estimate the relationship separately for each census year.

Taken together, the relatively high female mortality rates registered in the vital statistics and the high sex ratios observed in the surviving children recorded in the population censuses, indicate the existence of discrimination against girls around birth and/or during infancy and childhood. These practices appear to have been more pronounced in Southern Italy, especially from the end of the 19th century onwards.

Concluding remarks

Child sex ratios provide a cumulative measure of neonatal, infant and child mortality and therefore allow detecting patterns of female neglect. According to our estimations, around 2-3 per cent of girls went “missing” in Italy during the second half of the 19th century and the early 20th century. Crucially, female excess mortality is also visible using death statistics, ruling out

the possibility that these results are driven by registration issues and therefore pointing to the existence of discriminatory practices that increased female mortality rates early in life.

As in other contexts, female neglect seems to have been the result of a strong son preference, possibly dictated by economic motives and cultural norms (as pointed out by the literature that we reviewed in the introduction). While raising boys helped ensuring the viability of the family farm, girls were considered a burden for their families (Kertzer 1993, 111). In patrilocal contexts, investing in daughters was considered a waste of resources since it was lost to their parents as soon as they married and entered their grooms' families. In addition, the dowry system made daughters even more costly. Although girls could contribute to their own dowries by finding employment, parents were nonetheless the main funders, even in urban areas (Zucca Micheletto 2011). In the countryside, where female waged opportunities were scarce, the dowry's responsibility mostly fell on the families.

Given that sex ratios at birth were not excessively unbalanced, our analysis suggest that most of these girls went "missing" during infancy and childhood. The lack of anecdotal evidence on female infanticide further supports this argument. The existence of a thick network of foundling hospitals probably made infanticide unnecessary for getting rid of unwanted children. While the sex of the newborn was irrelevant for unwed mothers, married couples had more incentives to neglect their female infants and tended in fact to abandon more girls than boys (Corsini 1991; Hunecke 1991; Kertzer 1993, 110-112)²⁶. Kertzer (1993, 111) argues that the evolution in the relative number of girls being abandoned is closely linked to the extent to which legitimate children were abandoned. Selective infant abandonment could therefore partly contribute to some of the "missing girls" observed here due to their extreme mortality rates, both before and after reaching the foundling home. In fact, the closing of the wheels from the late 1860s onwards dramatically reduced the abandonment of legitimate children in northern cities (Kertzer 1993, 154-161), thus potentially contributing to the reduction in child sex ratios observed in some provinces from 1881 onwards²⁷.

Many Italian regions however actively prevented the abandonment of legitimate children (Ibid. 71), so this possibility was not readily available everywhere, and especially so in rural areas²⁸. Likewise, child abandonment could put the family honour at risk (Derosas 2012, 98). Therefore, resorting to infanticide was perhaps the only (or the easiest) means of adjusting family size in some areas. Not only the number of prosecuted infanticides was relatively high in Italy during the late-19th-century Italy, but these figures only represented a small fraction of the actual reality (Tagliacarne 1925; Corsini 2010)²⁹. Given the high rates of neonatal mortality, it was indeed relatively easy for married couples to conceal infanticides as natural deaths and the vast majority of infanticides never came to the attention of the police or judicial authorities

²⁶ Foundling homes were in charge of dowering their wards (Kertzer 1993, 111), thus providing an additional incentive to abandon girls.

²⁷ Although some contemporary commentators warned that the abolition of the wheel would increase the number of infanticides, there is little evidence that this was actually the case (Kertzer 1993, 157-159).

²⁸ While foundling homes in Milan, Brescia, Tuscan cities hardly erected any barrier against the abandonment of legitimate children and subsequently received a significant inflow of these foundlings, other Northern areas such as Bologna, Bergamo and other cities in Emilia-Romagna restricted the use of the wheel to illegitimate children (Kertzer 1993; 71-102). Although it is more difficult to estimate the importance of child abandonment by married couples in the South, it seems they also constituted an important fraction of the foundlings abandoned there (94-97). Although policy changes from the 1870s made this possibility more and more difficult, Southern Italy lagged behind adopting these policies.

²⁹ Most research on infanticide focuses on court cases and therefore deals with unmarried young women, whose sins were more difficult to conceal (Corsini 2010; Olivieri 2010). Interestingly, the punishment for infanticide became increasingly less severe and commonly linked to women's mental status. Gentilomo et al. (2012) argue that, due to the difficulty of proving mental illness, this was just a way to grant milder sanctions for infanticides.

(Kertzer 1993, 29; Derosas 2012, 96)³⁰. Braglia and Nicolini (2017) argue that not only many infanticides were effectively hidden before the mid-20th century, but also that they especially affected female infants³¹. Sex ratios at birth (or baptism) were indeed slightly inflated in many areas, thus suggesting that female infanticide could have also been responsible for the excess of males. Although the problem was likely to be worse in earlier periods in terms of both female infanticide and female abandonment³², it is also plausible that the closing of the wheel from the 1860s onwards, which basically prevented married couples from abandoning their unwanted children, may have increased the number of undetected infanticides.

A large part of the relative excess of boys is nonetheless probably explained by how Italian parents treated their children as they grew up before the 1920s, especially if we analyse sex-specific mortality rates during infancy and childhood. While the Italian figures indicate that female infants suffered higher (relative) mortality girls than their European counterparts, those girls aged 1–5 were especially penalised. This is consistent with the fact that breastfeeding is a non-competitive resource that protected boys and girls alike during the first months of life. The effects of gender-discriminatory practices are however quite visible as soon as infants are weaned³³. Berkowitz (1984, 88) argues that women in Southern Italy indulged sons far more than daughters. This unequal allocation of food and care during early childhood could have also included longer breastfeeding periods for boys. Relying on the information about household nutrition and expenditures contained in family monographies in the 1930s, Mancini (2020) tentatively suggests that young girls were somewhat discriminated in the allocation of household resources. As this author acknowledges, her results are not conclusive. However, the economic difficulties that families suffered in this later period are probably not as dire as the situation existing under the period of study here. Italian living standard had significantly increased during the first third of the 20th century and, even in the case that son preference was still in place, the consequences of gender discriminatory practices did not probably result in higher mortality rates.

Lastly, our results also uncover significant regional patterns, both in levels and in their trajectories over time. In this regard, while female excess mortality declined in the Northern provinces during the period of study here, it remained relatively high in the South at least until 1921. It is worth mentioning that the anonymous abandonment of infants through the wheel not only continued for longer in the South, but families there were also more prone to abandon their babies in other public places when there was not wheel nearby (Kertzer 1993, 161). Similarly, economic conditions deteriorated significantly in the South during the last decades of the 19th century (Schneider and Schneider 1976, 119-125), which surely aggravated the need to ration scarcer resources. Although these patterns are probably linked to the relative importance of different agricultural (land tenure) and family systems, as well as other economic, social, and cultural dimensions (and their evolution during a period of rapid societal change), identifying the reasons behind this phenomenon (and its demise from the 1920s onwards) goes beyond the scope of this paper. This article constitutes only a first exploration of a complicated issue. More research is needed to shed light on (1) when and how

³⁰ Female infanticide was also visible in other European countries during this period; Hanlon 2015; Beltrán Tapia and Marco-Gracia 2021; Beltrán Tapia and Raftakis 2021. See also Drixler (2012) for even more extreme practices in Japan.

³¹ These authors also hypothesize that sex-selective abortion may explain the low number of female live births and the high incidence of female stillbirths in the 1970s and 1980s due to the availability of various methods of diagnosing the sex of unborn babies.

³² While 110 boys per hundred girls were born among the legitimate children in Naples around 1803-1804, the Annunziata, the foundling home there, only received 90 boys for every 100 girls in 1815 (Kertzer 1993, 92).

³³ Marco-Gracia and Beltrán Tapia (2021) has found similar patterns in North-Eastern Spain using the information contained in the parish registers.

discrimination actually happened, and (2) the mechanisms that led parents to neglect their daughters. In addition, the patterns unveiled here also open the way to explore the socio-economic implications of gender-discriminatory practices on the divergent trajectories followed by Northern and Southern Italy.

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SUPPLEMENTARY MATERIAL

Tables

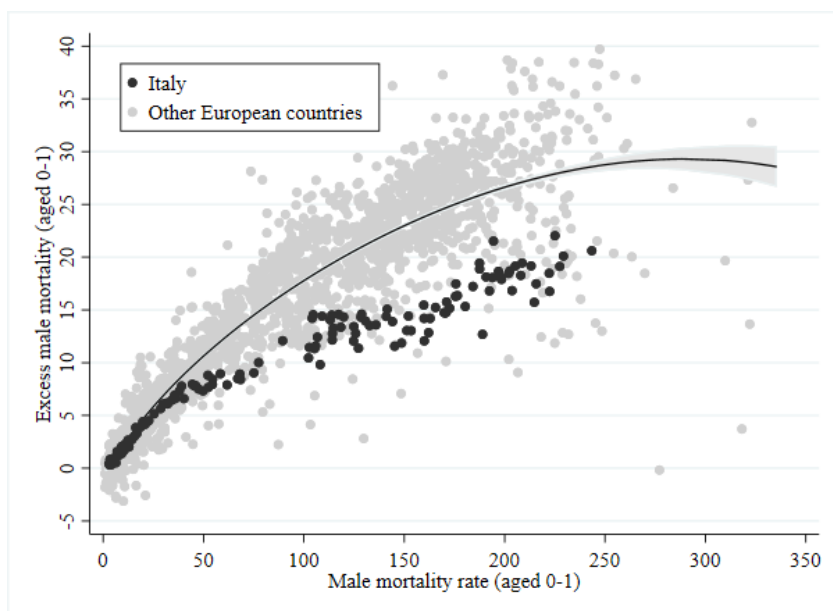
Table A1. Summary statistics. Child sex ratios in Italian provinces, 1861-1921

Children aged 0-4					
Year	Obs.	Mean	St. Dev.	Min	Max
1861	59	102.1	2.2	95.7	106.4
1871	69	103.0	1.9	96.7	107.9
1881	69	103.7	1.8	101.2	109.8
1901	69	104.2	2.0	100.2	109.5
1911	69	103.9	2.0	100.5	108.7
1921	69	104.5	2.4	99.2	112.8

Children aged 5-9					
Year	Obs.	Mean	St. Dev.	Min	Max
1861	59	102.8	2.6	98.3	109.6
1871	69	103.4	2.2	98.8	108.2
1881	69	103.5	2.0	99.2	110.5
1901	69	103.5	2.1	98.0	110.3
1911	69	103.9	2.7	98.2	111.3
1921	69	103.8	2.4	99.5	110.6

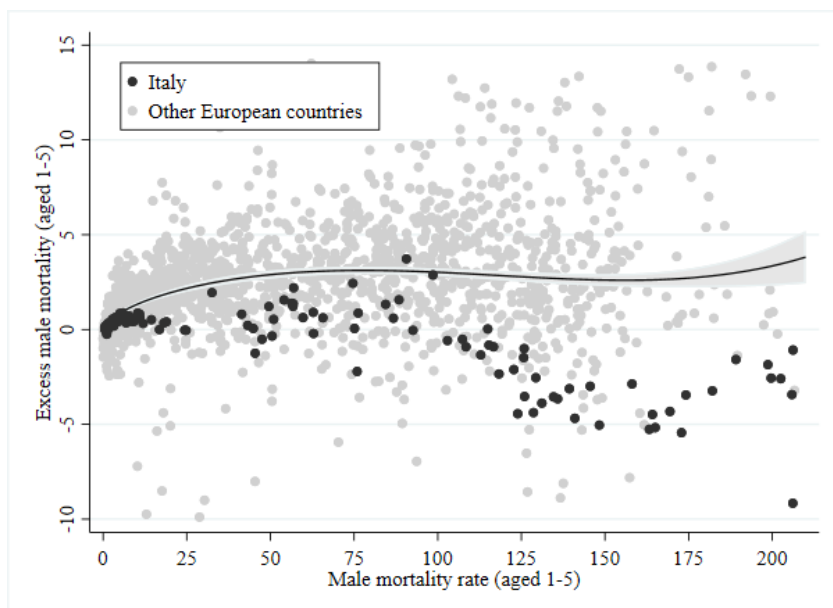
Figures

Fig. A1 Infant mortality and excess male mortality (ages 0–1) in Italy and Europe



Source: HMD.

Fig. A2 Infant mortality and excess male mortality (ages 1–5) in Italy and Europe



Source: HMD.

Fig. A3 Child sex ratios (ages 0–4 and 5–9), 1861-1921

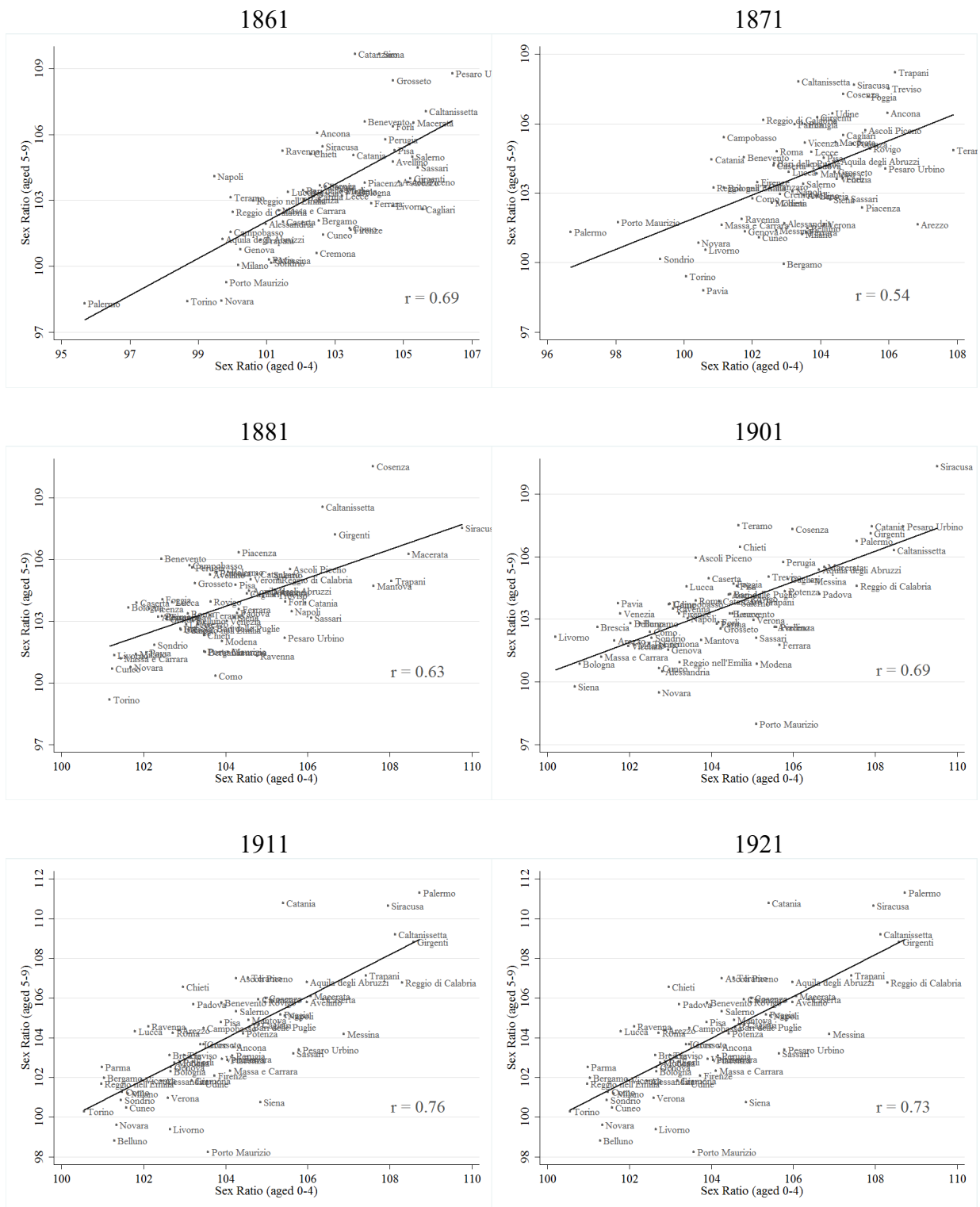


Fig. A4 Child sex ratios (ages 0–4) across censuses, 1861-1921

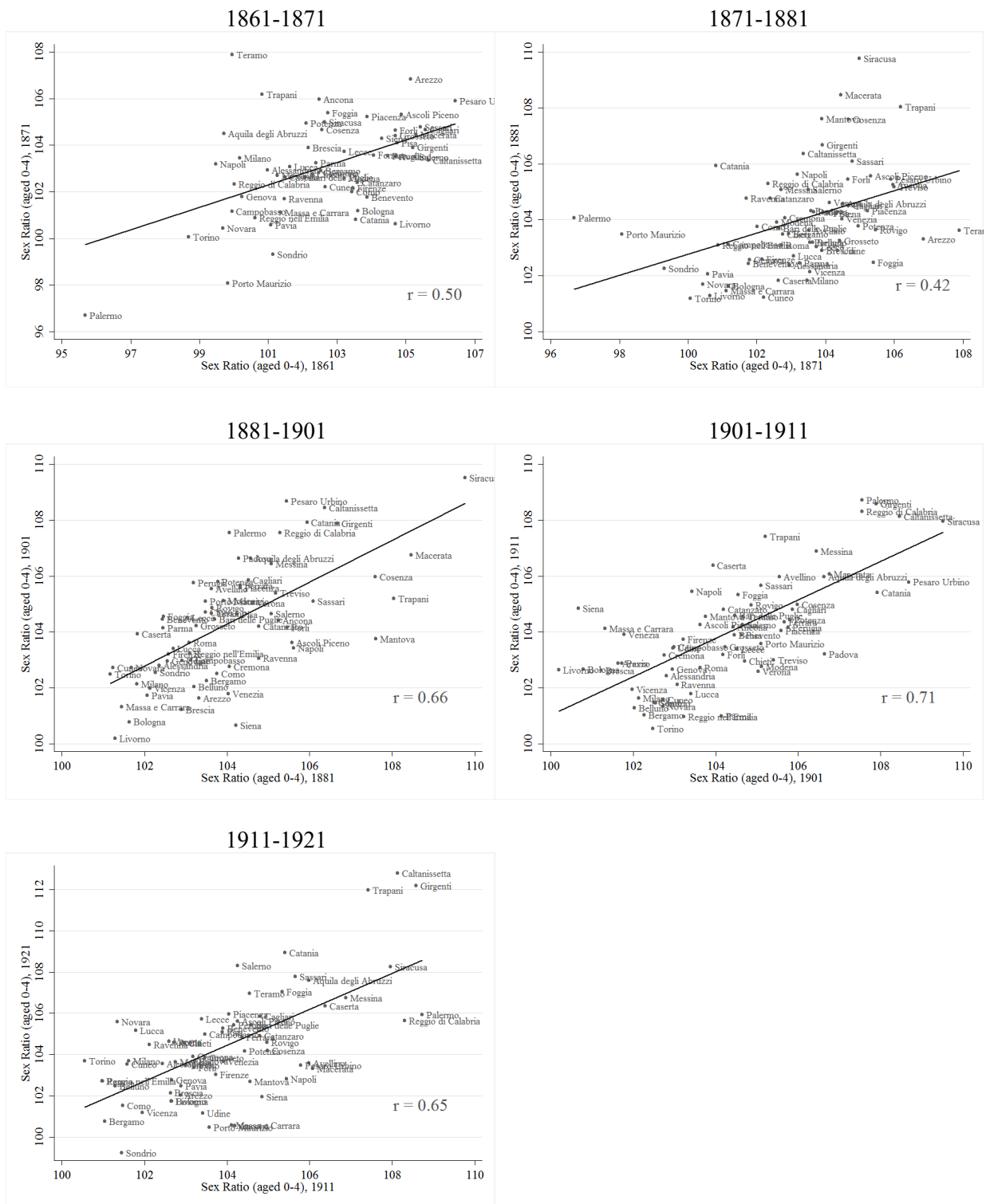
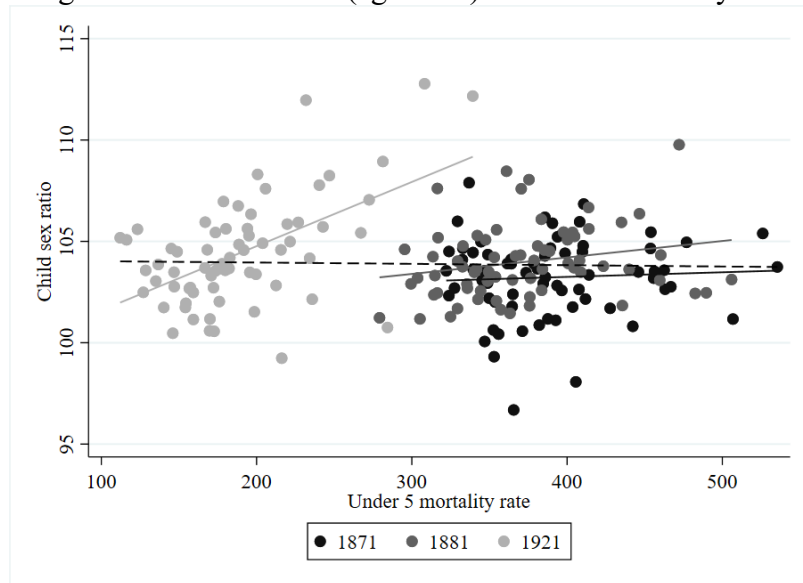
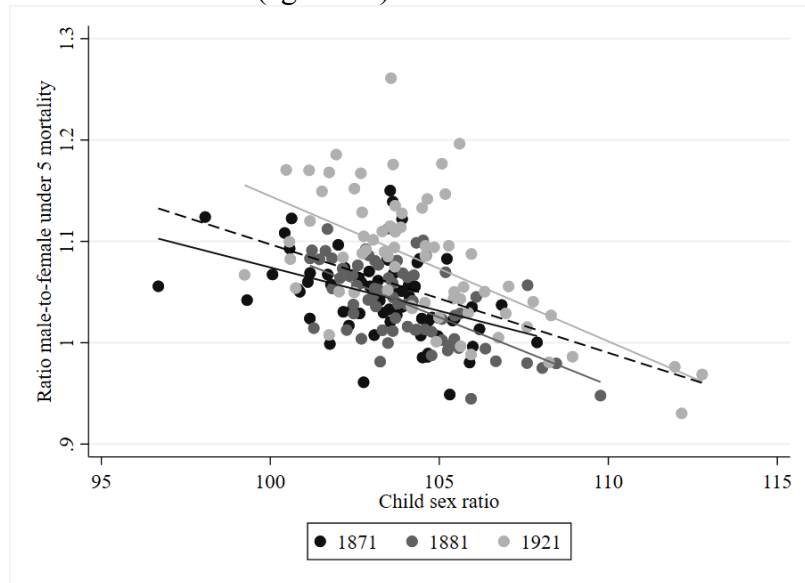


Fig. A5 Child sex ratios (ages 0–4) and child mortality rate



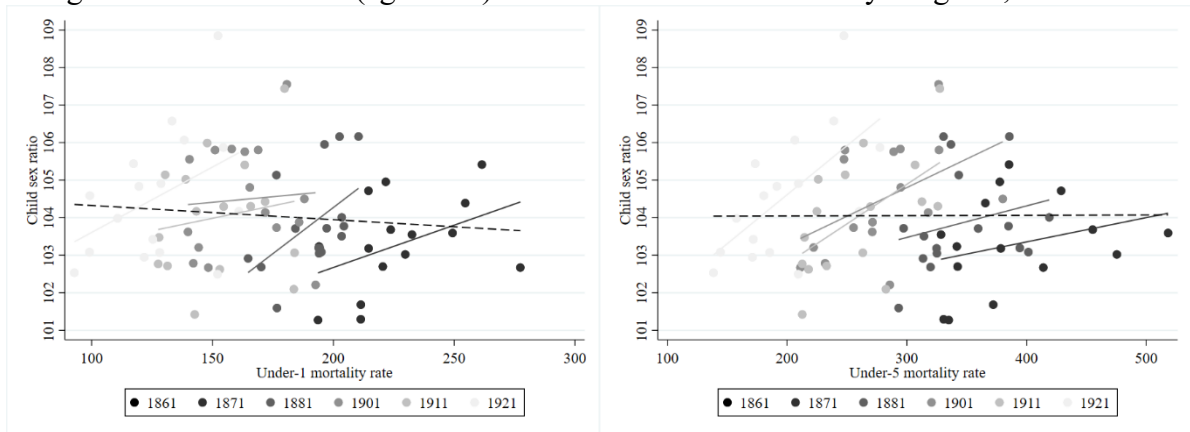
Note: while the dash line depicts the fitting line using all observations, the colored lines estimate the relationship separately for each census year.

Fig. A6 Child sex ratios (ages 0–4) and male-to-female under 5 mortality



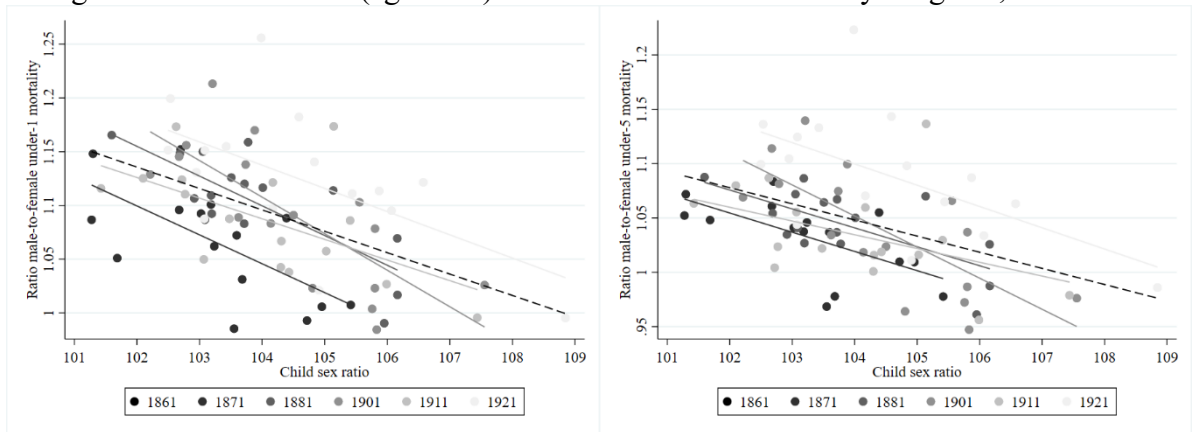
Note: while the dash line depicts the fitting line using all observations, the colored lines estimate the relationship separately for each census year.

Fig. A7 Child sex ratios (aged 0–4) and infant and child mortality: Regions, 1861-1921



Note: while the dash line depicts the fitting line using all observations, the colored lines estimate the relationship separately for each census year.

Fig. A8 Child sex ratios (ages 0–4) and male-to-female mortality: Regions, 1861-1921



Note: while the dash line depicts the fitting line using all observations, the colored lines estimate the relationship separately for each census year.