Death, sex, and fertility: female infanticide in rural Spain, 1750–1950

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Abstract

Relying on longitudinal micro data from rural Spain between 1750 and 1950, this article evidences that families mortally neglected a significant fraction of their female babies. Firstly, baptism records exhibited exceptionally high sex ratios at birth until the late nineteenth century. Secondly, having no previous male siblings increased the probability of male baptisms. Likewise, this same feature, together with the number of siblings alive, also increased female mortality during the first day of life. These findings are concentrated at higher parities and among landless and semi-landless families. Lastly, under-registration cannot explain these patterns affecting female mortality shortly after birth.

1. Introduction

Many pre-industrial societies regulated population size by resorting to infanticide and the mortal neglect of unwanted infants and children (Langer 1972; Harris and Ross 1987; Hrdy 1999; Hanlon 2016). These practices have traditionally targeted girls in India, China, and Japan, among other countries characterized by strong patriarchal traditions that favor males (Das Gupta et al. 2003; Bhaskar and Gupta 2007; Drixler 2013; Gupta 2014). Although women's status in historical Europe was definitely more advantageous than in other parts of the world, Europe was not a gender-equal paradise and women were discriminated in many dimensions (Szołtysek et al. 2017; Carmichael and Rijpma 2017; Dilli et al. 2019). Son preference, affecting the propensity to have additional children, was indeed present in many regions in pre-industrial Europe (Kolk 2011; Manfredini et al. 2016; Sandström and Vikström 2015; Reher and Sandström 2015).[1] This preference for boys seems to have been more intense and persistent in Southern Europe (Reher et al. 2017; Kok 2018).[2]

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[1] See also Bohnert et al. (2012) for the USA.

[2] While northern and central European countries shifted their preferences from boys to symmetrical sex preferences in the late nineteenth century, son preference persisted in southern Europe (Reher et al. 2017). Changes in sex preferences could be linked to the evolution of family systems and the strength of these systems (Reher 1998).

There is, however, little evidence that European families neglected their female babies. Derosas and Tsuya (2010), for instance, found no clear pattern of female infanticide in the three samples that they were analyzing: Casalguidi in Italy (1819–1859), Sart in Belgium (1812–1874), and Scania in Sweden (1829–1867). Summarizing this view, Lynch (2011) argues that household formation patterns, as well as cultural and religious values, prevented female infanticide in historical Europe. Several studies have though challenged this view and suggested that families resorted to female infanticide as a means of controlling the size and sex composition of their offspring, especially in Southern Europe (Bechtold 2001; Hynes 2011; Hanlon 2016; Beltrán Tapia and Raftakis 2021).[3]

Relying on longitudinal micro data from a small rural region in North-eastern Spain between 1750 and 1950, this article evidences that discriminatory practices increased female mortality shortly after birth. Firstly, aggregate sex ratios obtained from baptismal records were exceptionally high, at least until the late nineteenth century. Secondly, the data show that having no previous male siblings, a feature that could trigger discrimination in the presence of son preference, increased the probability of male baptisms during the same period. Likewise, this same feature, together with the number of siblings alive, also increased female mortality during the first day of life. These findings seem to be concentrated at higher parities and among landless and semi-landless families, which were subject to harsher economic conditions and therefore more likely to resort to extreme decisions under difficult circumstances. Crucially, the fact that the results are robust to employing data from birth and death registers rules out the possibility that under-registration explains this pattern: although female misreporting would bias sex ratios at birth upwards, it would have the opposite effect on mortality rates. These discriminatory patterns affecting female mortality shortly after birth disappeared during the first decades of the twentieth century.

This article therefore supports previous studies that challenged the idea that there were no missing girls in historical Europe, especially in Southern and Eastern Europe (Beltrán Tapia and Gallego-Martínez 2017; Beltrán Tapia 2019; Beltrán Tapia and Raftakis 2021; Marco-Gracia and Beltrán Tapia 2021; Beltrán Tapia et al. 2021). In this regard, the paper shows that the high sex ratios in infancy and childhood found in previous studies on pre-industrial Spain are not driven by problems with the quality of the registers (Beltrán Tapia and Gallego-Martínez 2020; Echavarri 2021) but by female excess mortality. In addition, the micro-data used here shed light on how these societies ended up showing unbalanced number of boys and girls by illustrating that a fraction of these missing girls were neglected at birth, once the family found out the sex of the newborn. While the neglect of female babies was possibly a conscious family decision that affected a relatively small number of families under certain circumstances, our data cannot distinguish whether the death of infant girls was the result of direct female infanticide or more indirect forms of mortal neglect (starvation, smothering, exposure, etc.).[4] Given that anecdotal evidence hardly exists, it seems that families succeeded in disguising female infanticide as natural deaths. Child abandonment was widespread (Sarasúa 2021), so it is also plausible that girls were more likely to be exposed.

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[3] Interestingly, Hynes (2011) and Hanlon (2016) consider that families could also target boys depending on the circumstances. Another strand of the literature suggests that gender-discriminatory practices unduly increased female mortality during infancy and childhood via an unequal allocation of food, care, and/or workload (see, for instance, Beltrán Tapia 2019).

[4] See Langer (1972) for the different ways that families could dispose of unwanted children.

However, the number of children admitted at nearby foundling hospitals is relatively balanced which suggests that these girls never reached these institutions alive.[5]

Likewise, the finding that families neglected female infants suggests that these societies regulated the size and sex composition of their offspring despite the religious norms against it. The dominant view defends that the low number of children raised in European families was the result of different ways of reducing fertility. This could be achieved either indirectly via high age at marriage and a high singleness rate (Hajnal 1965; Wrigley and Schofield 1981), or directly by adjusting birth intervals or implementing fertility-stopping rules (Schofield 2000; Bengtsson and Dribe 2006; Reher and Sanz-Gimeno 2007; Marco-Gracia 2019, 2021). Our results imply that some sort of "death control" was also present (Langer 1972; Harris and Ross 1987; Hrdy 1999; Hanlon 2016, 2017). Resorting to infanticide, mortal neglect or abandonment could have been a drastic solution to regulate fertility, especially in already large families subject to economic stress. In this regard, girls entailed a larger burden to the household income because both the need to provide a dowry militated against girls and because there were less female waged labor opportunities.

The evidence provided here shows that families especially targeted girls, but boys could have undoubtedly fell victims of these practices as well. The fact that families somewhat increased the mortality of their children also has implications for our understanding of the demographic transition. The subsequent reduction of mortality rates would therefore partly respond to the gradual disappearance of these practices. Likewise, many of these deaths were never registered as births or deceases, thus indicating that fertility and mortality rates in pre-industrial rural Spain were higher than what it has been traditionally assumed.

Our findings are especially relevant because they take place in an area where nuclear households prevailed and inheritances were equally distributed among all children, regardless of their sex. Likewise, women maintained full control of the resources they brought to the marriage and were entitled to freely dispose of their patrimony through wills at their death (Jarque Martínez and Salas Ausens 2007, 126–127). Moreover, although it is true that women did not enjoy the same status in the labor market than men (lower salaries, less workdays, etc.), female waged labor was relatively widespread and their contribution was crucial to sustain the household economy (Borderías and Muñoz 2018; Germán Zubero 2009; Lana Berasain 2007). These features are not particularly related to patriarchal societies (Szołtysek et al. 2017), so these results open up the possibility of finding similar or even more extreme manifestations of son preference in other European regions.

2. Historical background

This study focuses on a small rural area in Aragon, in North-Eastern Spain, that is located around 19–40 kilometers away from Zaragoza, the regional capital (see figure 1). This area, a combination of plains and foothills near the Huerva river, comprises 13 small municipalities covering around 500 squared kilometers and hosting 5,525 inhabitants in 1750, 8,315 in 1857, and 9,556 in 1950.[6] The population mostly lived in nuclear households in concentrated settlements and was essentially devoted to agriculture (mostly wheat and some

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[5] Not only children died before being discovered, but many did not survive the journey to the foundling hospital. Given the staggering infant and child mortality rates suffered in foundling homes, reaching these institutions did not significantly improve the survival chances of these children.

[6] The localities are Alfamén, Aylés, Botorrita, Cosuenda, Jaulín, Longares, Mezalocha, Mozota, Muel, Torrecilla de Valmadrid, Tosos, Valmadrid, and Villanueva de Huerva.
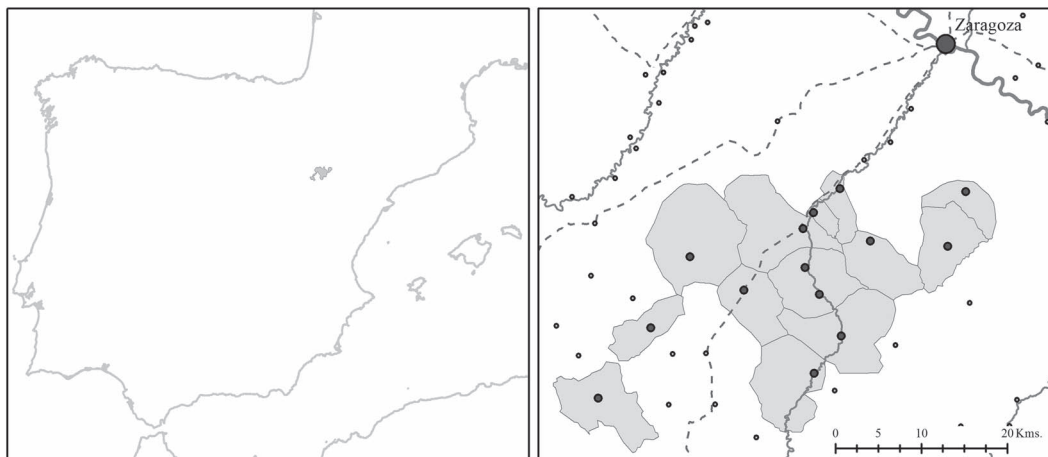
Figure 1. *Area of study: Middle Huerva (Aragón, Spain)*. Note: Dark dots refer to the localities studied here (except Zaragoza, the provincial capital) and the corresponding shaded areas to their municipal boundaries. Apart from rivers (in grey) and main roads (dotted lines), the map also depicts neighboring villages (white dots).

wine) and sheep grazing. Our records show that around 85 percent of the male working population was engaged in the agricultural sector between 1800 and 1950. Average fertility was relatively stable around 6–7 children among complete families up to 1900 and declined rapidly thereafter following the demographic transition. Infant and child mortality rates were very high though and only around half of the children survived to their fifth birthday. These features were shared by many regions in inland rural Spain, thus making this area representative of a wider context.

Mortality rates began to decline in the last third of the nineteenth century due to increasing living standards. The decline firstly benefited children in their late childhood and spread later to younger cohorts. Infants were the last ones to join this trend and their survival chances only significantly increased from 1900 onwards when hygienic conditions and their mothers' health improved, an improvement that was especially visible during early childhood. Anthropometric evidence also indicates that standards of living were extremely low: the average male height was around 160 centimeters in mid-nineteenth-century, well below their European counterparts or their fellow Spaniards in other regions (Martínez-Carrión et al. 2016; Hatton and Bray 2020). In an area where most of the population enjoyed living standards close to subsistence levels, choices mattered and discriminatory practices could have had lethal consequences.

Despite the lack of hard quantitative evidence, it seems that infanticide, but especially child abandonment, was a relatively common practice. Anecdotal evidence from religious trials indicates that killing unwanted newborns before baptizing them was a "well-established" custom in Early Modern Aragon (Tausiet 2001). It should be noted that the attitude of the Church toward infanticide was much more permissive in Early Modern Aragon and considered these crimes as involuntary homicides due to lack of attention providing it took place within the private sphere of the family (Tausiet 1998, 83). The same source also stresses that many infants died due to neglect in the form of inadequate feeding or lack of attention. Child abandonment was indeed pervasive and attracted a great deal of attention during this

period (Arteta de Monteseguro 1802; Fernández Doctor 1987; Salas Auséns 2006). In this regard, it is quite likely that many of these children did not even reach the foundling hospital and were therefore never registered.

Although there is hardly any information on whether parents treated their boys and girls differently, son preference seems to have formed part of this area's shared cultural norms. In this regard, Spanish women did not enjoy the same status as men: legally subordinated to their fathers and husbands, women were expected to remain within the domestic realm and those who did work in paid jobs received significantly lower wages (Camps 1998; Sarasúa 2002; Borderías et al. 2010; Borderías and Muñoz 2018). The custom of the dowry also militated against girls as plenty of studies have documented for regions in South and East Asia (Das Gupta et al. 2003; Bhalotra et al. 2020).[7] Many state regulations frequently attempted to limit this practice in order to make it less onerous (Martín Rodríguez 1984, 264). Coherent with the state's interests in promoting fertility (so as to strengthen the nation with man and military power), the reason behind restricting the amount that parents had to pay their daughters to secure their marriages was mainly to facilitate weddings (and subsequently fertility). It however clearly implies that this practice was a burden for the families. The norm itself, consigned in the *Pragmática* of 1623 but alive during the period of study here, indicated that the costs associated with the dowry had detrimental consequences for families' estates because they sometimes had to borrow the required money. In this regard, Harding (1984: 103) mentions that a farmer lost his family state in the late nineteenth century because it had to provide dowries for his eight daughters.

Fertility decisions seemed to have indeed been related to the sex composition of the surviving children (Reher and Sanz-Gimeno 2007; Reher and Sandström 2015; Marco-Gracia 2021). Those families who did not have previous sons not only were more likely to continue bearing more children but also had shorter birth intervals, so strategies to control fertility were used to ensure at least a male heir. Reher and González-Quiñones (2003) also show that the death of the mother especially affected the survival chances of their daughters, thus suggesting that son preference was stronger for fathers. It also appears that women were discriminated through an unequal allocation of resources within the household, both in terms of nutrition and educational investments (Sarasúa 2002; Borderías et al. 2014; Marco-Gracia and Beltrán Tapia 2021). As well as to the relative backwardness of this area, literacy rates also testify to how unequally parents treated boys and girls: while around 40 percent of men were literate in 1860, less than 5 percent of women were able to read and write. As it will be shown here, sex ratios at baptisms were abnormally high up to the late nineteenth century, a circumstance that was shared by other Spanish regions. On average, 107 boys per hundred girls were baptized by legitimate couples in rural areas between 1858 and 1870 but this figure hides significant regional variations: 11 provinces actually exhibited values over 108 (Junta General de Estadística 1863; Instituto Geográfico y Estadístico 1877). Similar extreme values were still visible in the early twentieth century (Echavarri 2021). Next sections address whether these underlying attitudes toward boys and girls translated into their respective survival chances at birth.

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[7] See also Beltrán Tapia and Raftakis (2021) on the discriminatory effect of the dowry in nineteenth-century Greece.

3. Data and methodology

The statistical analysis relies on the complete church registers of these villages, whose records provide high-quality information on all baptisms, marriages, and deaths that occurred between 1575 and 1999 (although the starting date varies by location; more details about the "Alfamén and Middle Huerva Database" in Marco-Gracia 2017, 2019). Document 1 in the appendix offers an example of these registers. In total, this dataset contains information on 88,989 individuals, including name, sex, place and date of birth, parents' names, and date of death, among others, thus permitting the reconstitution of the life history of these individuals and their families. This longitudinal dataset has also been complemented with information on occupation and literacy contained in population lists (1747–1830), population censuses (1857, 1860), and electoral rolls (1890–1955). Table A1 in the Appendix provides the number of observations by period, classified by sex, father's occupation, and father's literacy.

We should bear in mind that registration quality greatly improved from 1750 onwards. Infant and child mortality rates before that date are too low, so under-registration of deaths is likely to be an issue. Although registration quality had been improving throughout the eighteenth century, the year 1774 was especially important: the priests in these villages received a pastoral visit conveying the orders from the Archbishop of Zaragoza. These mandates emphasized the importance of keeping accurate and detailed parish records.[8] Given that the availability of complementary information (i.e., father's occupation and literacy) also increased from the second half of the eighteenth century onwards, we will restrict most of our analysis to the period 1750–1950.

Twins, individuals whose parents cannot be identified (out-of-wedlock, abandoned, and mis-specified infants) or temporary migrants who happened to have a child in the study have been excluded from the analysis.[9] Apart from mitigating unobserved heterogeneity, this approach allows us to unveil discriminatory practices taking place within ordinary families. This restricted data set includes information on 57,521 individuals born between 1750 and 1950. It should be noted that a significant fraction of these observations lacks age of death or marriage ($n = 17,623$), mostly due to migration out of the area of study. We are interested in what happens right after birth, so we have assumed that these individuals did not die during the first day of life. This is a plausible assumption because only a negligible fraction of infants may have migrated and died shortly after birth. In any case, the results reported here do not change if we restrict the analysis to those observations whose date of death (and/or marriage) is known.[10]

Methodologically, this article combines a descriptive analysis of sex ratios at baptism with econometric analyses that explore the individual-level information contained in the birth and death registers in order to shed light on the circumstances leading to the high sex ratios observed in the baptismal records. Relying on logistic regressions, these models link the probability of (1) being male at baptism and (2) dying during the first hours of life with

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[8] While birth registers before that date only reported the name of the parents, they began to include that of grandparents. Death registers similarly now included the names of their relatives. Likewise, these records now reported not only where these people lived but also where they were born.

[9] Twins are excluded from the analysis because they did not only suffer extremely high mortality rates but also generated an unexpected shock to the household resources that can distort our analysis (Clark et al. 2020). Excluding also those individuals born in families who raised twins does not change the results reported here.

[10] Additional results available upon request.

individual and household characteristics.[11] As well as the number of children alive at birth, the explanatory variables include their sex composition: having either no male or female siblings alive (compared to mixed-sex siblings).

Apart from the behavioral effect that having no male or female siblings may have had, the number of siblings alive at birth may also induce discriminatory practices by putting more pressure on the available resources. In this regard, in the absence of sex-specific neglect, resource-constrained environments are expected to take a greater toll on males due to their greater vulnerability both in utero and around birth (Dipietro and Voegtline 2017).[12] It should be noted though that this variable also distinguishes between high- and low-mortality families. In order to test the robustness of our results, we conduct an additional exercise including a set of dummy variables to consider mother's age, father's occupation, and father's literacy.[13] In addition, all models control for parity, village, and time-period fixed effects. Lastly, restricting the analysis by birth order and occupation will allow us exploring the heterogeneity of our results. Table A2 in the appendix reports summary statistics of the variables employed here.

Crucially, conducting exercises on birth and death registers rules out the possibility that under-registration is explaining the patterns found here: although female misreporting would bias sex ratios at baptism upwards, it would have the opposite effect on mortality rates (reducing the number of female deaths during the first hours of life). As evidenced later, our results provide similar conclusions from both types of records, thus supporting the hypothesis that son preference fostered female neglect shortly after birth in our study area.

4. Aggregate sex ratios at birth

Baptism registers provide the name, sex, place and date of birth, and parents' and godparents' names. This sacrament was free of charge,[14] so there were no incentives to avoid registration. The opposite was actually the case because a baptismal record was required for other future formalities such as getting married or migrating. Moreover, this information was registered

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[11] While the dichotomous dependent variable takes a value of 1 if the baptized child was male, the analysis of death records involves attaching a value of 1 when the infant died during the first day of life.

[12] Notice that the positive effect that having older siblings could have, mainly through taking care of the new member of the family, would not be visible right after birth but would take place at an older age.

[13] Mother's age is classified as below 20, 20–30, 30–40, and above 40. The information on father's occupation has been grouped into six categories: (1) day-labourers and small owners who were unable to make a living exclusively from their properties; (2) farmers with enough land to secure their livelihood; (3) sheep and goat shepherds; (4) artisans; (5) elites, mostly doctors, teachers, and council representatives; and (6) other occupations, a heterogenous group including mule drivers, soldiers, low-skilled occupations working for the municipality, among other occupation that do not fit within the other groups. While mother's age is missing in around 30 percent of our observations, father's occupations and literacy are lacking in almost 60 percent of our individuals. This scarcity is more important in the earlier periods and very low in the final years analyzed here. Missing values are categorized as an additional category ("unknown"), so as not to lose observations when mother' age and father's occupation and literacy are included in the analysis. The results reported here hardly change if these observations are excluded.

[14] In 1697, the synodal constitutions of the Archbishopric of Zaragoza established which ceremonies celebrated in the province were free and which ones involved paying a fee (and its amount). These constitutions were valid until 1943.

quickly after birth because catholic beliefs stressed that if a child died without baptism, he or she could not enter heaven and ensure spiritual salvation (Hanlon 2016, 536; Minello et al. 2017)[15]. Importantly, an additional institutional mechanism supports the exceptional quality of these records. During the Epiphany Mass, the first festivity of each year (January 6), the local priest read aloud all birth, marriage, and death registers from the previous year to make sure that every event was recorded.[16] Claims happened very rarely but, when they were made, a register was added to the previous year's book, thus further evidencing how meticulously these records were kept. This procedure was also in the interest of the families because, as mentioned above, the existence of the Church record was required later in life (for marriage or migration). Our records indicate that this mechanism to correct potential errors in the records was at a place at least from the late eighteenth century. The exceptional quality of these records implies that if a baby was not registered, it is because he or she had died during birth or the first days of life.[17]

Our records contain a total of 88,989 baptisms between 1575 and 1999. Figure 2 plots sex ratios at baptism between these two dates using a 25-year moving average. The number of boys per hundred girls remained exceptionally high between 1625 and 1750, averaging 113.5 (17,868 births). While the second half of the eighteenth century witnessed relatively balanced sex ratios at birth, these figures increased again during the 1790s and remained relatively high during the whole nineteenth century, and especially so in the 1800s and the 1860–1880s (reaching figures above 110 boys per hundred girls). The average sex ratio during the whole nineteenth century was 108.8, high enough to be statistically different from 105 at the 99 percent confidence level (33,421 births; *p*-value = 0.0006). Sex ratios became relatively normal from 1900 and remained so during the twentieth century. As discussed in the previous section, registration quality greatly improved during the second half of the eighteenth century. Thus, our subsequent analysis will exclude the period before 1750. By doing so, we are adopting a conservative research strategy that disregards the most extreme sex ratios and therefore mitigates the possibility of finding spurious results.

Moreover, although we follow the literature in using 105, the 'natural' sex ratio at birth, as our benchmark for comparison (Chao et al. 2019), the historical figure in absence of human manipulation might be slightly lower, thus making our findings even more significant. The probability of miscarriages is higher in high-mortality environments (Woods 2009). Given that the female survival advantage also exists in utero (Di Renzo et al. 2007; Dipietro and Voegtline 2017), more boys are expected to die before birth, thus pushing down the "natural" sex ratio at birth.[18] There is very little research on how this figure should look like in historical populations (Visaria 1967; Chahnazarian 1988), but modeling the evolution of

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[15] Our information confirms that newborns were baptized within the same day that they were born from the late eighteenth century to the 1880s (see table A3 in the Appendix). The distance between birth and baptism increased in the following decades due to the decline in mortality rates and changing social and religious behavior.

[16] The Epiphany celebrates the revelation that God is incarnated as Jesus Christ and is probably one of the most important Catholic celebrations, so all villages gathered for the *Misa Mayor* (Major Mass). The priest consigned in the source that this reading was made during this event.

[17] Virtually all the individuals listed in the 1857 populations census as born in the villages analyzed here are recorded in the parish birth registers: only 5 out of 8,301 (0.06 percent) are missing and this probably over-estimates the number of missing registers because there might be an error in the information on place of origin.

[18] 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).
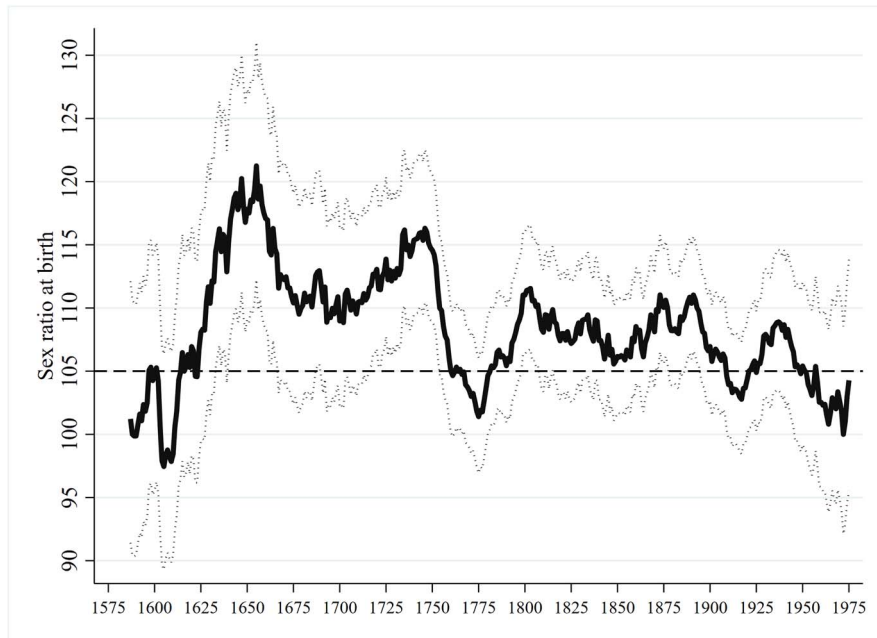
Figure 2. *Sex ratios at baptism, 1575–1975.* Note: 25-year moving average. Dotted lines represent the 95 percent confidence interval. Source: AMHDB.

sex ratios at birth over time in Europe (1750–2015) using the Human Mortality Database yields an estimated figure close to 104 in high-mortality environments as those existing in eighteenth- and nineteenth-century Spain (see figure A1 in the Appendix),[19] thus making the figures observed here even higher. It is important to note that this historical estimate should be considered as a maximum threshold because it is based on observed sex ratios at birth, thus potentially including information from countries where female infants were being neglected.[20] In addition, sex ratios at baptism should be even lower than at birth because some infants could have died before being baptized, an issue that would again especially affect boys due to their vulnerability (Waldron 1998; Zarulli et al. 2018).

Although female under-registration could have been an issue before 1750, it is very unlikely that it explains the high figures observed during the nineteenth century. As discussed above, the characteristics of this source guarantee that under-registration was not only negligible but also unrelated to the baby's sex. Although baptism was free of charge, it is possible though that families did not register a child if he or she died shortly after birth in order to avoid the funeral fee (or if these families thought that the child was going to die shortly). If this was the case, the sex ratios can be considered net of neonatal deaths. This potential issue however would not prevent detecting female infanticide and/or neglect. Likewise, due to the female

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[19] If under-registration of births was higher for girls in the past, this figure would be even lower because the sex ratios observed in the eighteenth and nineteenth centuries would be biased upwards.

[20] In this regard, sex ratios at birth in Mediterranean countries tend to be relatively high, especially in earlier periods. Unfortunately, the series for Eastern European countries do not usually allow looking at the period before 1950.

biological advance, more boys would be expected to die during the first hours and therefore being under-reported. However, as mentioned before, religious beliefs powerfully dictated that children should be baptized as soon as possible, so it is very unlikely that newborns went unregistered. In this regard, the distance between birth and baptism is very similar for boys and girls in all periods analyzed here, thus suggesting that there were no sex differences in baptismal patterns (see table A3 in the Appendix). If under-registration is not an issue, such high sex ratios can only occur if families were disposing of some of their female babies before getting baptized.[21]

5. Individual characteristics and the probability of being baptized male

Sex ratios at baptism were excessively unbalanced in our area of study, at least until the early twentieth century. Analyzing the individual-level information associated to each of these births allows shedding light on the behavioral factors behind these high sex ratios. Focusing on the period 1750–1900, when female neglect was potentially more important, table 1 reports the results of estimating a logit model assessing whether the probability of being baptized male is related to different individual characteristics: birth order, the number of children alive at the moment of birth, and the sex composition of those previous children (having no males or no females siblings compared to mixed-sex siblings). Theoretically, the probability of being male or female at birth is independent of the sex of previous children. While column (1) presents the baseline specification (including parity, village, and period fixed effects), column (2) adds a set of additional control variables: mother's age, father's occupation, and literacy. Columns (3) to (8) restrict the analysis to different parities (3, 4, and 5+). This analysis has been replicated for all births (Panel A) and those happening in agricultural families (farmers and laborers; Panel B).

As shown in columns 7–8 in panel A, the probability of being male increases at parity 4 with the number of siblings and when there are no previous males alive. Interestingly, having no female siblings does not show any effect on the probability of being male. The fact that these results disappear at higher parities (5+) is probably due to the lack of variation in the data (the likelihood of not having male siblings at higher parities is smaller). Moreover, high-fertility families might be different in other dimensions that may confound the analysis. We should also be aware that, by considering all observations, this first exercise (Panel A) is mixing up different types of families, thus obscuring the results. Focusing on agricultural families (farmers and laborers) indeed show clearer results. The probability of being born male increases now not only at parity 4 but also at parity 3 (Panel B). It appears that the pressure to have a boy increased in those families that did not have any male descendant to the point to significantly alter the natural sex variability. In particular, at parity 4 and controlling for the other variables in the model (column 8, panel B), not having any boy alive increased the average predicted probability of being male at baptism from 49.9 to 59.6 percent.

In order to further explore how these issues may have evolved over time, table 2 replicates the analysis for different periods (1750–1850, 1850–1900, and 1900–1950), focusing on births happening in agricultural families at parity 4. The results clearly show two different patterns before and after 1900. The effect of having no previous male siblings seems to have decreased over time. In fact, this pattern had totally disappeared in those baptisms occurred during the first half of the twentieth century, when having no male or female siblings does not

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[21] Differential-stopping rules do not affect societal sex ratios at birth (Basu and De Jong 2010, 523).

Table 1. *Probability of being male at baptism, 1750–1900*

Panel A: all observations

Dep. variable: probability of being male at birth

	All births		Parity 2		Parity 3		Parity 4		Parity 5+	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Children alive	0.012	0.014	−0.195	−0.155	0.031	0.033	0.099**	0.097**	0.002	0.003
	(0.010)	(0.011)	(0.458)	(0.453)	(0.059)	(0.059)	(0.043)	(0.043)	(0.011)	(0.012)
No males	−0.006	−0.005	−0.300	−0.261	0.079	0.080	0.194**	0.193**	−0.094*	−0.090*
	(0.030)	(0.030)	(0.464)	(0.458)	(0.077)	(0.077)	(0.075)	(0.075)	(0.053)	(0.053)
No females	−0.000	0.000	−0.254	−0.214	0.033	0.038	0.048	0.044	0.021	0.025
	(0.029)	(0.029)	(0.464)	(0.458)	(0.076)	(0.076)	(0.074)	(0.074)	(0.049)	(0.049)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Add. controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	44,089	44,089	7,498	7,498	6,377	6,377	5,352	5,352	15,581	15,581
Pseudo R2	0.0001	0.0004	0.0013	0.0033	0.0018	0.0028	0.0045	0.0062	0.0007	0.0009

Panel B: farmers and laborers

Dep. variable: probability of being male at birth

	All births		Parity 2		Parity 3		Parity 4		Parity 5+	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Children alive	−0.001	0.001	0.320	0.397	0.216*	0.208*	0.070	0.067	−0.017	−0.018
	(0.020)	(0.020)	(0.912)	(0.979)	(0.112)	(0.112)	(0.083)	(0.083)	(0.021)	(0.022)
No males	0.065	0.067	0.247	0.326	0.361**	0.351**	0.394***	0.398***	−0.089	−0.088
	(0.058)	(0.058)	(0.921)	(0.987)	(0.149)	(0.150)	(0.142)	(0.142)	(0.101)	(0.101)
No females	−0.031	−0.030	0.373	0.454	0.175	0.176	−0.108	−0.105	−0.022	−0.021
	(0.054)	(0.054)	(0.923)	(0.989)	(0.147)	(0.147)	(0.137)	(0.137)	(0.085)	(0.086)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Add. controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	12,268	12,268	2,044	2,044	1,820	1,820	1,562	1,562	4,572	4,571
Pseudo R2	0.0003	0.0011	0.0041	0.0069	0.0063	0.0092	0.0135	0.0154	0.0019	0.0021

Note: Coefficients estimated using a logit regression model. Robust standard errors in parentheses (clustered at the household level); *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; for simplicity, the intercept is not reported. While the basic set of controls includes parity, village, and period fixed-effects, the additional controls include mother's age, father's occupation, and father's literacy.

Table 2. *Probability of being male at baptism (farmers and laborers at parity 4), 1750–1950*

	Dep. variable: probability of being male at birth					
	1750–1850		1850–1900		1900–1950	
	(1)	(2)	(3)	(4)	(5)	(6)
Children alive at	0.238	0.254	−0.009	−0.011	0.013	0.019
birth	(0.153)	(0.154)	(0.099)	(0.099)	(0.102)	(0.104)
No males at birth	0.516**	0.530**	0.364**	0.369**	−0.266	−0.260
	(0.261)	(0.263)	(0.169)	(0.170)	(0.185)	(0.186)
No females at birth	−0.207	−0.162	−0.103	−0.101	0.033	0.033
	(0.246)	(0.247)	(0.165)	(0.165)	(0.170)	(0.170)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls	No	Yes	No	Yes	No	Yes
Observations	487	487	1,092	1,092	963	963
Pseudo R2	0.0197	0.0256	0.0178	0.0203	0.0099	0.0121

Note: Coefficients estimated using a logit regression model. Robust standard errors in parentheses (clustered at the household level); $***p < 0.01$, $**p < 0.05$, $*p < 0.1$; for simplicity, the intercept is not reported. While the basic set of controls includes parity, village, and period fixed-effects, the additional controls include mother's age, father's occupation, and father's literacy.

alter the sex of the new baby. This implies that son preference was especially marked during the traditional demographic regime, a result that was also apparent when looking at crude sex ratios at birth (figure 2). The fact that this finding disappears in the early twentieth century is compatible with changes in cultural norms about the need of having male descendants. In this regard, improved living standards is likely to have mitigated economic constraints and the demographic transition toward lower fertility and mortality levels may have also altered parents' perceptions about their children's mortality and therefore their behavior.[22] Likewise, the increasing availability of female labor opportunities, especially in the neighboring Zaragoza, may have also affected the perceived relative value of girls.

Although splitting the analysis by occupation makes the results noisier due to reduced samples, it seems that female neglect around birth was concentrated among landless and semi-landless families. In this regard, table 3 reports the results of replicating the analysis for farmers and laborers separately (panels A and B, respectively). Having no male offspring especially increased the probability of a male birth in laborers' families (the coefficients on farmers' families are also positive but smaller and not statistically significant).[23] These families were subject to harsher economic conditions and therefore more likely to resort to extreme decisions under difficult circumstances. Not only the expectation of having to provide a dowry militated against girls but also laborers relied on the demand for waged agricultural labor and this clearly favored males. In this regard, while the farmers' daughters could work on the family farm, it was difficult for landless families to find paid jobs for their daughters. This circumstance also made boys more attractive because they could better complement the family income.

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[22] Although it has been argued that parental indifference to their infants was very common in high-mortality contexts (Ariès 1979; Zelizer 1985), Woods (2003) is highly skeptical about this hypothesis.

[23] The size of the samples does not allow replicating the analysis on other occupational categories (shepherds, artisans, elites, and/or other occupations).

Table 3. *Probability of being male at baptism (by occupation), 1750–1900*

Panel A: farmers

Dep. variable: probability of being male at birth

	All births		Parity 3		Parity 4		Parity 5+	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Children alive	−0.012	−0.009	0.166	0.153	0.084	0.059	−0.018	−0.024
	(0.027)	(0.028)	(0.171)	(0.173)	(0.126)	(0.127)	(0.029)	(0.030)
No males	0.064	0.068	0.374	0.350	0.271	0.264	−0.120	−0.116
	(0.085)	(0.085)	(0.229)	(0.233)	(0.220)	(0.220)	(0.143)	(0.142)
No females	−0.108	−0.113	0.018	0.016	−0.290	−0.305	−0.071	−0.074
	(0.079)	(0.079)	(0.226)	(0.230)	(0.212)	(0.212)	(0.126)	(0.126)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Add. controls	No	Yes	No	Yes	No	Yes	No	Yes
Observations	5,453	5,453	771	768	674	674	2,187	2,187
Pseudo R2	0.0007	0.0021	0.0203	0.0309	0.0241	0.0285	0.0049	0.0053

Panel B: laborers

Dep. variable: probability of being male at birth

	All births		Parity 3		Parity 4		Parity 5+	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Children alive	0.010	0.008	0.241	0.252*	0.039	0.024	−0.006	−0.002
	(0.028)	(0.029)	(0.150)	(0.151)	(0.111)	(0.111)	(0.031)	(0.032)
No males	0.066	0.070	0.322	0.332*	0.465**	0.450**	−0.028	−0.021
	(0.078)	(0.079)	(0.198)	(0.198)	(0.188)	(0.190)	(0.143)	(0.142)
No females	0.042	0.032	0.266	0.281	0.022	0.014	0.036	0.037
	(0.074)	(0.074)	(0.196)	(0.197)	(0.182)	(0.182)	(0.118)	(0.119)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Add. controls	No	Yes	No	Yes	No	Yes	No	Yes
Observations	6,815	6,815	1,048	1,046	887	887	2,385	2,384
Pseudo R2	0.0004	0.0019	0.0033	0.0047	0.0165	0.0219	0.0036	0.0045

Note: Coefficients estimated using a logit regression model. Robust standard errors in parentheses (clustered at the household level); ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$; for simplicity, the intercept is not reported. While the basic set of controls includes parity, village, and period fixed-effects, the additional controls include mother's age, father's occupation, and father's literacy.

6. Mortal neglect of female babies from death records

The previous results linking the probability of being baptized male to individual characteristics support a behavioral explanation for the high sex ratios at baptism found at the aggregate level. Anecdotal evidence on female infanticide is rare but the asymmetry between the number of male and female baptisms, especially at higher parities and in families of low socio-economic status with no previous male descendants, suggests that some families disposed of their female babies or disguised female infanticides as natural deaths.

Although we have already discussed that female under-registration was negligible and therefore does not affect the previous analysis, examining death registers provide further evidence that baby girls were neglected, especially under certain circumstances. If under-

Table 4. *Probability of dying during the first days of life (by sex), 1750–1900*

Panel A: males

	Day 0		Days 0–1		Days 1–7	
	(1)	(2)	(3)	(4)	(5)	(6)
Children alive at birth	−0.012	−0.034	−0.048	−0.065	−0.104*	−0.104*
	(0.068)	(0.069)	(0.060)	(0.061)	(0.058)	(0.060)
No males at birth	0.319*	0.296*	0.338**	0.321**	0.190	0.187
	(0.173)	(0.175)	(0.152)	(0.152)	(0.151)	(0.151)
No females at birth	0.380**	0.356**	0.424***	0.407***	0.247	0.245
	(0.168)	(0.169)	(0.150)	(0.151)	(0.158)	(0.158)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls	No	Yes	No	Yes	No	Yes
Observations	22,561	22,561	22,728	22,728	22,312	22,312
Pseudo R2	0.0201	0.0247	0.0191	0.0229	0.0132	0.0148

Panel B: females

	Day 0		Days 0–1		Days 1–7	
	(1)	(2)	(3)	(4)	(5)	(6)
Children alive at birth	0.078	0.072	0.068	0.063	−0.019	−0.049
	(0.081)	(0.081)	(0.073)	(0.073)	(0.076)	(0.079)
No males at birth	0.724***	0.723***	0.701***	0.703***	0.055	0.032
	(0.222)	(0.222)	(0.195)	(0.194)	(0.178)	(0.181)
No females at birth	0.479**	0.466**	0.306	0.296	0.190	0.165
	(0.224)	(0.221)	(0.201)	(0.200)	(0.184)	(0.187)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls	No	Yes	No	Yes	No	Yes
Observations	21,176	21,176	21,361	21,361	20,969	20,969
Pseudo R2	0.0244	0.0286	0.0221	0.0256	0.0105	0.0162

Coefficients estimated using a logit regression model. Robust standard errors in parentheses (clustered at the household level); ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$; for simplicity, the intercept is not reported. While the basic set of controls includes parity, village, and period fixed-effects, the additional controls include mother's age, father's occupation, and father's literacy.

registration systematically targeted girls, it would have affected both births and deaths around birth. The latter is actually more plausible because, unlike baptisms, registering deaths imply paying a fee. The bias would however now work in the opposite direction and we would be observing fewer female deaths, thus making it more difficult to identify neglect against infant girls. This section therefore explores whether the individual-level characteristics analyzed in the previous section also affected the probability of dying during the first day of life differently for boys and girls. If anything, potential neglect would happen right after birth. Therefore, once infants are accepted, breastfeeding would protect them regardless of their sex, so we would expect no clear differences by sex after the first one or two days of life.

Table 4 reports the results of estimating a logit model assessing whether the probability of dying during the first one or two days of life (columns 1–4) and the rest of the first week of life (columns 5–6) is affected by individual-level characteristics: the number of previous

children alive and the sex composition of those children (controlling for other characteristics as in the previous section).[24] This analyses show that, while having no surviving brothers or sisters at birth had similar effects on male mortality (panel A), it is the absence of male siblings what significantly increased female mortality right after birth. This is extremely telling because it supports the previous evidence regarding unbalanced sex ratios at baptism. The number of girls dying shortly after birth is significantly higher when no other sons are alive, thus suggesting that some families were neglecting their newborn girls because they only wanted a boy. In particular, and according to the coefficient estimated in column 4 (panel B), the average predicted probability of a girl dying during the first two days of life shifts from 1.1 percent when there was already at least one son in the family to 2.3 percent when there is none. Although not statistically significant, it should be noted that, while the effect of the number of siblings alive has a negative sign for boys, it has the opposite sign for girls. This runs contrary to what should be expected because, if anything, having fewer available resources would especially affect males due to the female biological advantage. Discriminatory practices may have therefore offset the natural male vulnerability. Crucially, these effects on female mortality are no longer visible when we analyze what was happening during the rest of the first week.[25] As argued above, those parents who neglected their female babies did so at birth or shortly after. If, on the contrary, girls were accepted into the family and breastfed, their survival chances from then onwards would not depend on the behavioral factors analyzed here (notice that, except in the case of twins, breastfeeding is a non-competing resource). Excess female mortality would nevertheless resurface again as soon as these infants were weaned (Marco-Gracia and Beltrán Tapia 2021).

Likewise, table 5 clearly evidences that the probability that a baby girl died during the first one or two days of life was higher in landless or semi-landless families with more children alive at birth, an effect that is not visible for boys despite that they should be theoretically weaker (as reported in table A4 in the Appendix, these effects are not present in land-owning families). Moreover, although the effect of having no male siblings on female mortality is not statistically significant, this is probably due to the reduced number of observations. The size of the coefficient is actually very similar to the one shown in table 4, thus suggesting that this feature is likely to have increased female mortality rates. Notice also how this positive coefficient contrasts with the negative one found on male mortality (columns 1–4, panel A). Again, the patterns found on female mortality shortly after birth disappear when we focus on what happened during the rest of the first week of life (columns 5–6, panel B). These results thus confirm those reported in the previous section on the probability of being baptized male. Families from low socio-economic status that relied on the demand for waged labor were subject to more strenuous circumstances and therefore more likely to be involved in discriminatory practices against newborn girls. As well as the burden imposed by the dowry, the fact that boys were more easily employable in these agricultural markets also contributed to reducing the relative value of girls. Lastly, the effect of the number of siblings and their sex composition on female mortality are no longer visible when we restrict the analysis to the period 1900–1950 (see table A5 in the Appendix), thus also supporting our finding in the previous sections analyzing baptisms.

[24] By definition, those children born first did not have male or female siblings alive. The results reported here do not change if the analysis is replicated excluding them.
[25] The results are not altered if, instead of considering the probability of dying between days 1 and 7, we focus on the period between days 2 and 7.

Table 5. *Probability of dying during the first days of life (by sex): laborers, 1750–1900*

Panel A: males	Dep. variable: probability of dying					
	Day 0		Days 0–1		Days 1–7	
	(1)	(2)	(3)	(4)	(5)	(6)
Children alive at birth	−0.211	−0.300	−0.247	−0.343*	−0.424	−0.477*
	(0.221)	(0.234)	(0.189)	(0.201)	(0.285)	(0.272)
No males at birth	−0.420	−0.516	−0.218	−0.313	0.477	0.425
	(0.500)	(0.515)	(0.417)	(0.434)	(0.454)	(0.451)
No females at birth	−0.553	−0.606	−0.117	−0.178	0.166	0.112
	(0.438)	(0.453)	(0.359)	(0.371)	(0.433)	(0.425)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls	No	Yes	No	Yes	No	Yes
Observations	3,555	3,485	3,555	3,485	3,392	3,392
Pseudo R2	0.0338	0.0438	0.0265	0.0358	0.0485	0.0543

Panel B: females	Dep. variable: probability of dying					
	Day 0		Days 0–1		Days 1–7	
	(1)	(2)	(3)	(4)	(5)	(6)
Children alive at birth	0.324*	0.314**	0.305**	0.341**	−0.168	−0.190
	(0.172)	(0.155)	(0.143)	(0.143)	(0.228)	(0.243)
No males at birth	0.608	0.557	0.379	0.380	−0.341	−0.339
	(0.626)	(0.593)	(0.544)	(0.532)	(0.459)	(0.475)
No females at birth	−0.152	−0.147	−0.329	−0.290	−0.107	−0.122
	(0.680)	(0.680)	(0.540)	(0.549)	(0.510)	(0.527)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls	No	Yes	No	Yes	No	Yes
Observations	3,079	3,079	3,079	3,079	3,107	3,107
Pseudo R2	0.0396	0.0783	0.0428	0.0706	0.0182	0.0386

Coefficients estimated using a logit regression model. Robust standard errors in parentheses (clustered at the household level); ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$; for simplicity, the intercept is not reported. While the basic set of controls includes parity, village, and period fixed-effects, the additional controls include mother's age, father's occupation, and father's literacy.

7. Conclusion

Although documenting female infanticide in historical Europe has proved difficult, this article shows that the number of male baptisms in our area of study was exceptionally high up to the early twentieth century. In addition, individual-level information shows that the probability of male baptisms was significantly higher when there were no previous male siblings alive. Likewise, as evidenced by death registers, female survival chances during the first one or two days of life were also negatively affected by this same feature, as well as by the number of siblings alive. These patterns were especially visible among landless and semi-landless families who were subject to more strenuous circumstances and therefore more likely to face life-or-death decisions. Taken together, these findings strongly support the idea that a significant

fraction of female babies were neglected or disposed away. The mortal neglect of girls shortly after birth was probably a conscious family decision that affected a small number of families under certain circumstances. Apart from the need to provide dowries for their daughters, the fact that there existed less female waged labor opportunities also militated against girls. These practices disappeared during the first decades of the twentieth century as soon as the demographic transition and other economic, social, and cultural changes reduced general mortality rates and undermined the strong son preference detected here.

The sources are though silent regarding how these girls went missing. There were of course many ways of disposing of unwanted children and these crimes were easy to commit and difficult to prove (starvation, dehydration, strangulation, drugged to death, smothering, exposure to elements, etc.; Langer 1972, 96; Harris and Ross 1987, 5–6). In his *Elementa medicinae et chirurgiae forensis*, written in Latin in 1781 (and translated into Spanish in 1796), Joseph Jakob von Plenk, a prestigious Austrian physician, devoted 18 pages to describe different ways of committing infanticide, many of them practically indistinguishable from natural deaths. Given the high rates of stillbirths and neonatal mortality, infant deaths within married couples did not raise the suspicion of civil or religious officials (Hynes 2011, 509; Hanlon 2016, 537). Although strongly condemned by the Catholic Church, infanticide was indeed known in our area of study (Tausiet 1998). Increasing the mortality of newborn girls through indirect methods, rather than directly killing them, was perhaps also plausible. As well as the "quiet disposal" of babies, Wrigley (1966, 105) argues that families could have not striven enough to keep them alive especially during the crucial first hours of life. Given that there is hardly any anecdotal evidence on female infanticide, our findings suggest that some families disguised female infanticide or neglect as natural deaths.

Exposing these babies at the entrance of the church, or in other less visible places hoping that someone would take care of them, was also a possibility and it is quite likely that many of these abandoned children did not survive and die of hunger or cold (Salas Auséns 2006; Revuelta-Eugercios 2011). The closest foundling hospital was in Zaragoza, at around 30 kilometers of our area of study and exposing children also carried social stigma. Pregnant single women often traveled to the city in order to conceal the pregnancy and deliver there. Less than 0.5 percent of the total number of baptisms are identified as abandoned children but we cannot know how many families made use of this mechanism because many of these children never reached the foundling hospital. Moreover, not only this sample size is too small to draw any conclusion,[26] but also many of them were the result of illegitimate relationships and therefore not driven by economic considerations but by shame, thus independent of the sex of the baby (Sarasúa 2021). We should also bear in mind that our empirical exercises exclude abandoned infants and those whose parents cannot be identified (including out-of-wedlock births), so our results effectively focus on ordinary families.

Boys could undoubtedly fell victims of these practices as well, but the evidence provided here shows that families especially targeted girls. This article therefore challenges the notion that there were no missing girls in historical Europe and suggests that these families regulated the size and sex composition of their offspring despite the religious norms against it, at least in inland rural Spain. These findings have important implications for our understanding of the traditional demographic regime and the subsequent transition to lower fertility and mortality rates. The relatively low number of children raised by these families cannot be longer explained solely by the use of different methods to reduce fertility either indirectly (delaying

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[26] The sex ratio of abandoned children between 1750 and 1900 in the study area was 104 (170 boys and 163 girls).

age at marriage or celibacy) or directly (spacing or stopping). By increasing the mortality of their unwanted children, these families also adopted a "death control" (Harris and Ross 1987; Hanlon 2017). Resorting to infanticide or infant neglect was a complementary strategy to control fertility that allowed families to limit family size and adjust the sex composition of their offspring according to their preferences in a context where son preference prevailed. The gradual disappearance of these practices would therefore partly contribute to explaining the decline in fertility and mortality that took place during the demographic transition. Likewise, the fact that many of these infanticides escaped from birth and death registers also indicates that fertility and mortality rates in pre-industrial rural Spain were higher than what it has been routinely assumed. It is true nonetheless that this analysis focuses on a small region in North-eastern Spain, so more research is needed to assess whether this behavior was also shared in other regions in Southern Europe.

Acknowledgments

Supplementary Material

Supplementary material is available at *European Review of Economic History* online.

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