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Society, economy and missing girls in 18th century Spain

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ABSTRACT

Relying on local-level information in late-18th-century Spain (almost 17,500 locations), this article (1) shows that average child sex ratios were extremely high, a result that cannot be explained by female under-registration, (2) identifies which regions were more prone to suffer from 'missing girls', and (3) explores the factors that might be behind this phenomenon in 18th-century Spain. Our results show that, broadly speaking, Southern Spain exhibited an excess of male children. Those areas showing relatively high child sex ratios are associated with precarious economic conditions and a marriage market that resulted in (almost) universal female marriage and a large spousal age gap. Lastly, our model only explains a small part of the variation in child sex ratios, thus suggesting that it is likely that unobserved social and cultural factors, which are more difficult to measure, were also playing a role in triggering gender-discriminatory practices during infancy and childhood.

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KEYWORDS
Child sex ratios; gender discrimination; infant and child mortality; Spain; 18th century

1. Introduction

Sex-selective abortion, female infanticide and gender discriminatory practices unduly increase female mortality during infancy and childhood resulting in high sex ratios in some developing countries today, most notably in South and East Asia but also in Africa and the Caucasus (Das Gupta et al., 2003; Jayachandran, 2015; Sen, 1990). Rooted in economic, social, and cultural considerations, gender discrimination against girls have long been practiced in societies characterised by strong patriarchal traditions (Bhaskar & Gupta, 2007; Dong & Kurosu, 2017; Drixler, 2013; Drixler & Kok, 2016; Fenske et al., 2025; Gupta, 2014; Lee & Campbell, 1997; Lee & Wang, 1999; Mungello, 2008). Although previous research argued that these practices had been absent in historical Europe (Derosas & Tsuya, 2010; Lynch, 2011), recent studies have uncovered that they were probably more widespread than customarily assumed, especially in southern and eastern Europe (Beltrán Tapia & Szoltysek, 2022).[1]

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The Spanish case showcases pre-eminently in these studies.[2] Firstly, the population censuses published during the second half of the 19th century reported relatively high average child sex ratios (Beltrán Tapia & Gallego-Martínez, 2017). Secondly, parish registers from a rural area in Northeastern Spain show that these patterns are unlikely to arise due to registration issues (Beltrán Tapia & Marco-Gracia, 2022; Marco-Gracia & Beltrán Tapia, 2021, 2022). In particular, this longitudinal information shows that female neglect happened both right after birth and during infancy and childhood (especially regarding the allocation of food and/or care between boys and girls), patterns which were more visible among resource-constrained families. Lastly, the national averages hide substantial regional disparities and the variation in child sex ratios in this period has been linked to economic, social, and cultural factors (Beltrán Tapia & Gallego-Martínez, 2020; Echavarri & Beltrán Tapia, 2024). In a context of widespread poverty, son preference tended to be stronger in rural areas. Likewise, the lack of wage labour opportunities for women and the prevalence of nuclear families exhibited a negative association with girls' survival. In this regard, the expansion of wage labour associated to the expansion of the textile sector in the late 19th century indeed appears to have had beneficial effects on girls' status and their survival chances during infancy and childhood (Beneito & García-Gómez, 2022). Other factors were also probably relevant as these practices are more or less visible in particular regions and/or periods (Catalán Martínez, 2024; Llopis Agelán et al., 2015).[3] Although discriminatory patterns affecting female mortality early in life disappeared in the first decades of the 20th century, they seemed to have re-emerged during the difficult circumstances arising from the Spanish Civil War (1936–39) and its aftermath (Echavarri, 2022).[4]

Most of this evidence, however, pertains to the 19th and early 20th centuries, so little is known on earlier periods. Although Beltrán Tapia and Marco-Gracia (2022) document extremely unbalanced sex ratios at baptism during the 17th and 18th century, those records might be contaminated by registration issues (the infant mortality rates computed from those early sources are abnormally low). Focusing on the Basque country, Catalán Martínez (2024) also finds an excess of male baptisms between 1550 and 1700, a phenomenon that was probably associated to the under-recording of girls during harsh times due to the high cost of baptismal certificates. The available evidence therefore relies only on parish registers and remains scant and very localized in particular regions. There is however a wealth of countrywide statistical information that could be used to fill this gap and shed further light on the Spanish case. The 18th century is promising since it witnessed the undertaking of several counts for all (or most) of the territory: Campoflorido (1712–1717), Ensenada (1749–1753), Aranda (1768–1769), Floridablanca (1787) and Godoy (1797).[5] In all these sources the information was presented at the local level, that is, the population entity (or *pueblo*).[6]

This article relies on the Census of 1787, popularly known as the Census of Floridablanca, which is considered as the best count of the 18th century (Livi Bacci, 1968; Dopico & Rowland, 1990, pp. 591–92; Reher and Valero Lobo 1995, 20).[7] This enumeration was the first that did not have a tax purpose and was carried out anonymously to avoid the widespread concerns about being registered. Local authorities, with the help of the parish priest, visited each household and annotated the number of individuals classifying them by sex, age, marital status, and occupation. Likewise, the Floridablanca census classifies locations according to their institutional characteristics. In total, the census provides local-level information for around 17,500 population entities, covering most of Spain's territory.[8]

Although the population is classified in very broad age-groups, the census allows computing sex ratios for the population younger than 7 years old, which yields a figure of 104.5 boys per hundred girls (Floridablanca, 1787). Given that the high-mortality environments that afflicted historical populations were especially harsh for boys due to biological male vulnerability, this figure cannot be compared to the contemporary one. Precise information on the mortality environment existing in late 18th century Spain is scarce but the available studies suggest that around 20–25% of infants died during the first year of life, a figure that was even higher during difficult periods.[9] Recent estimations suggest that the *natural* child sex ratio in such high-mortality contexts should revolve around parity, 100 boys per hundred girls, or below (Beltrán Tapia, 2019; Beltrán Tapia & Gallego-Martínez, 2017; Malein & Beltrán Tapia, 2022; Szoltysek, Ogórek, et al., 2022). Compared to this benchmark, therefore, the child sex ratios found in the Floridablanca census suggest that around 4–5% of girls went 'missing'. The additional evidence reported here strongly suggests that this result cannot be explained by female under-registration.

This average, however, conceals a significant degree of regional variation. Relying on this wealth of local-level information, we are able to (1) identify which regions were more prone to suffer from 'missing girls' and (2) explore the factors that might be behind this phenomenon in 18th century Spain. Broadly speaking, southern Spain exhibited an excess of male children, thus suggesting that girls' survival in that area was compromised. Regression analyses indicate that those regions showing relatively high child sex ratios are associated with precarious economic conditions and a particular marriage market. On the one hand, areas exhibiting a large proportion of the population living close to subsistence levels were probably forced to make hard choices when allocating limited household resources, a circumstance that seems to have increased female unexplained mortality during infancy and childhood. A large spousal age gap, arising from early and (almost) universal marriage for women, together with a later marriage and higher celibacy rates for men, is also negatively associated with girls' survival chances. These findings therefore not only trace the existence of unexplained female mortality during infancy and childhood at least to the late 18th century, but also link this phenomenon to particular demographic and socio-economic features present in those societies. As well as the literature mentioned above on 19th- and early-20-century Europe, this article therefore directly speaks to the scarce studies exploring these issues in Early Modern Europe (Barbiera et al., 2017; Catalán Martínez, 2024; Hanlon, 2016; Maravall & Baten, 2019).

2. Sources and data

The Census of 1787, henceforth C1787, offers valuable information for more than 20,000 population entities (see samples of the source material in Figure A1 in the Appendix).[10] On the one hand, entities are classified depending on their category (*Ciudad* or City; *Villa* or Town; *Lugar* or Place; etc.). Likewise, the C1787 provides their institutional jurisdiction: each location could be under the Crown (or Royal) jurisdiction, constituted a Lordship (ecclesiastical or secular) or belong to a Military Order. As well as the total population living in these locations, the C1787 provides the number of males and females according to different age-groups and marital status. Lastly, the male population was also classified into major occupational categories.

Specifically, and for this study, we have demographic information for almost 17,500 entities in the Iberian peninsula and the Balearic and Canary archipelagos (hereby excluding territories in northern Africa and Spanish America).[11] According to C1787, this territory hosted a population of more than 10.4 million people. To measure the importance of missing girls, we rely on the child sex ratio, defined as the number of boys per hundred girls (aged 0–7). Although the choice of the age-group is dictated by the nature of the data,[12] this indicator provides a cumulative measure of gender discrimination affecting sex-specific mortality rates around birth and during infancy and childhood. Its main limitation is that it cannot distinguish whether the unexplained female mortality is due to female infanticide (or other forms of female neglect around birth) and/or the result of an unequal allocation of food and/or care during the first years of life. The census, which is summarised in the *Estado General de la Población de España en el año de 1787*, yields a child sex ratio of 104.5 boys per hundred girls for the whole of Spain (out of almost 1.9 million children aged 0–7),[13] a figure that is quite similar to those found in the censuses of 1860, 1877 and 1887.

As mentioned above, this child sex ratio cannot be compared to today's standard because the high-mortality environments existing in the past especially affected boys due to the female biological advantage. On average, *natural* child sex ratios were lower in the past, often well below 100 boys per hundred girls in especially harsh environments (Beltrán Tapia, 2019; Beltrán Tapia & Gallego-Martínez, 2017; Malein & Beltrán Tapia, 2022; Szoltysek, Ogórek, et al., 2022). According to Chacón Jiménez et al. (1991, p. 37), around 30 and 50% of all infant did not reach their first birthday in Spain during late 18th century.[14] Although these estimations are not as precise as those existing for later periods, situating a *natural* sex ratio around 100 seems an adequate benchmark for the conditions existing when the census was carried out. The long-term evolution of child sex ratios in Europe points in the same direction (Figure 1).[15] Comparing the child sex ratios observed in the Floridablanca Census with its appropriate historical benchmark therefore suggests that around 4–5% of girls were 'missing'.

To our knowledge, only a few studies have explicitly considered the high child sex ratios in this census. In fact, it does not seem that this abnormally high figure has been acknowledged before, possibly because of the lack of an appropriate benchmark. If anything, this excess of boys has been attributed to the possibility that girls were under-registered (Eiras Roel, 1991, p. 74).[16] These authors, however, do not discuss why under-registration may have affected girls more. The implicit assumption is that, in patriarchal societies where females were less valued, census takers may have simply ignored an indeterminate number of female children as essentially unimportant for the enumeration (Beltrán Tapia & Szoltysek, 2022). However, if anything, the idea that pre-modern censuses were used for tax and military purposes created incentives to conceal the male members of the population at both the community and the household level. Although the Floridablanca census was the first census that did not have a tax purpose and was carried out anonymously to mitigate the concerns on registration,[17] the authorities did not completely succeed in their purposes. The population was still concerned about taxes and conscription (Sala-Vives & Pujadas-Mora, 2021), issues that would have prompted them to hide boys, not girls. Another problem of this census is that it separately recorded the population living in different institutions (religious and other collective institutions) without distinguishing by age.

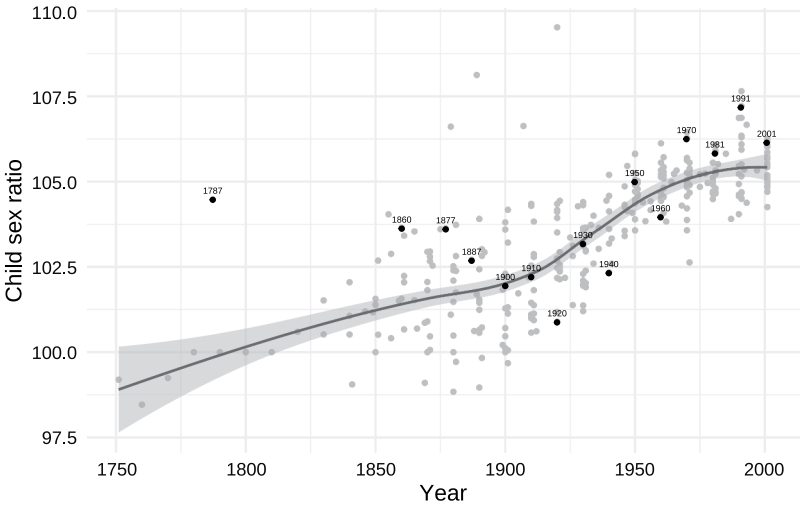

Figure 1. Child sex ratios (aged 0–4) in Spain and Europe, 1750–2001. Note: The black dots refer to the values extracted from the Spanish censuses. As explained in the text, the child sex ratio for the 1787 Census refers to the 0–7 age-group. The outliers refer to Greece between 1860 and 1921, a country where female neglect was pervasive during that period (Beltrán Tapia & Raftakis, 2022). Source: Floridablanca (1787) and Beltrán Tapia (2019).

This exclusion however did not alter the image depicted here because (1) this issue mostly affected adults and (2) males also outnumbered females in these institutions (foundling hospitals).[18]

Moreover, the sex ratio of the population aged 7–16 was even higher (105.7) than that of those aged 0–7 (104.5). In a context where female emigration abroad was negligible and the fear of conscription may have provided incentives to hide older boys, this figure confirms that child sex ratios did not suffer from an under-enumeration of girls. Recent research has indeed shown that the high child sex ratios found in the 19th-century censuses did not arise from female under-registration because death registers, a completely different source, also exhibit an excess of unexplained female deaths early in life (Beltrán Tapia & Marco-Gracia, 2022; Marco-Gracia & Beltrán Tapia, 2021). This is crucial because the under-registration of girls in death records would imply that their mortality rates could be even higher than what those registers show (Llopis Agelán et al., 2015). The fact that female under-registration in population counts and death registers would bias the results in opposite directions therefore confirms that this was not the main factor behind the excess of boys found in the censuses.

The national average nonetheless conceals a high degree of internal variation. Figure 2 depicts child sex ratios (aged 0–7) at the province level. Broadly speaking, there were an excess of male children in southern Spain.[19] The North-South divide mimics differences in other dimensions such as settlement patterns, literacy and living standards, among others. Although suggestive, this spatial variation cannot thus be taken as a direct proxy of the importance of gender-discriminatory practices unduly increasing female mortality because child sex ratios could also be influenced by other factors, especially differences in the quality of the registration and the underlying mortality environment (as well as random fluctuations in the smallest provinces).

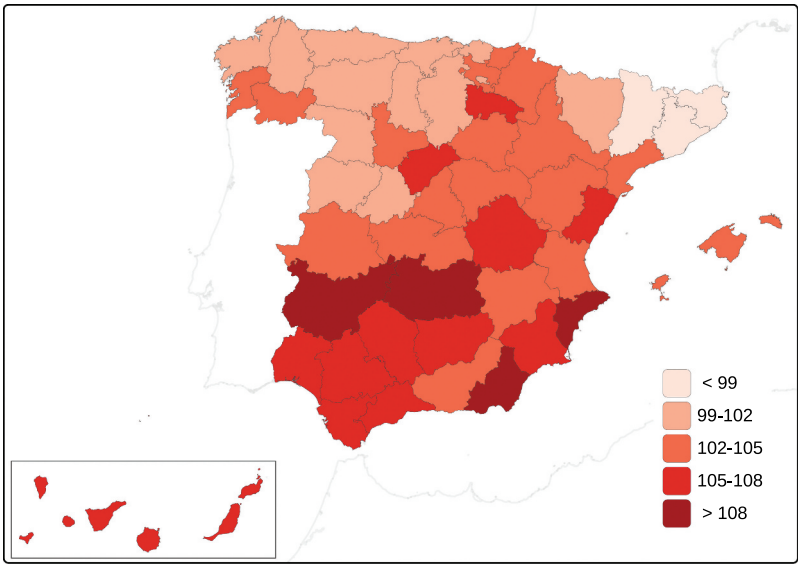

Figure 2. Child sex ratios (aged 0–7) in 1787. Source: Census of Floridablanca (1787).

On the one hand, although we have already discussed that, on average, female under-registration was negligible, we cannot completely rule out that it may have affected some of the regional patterns detected here.[20] It should be noted, however, that the regional pattern observed above also holds if we look at the older age-group (aged 7–16): the correlation coefficient between the provincial sex ratios observed in these two age-groups is 0.75 (see Figure A3 in the Appendix). Provinces with an excess of male children also suffer from this issue at older ages, thus ruling out the possibility that the under-registration of girls early in life is driving these results.

On the other hand, those areas with higher infant and child mortality rates would naturally exhibit lower child sex ratios due to the higher male vulnerability to harsh conditions. If anything, however, conditions were especially detrimental in inland Spain (Pérez Moreda, 1980; Ramiro Fariñas & Sanz Gimeno, 2000; Reher et al., 1997), so the mortality environment cannot explain the high child sex ratios found in some of these areas. Interestingly, North-eastern Spain (specifically Girona, Lleida and Barcelona) exhibited strikingly low child sex ratios (below 95 boys per hundred girls), an issue that is puzzling and deserves further attention. As discussed above, low child sex ratios can arise in high-mortality environments. Reaching values below 95 would however imply suffering extremely high infant mortality rates (around 400–450 deaths per 1,000 live births), something that does not exactly fit what we know about this area and period.[21] It is argued, however, that the 1783–84 mortality crisis especially affected the central and north-eastern areas of Catalonia (Nadal, 1971).

The wealth of information contained in this historical source allows to further explore patterns at the local level and its relation to particular demographic and socio-economic features. The enumeration included demographic information on almost 17,500 locations. The average sex ratio (103.3) does not perfectly coincide with the figure reported by the census itself based on the national information (104.5). As well as to small discrepancies

between the local figures and the aggregation done by the census enumerators, this might be due to the *Estado General* excluding an indeterminate number of children living in religious or other type of collective institutions, communities that tend to be more male-dominated as discussed before. Therefore, if anything, the local-level information contained in C1787 under-estimates the number of missing girls. The fact that the sex ratio at the following age-group (8–16) is higher also points in the same direction.

It should also be stressed, however, that most of these locations are very small: the average number of children aged 0–7 is 104 and 50% of these settlements have only 40 children or less. Table 1 reports the relative number of boys and girls subsequently excluding the smallest locations. Child sex ratios were slightly lower in the smallest entities. This is somewhat surprising because rural areas enjoyed a less pernicious mortality environment that would push child sex ratios up due to the female survival advantage. This finding may suggest that, if anything, families in these contexts under-reported boys at young ages. The fact that child sex ratios at older age-groups are higher and hardly vary according to settlement size further supports this interpretation.

The child sex ratios in the smallest locations, most of our sample, are in any case subject to a high degree of random variability.[22] The observed figures can therefore be really high or low just out of chance. Figures A4 and A5 in the Appendix illustrate this extreme variation. Instead of sex ratios (number of boys per hundred girls), these figures report the relative number of boys and girls as proportions (males divided by the total number of children) due to its statistical properties.[23] As evident there, the number of locations that exhibit abnormally high child sex ratios is very important.[24] Again, those locations with a large proportion of boys in the youngest age-cohort (aged 0–7) also tend to exhibit an excess of males at an older age (aged 8–16), thus further stressing that the results reported here are not driven by female under-registration (Figure A6).

In order to map the demographic information contained in the Floridablanca Census, it is first necessary to georeference the population entities it contains. In this regard, we have been able to geo-reference 16,060 locations recorded in the Floridablanca Census (91.8% of the total).[25] Figure A7 in the Appendix shows the size and spatial distribution of these settlements. Child sex ratios in the geo-referenced locations are in any case virtually identical to those of the full universe of settlements (Table A1). Figure 3 depicts the regional variation obtained from this wealth of information. In order to mitigate the role of random noise, smoothing techniques are employed: local variations are interpolated and smoothed over a spatial grid (5-kms. resolution) using Inverse Distance Weighting. Instead of depicting the child sex ratio in each location, the study area is first divided into a regular grid of square cells (representing a 5×5 kms. area), where each cell is assigned the value of the location falling within its limits. Grids that do not have a direct observation (settlement) are assigned values using the values of neighbouring cells, assuming

Table 1. Child sex ratios (by settlement size), 1787.

Locations	Obs.	Sex ratio (aged 0–7)	Sex ratio (aged 8–16)
All	17,492	103.3	105.4
Over 50 children	7,249	103.8	105.5
Over 100 children	3,851	104.3	105.5
Over 250 children	1,383	104.7	105.6
Over 500 children	561	104.8	105.4

Source: Census of Floridablanca (1787).

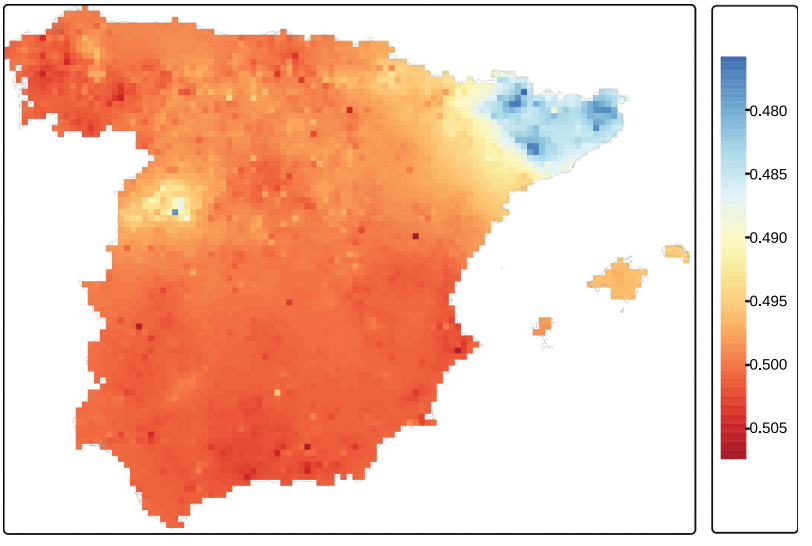

Figure 3. Proportion of male children (aged 0–7) at the local level in 1787. Source: Census of Floridablanca (1787). Note: Local variations are interpolated and smoothed over a spatial grid (5-kms. resolution) using Inverse Distance Weighting. The map includes 91.5% of the inhabited locations recorded in the census (see text for more details).

that closer cells are more similar than distant ones. Each grid cell's value is therefore a weighted average of nearby observations.

This figure confirms that, on average, the relative number of males is higher in Southern Spain. Given that the child sex ratios in North-Eastern Spain are extremely low and obscure the variation in the rest of Spain, Figure A8 in the Appendix replicates the same map but excluding that region. The results corroborate the north-south disparities and makes it clear that the proportion of male children in the southern half of the Peninsula is distinctively high. There is, however, a wide variation in child sex ratios, both across and within regions. Can this variation be explained by demographic, socio-economic and cultural factors? Next section therefore conducts an econometric exercise with the aim of identifying local features that are correlated with child sex ratios.

3. Methodology: what might be behind child sex ratios?

The C1787 exhibits a relatively unbalanced number of boys aged 0–7, a feature that is especially visible in some territories. Given that this source offers detailed information for each entity, this section delves into the factors that might explain the large regional variation found in the descriptive analysis. Apart from pure randomness, regional disparities may arise from multiple causes, including factors that are unrelated to the presence of gender discrimination itself. To shed light on this, we identify demographic, economic and other factors that may theoretically explain this variability and then regress district sex ratios on that set of variables according to the following equation:

$$Pr(male)_i = \alpha + \beta X_i + e_i$$

The dependent variable is the number of boys (aged 0–7) relative to the total number of children (aged 0–7) in each entity and e_i in the error term. In line with the literature on gender discrimination in infancy and childhood, the independent variables aim to capture several distinct characteristics of these entities or environments. For the sake of simplicity we organise the independent variables as follows:

3.1. Economic environment

Economic conditions are captured using different proxies that are intended to reflect the underlying economic structure. First, we use total population (in natural logs) to capture the size of the community. As commented above, son preference and related discriminatory practices tend to be stronger in small and rural areas due to the lack of female labour opportunities outside the domestic sphere (Klasen & Wink, 2002; Qian, 2008). Still, urban and semi-urban areas usually suffer from higher mortality rates, so the net effect is somewhat uncertain.[26]

Besides, and to better identify the economic context, we also rely on the occupational structure. In this regard, we first consider the importance of (male) manufacturing and liberal professions, measured as the percentage of the working-age population (aged 16–50) who is reported working in these occupations.[27] Better economic conditions are expected to both decrease the need for discriminating in the allocation of resources but also reduce overall mortality, which especially benefits boys. Although specific information on the availability of female occupations is lacking, this feature is captured by population size and the importance of manufacturing. As well as the most important manufacturing sector, the textile sector was probably the economic activity that generated the largest demand for female waged labour in 18th century Spain (Sarasúa, 2018). Likewise, the relative importance of servants and labourers often indicates a higher level of socioeconomic inequality. Assuming that most of them are unskilled low-productive wage labourers, it is then likely that this social group, on average, is near subsistence levels, which in turn could lead to discriminatory practices. Again, this could be offset by the female survival advantage in utero, infancy and early childhood that would result in lower child sex ratios in populations suffering economic deprivation.[28]

3.2. Institutions

The Spanish territory during the Old Regime was the result of a dynastic union between different kingdoms that had their own institutions. The territories comprising the Crown of Aragon maintained their own distinct legal and institutional frameworks, known as the *fueros*, which remained in place until the early eighteenth century. The Spanish War of Succession (1701–1714) and the subsequent accession of the Bourbon dynasty to the Spanish throne resulted in the abolition of the *fueros* within the Aragonese territories, which were replaced by the Castilian legal system through the enactment of the *Nueva Planta* decrees. By contrast, the *fueros* of the former Kingdom of Navarre persisted for a more extended period, thereby outlasting those of Aragon. To capture the possible effect of differences in the legal frameworks and the distinct features of these regions (Grafe, 2012; Soares da Cunha et al., 2024),

we include dummy variables for the population entities belonging to the Kingdoms of Aragon and Navarre, respectively.

The administrative structure of these locations revolved around the closer town enjoying *city* (*ciudad*) privileges. A dummy variable therefore distinguishes these locations from the rest. *Cities* could arguably have a different economic structure in terms of the types of occupations. We are however already considering the importance of different occupational categories in the model, so these variables could capture administrative capacity. If that were the case and the reach of the state was higher in these areas, the quality of the enumeration would be higher and the room for under-registration therefore smaller. If girls were more likely to be under-reported, this coefficient should have a negative sign, that is, less boys would be counted in these locations, in relative terms.

In this regard, the census also identifies the jurisdictional rights assigned to each location, that is, whether the community lived under royal domain (*realengos*), a lordship (*señoríos*, either of noble or ecclesiastical nature) or the auspices of a military order (*órdenes militares*). While the economic and political power in *realengos* was exercised by the king himself, the Crown delegated these rights to the holder of the title jurisdictions under lordships or military orders. It is argued that their different institutional features made them more or less conducive to extraction or rent-seeking and therefore affected the living standards of the population. Oto-Peralías (2019), for instance, shows that the delegation of governmental authority to lordships during the Old Regime had a negative effect that is still visible today.[29] A set of dummy variables distinguishing locations under royal domain from lordships and military orders is therefore included to capture this variation.

3.3. Demographic and social features

It is argued that the patriarchal dimensions attached to family systems partly explain the strength of son preference and gender discriminatory practices in contemporary developing countries (Das Gupta et al., 2003; Grogan, 2018; Miller, 2001). Recent research has indeed showed that these considerations also played a crucial role shaping child sex ratios in historical Europe (Szoltysek, Beltrán Tapia, et al., 2022). More specifically, these authors document that patrilocal norms and low female age at marriage were strongly associated with higher child sex ratios. Quantitative and qualitative evidence on Modern Greece also suggest that these features, in combination with a strict (and costly) dowry system, penalised daughter's status within the household and resulted in discriminatory practices (Beltrán Tapia & Raftakis, 2022).[30] The role of extended and complex families is however less clear. Although strong family ties have been related to more traditional views on gender roles (Alesina & Giuliano, 2010), research on historical Europe shows that, if anything, the presence of older generations in the household is related to lower child sex ratios (Szoltysek, Beltrán Tapia, et al., 2022). Similarly, analysing the 1860 Spanish population census, Beltrán Tapia and Gallego-Martínez (2020) find that areas where extended families prevailed also exhibited lower child sex ratios. The latter is consistent with other studies arguing that co-residence with her mother-in-law increased the wife's contribution to farming work in traditional peasant families, which in turn has resulted in lower levels of intimate-partner violence nowadays (Tur-Prats, 2019).

The C1787 allows measuring some of these features by using the information on marital status by age-groups. In this regard, the importance of early marriage is measured by separately considering the fraction of males and females already married in the age-groups 7–16 and 16–26. In order to further capture other dimensions of the different family types existing in Modern Spain, we have computed the importance of male and female celibacy (at age 50), which also captures the extent to which social and cultural norms regulated the possibility that men and women remained single or not. Likewise, demographic pressures, and the resource constraints that they imply to large families, are proxied by the number of children (aged 0–16) per married woman aged 16–50. In addition, we have also computed the percentage of the elderly (above 50) over the total population to further characterise the demographic setting present in these societies.

Other social and cultural factors are also likely to have played an important role, either fostering or mitigating gender discrimination. Lynch (2011) argues that, due to the explicit prohibition of infanticide, the role of the Catholic Church was crucial in shaping European families' behaviour regarding this practice. Yet, religious authorities clearly promoted patriarchal values, so its effect on gender discrimination may not be so clear-cut. Although Catholicism was the only religion present in Spain during this period, the level of identification with Catholic teachings could vary across regions. The importance of the Church has been proxied by computing the percentage of priests (and their helpers) over the total active population.[31] It can be argued that this variable not only captures the underlying religiosity, but also the capacity of these priests to monitor the community.

3.4. Other factors

Geographic and climatic features might also play a role in shaping child sex ratios. On the one hand, these dimensions shape the productive specialisation and therefore influence the different incentives to raise sons and daughters. They may also affect the underlying agrarian productivity, which may also result in different income levels and thus be associated to the need to prioritise sons in resource-constraint environments. On the other hand, not only high-mortality environment tends to take a greater toll on boys (Beltrán Tapia & Szoltysek, 2022), but many diseases affect males and females differently (Anderson & Ray, 2010; Waldron, 1998), so child sex ratios may also reflect these differences. Infant and child mortality rates varied indeed significantly across regions in Modern Spain and these differences partly reflect climatic conditions, especially due to the incidence of digestive diseases during summer (Cussó & Nicolau, 2000; Dopico, 1987; Dopico & Reher, 1998; Ramiro Fariñas & Sanz Gimeno, 2000). To capture these environmental factors, information on temperature and rainfall, together with altitude, ruggedness, and distance to the coast, are included in the analysis and treated as controls.[32] To further account for geo-climatic features, the model also considers the presence of main and secondary rivers.[33] Although we do not have a direct measure of the mortality environment that children faced, this set of variables should capture regional differences due to geographic and climatic features.

Moreover, we should bear in mind that we also consider population size and larger cities are expected to suffer higher mortality rates. Furthermore, our variable of

interest could be influenced by the proximity of urban markets and administrative and political entities, so distance to major cities (over 100,000 inhabitants; Madrid, Barcelona and Valencia) and to those locations above 5,000 inhabitants that enjoyed the city status (*ciudad*) is therefore included in the model. The latter is especially relevant because most foundling hospitals were based in these capitals (Pérez Moreda, 2005).

Tables A2 and A3 in the Appendix explain how the variables employed here have been constructed and report summary statistics. As regards the underlying data used to build all these variables, the limited availability of information on occupations provided by the Census of Floridablanca unfortunately reduces the sample size employed in the regression models (to around 14,200 population entities or pueblos).[34] This set of factors however does not exhaust the different dimensions that may shape the relative number of boys and girls observed in our sources. Given the potential existence of further unobserved heterogeneity, it is also important to test our models including regional fixed-effects (471 districts, *partidos judiciales*).[35] Likewise, spatial dependence is controlled for using longitude and latitude and their squares (Conley & Kelly, 2025). Furthermore, most of our locations are very small and are therefore subject to a high degree of random noise. It is therefore crucial to estimate our regressions using a generalized linear model (GLM) that takes into account the varying uncertainty derived from the sample size underlying each sex ratio (Beltrán Tapia & Gallego-Martínez, 2020; Szoltysek, Ogórek, et al., 2022).[36] The large number of locations nonetheless assures that the general patterns are not affected by this feature of our data. Sample size also introduces random variation in our explanatory variables, so additional specifications excluding the smallest locations are implemented to test the robustness of our main results. Lastly, we should stress that the research strategy implies that our results, the regression coefficients on these variables (β), cannot be interpreted as causal. Instead, the aim is to unveil general patterns behind the data and test existing hypotheses about the type of societies that were more prone to exhibit an excessive number of male children.

4. Results

Table 2 reports the results of regressing the relative number of boys on the set of explanatory variables described above using a Generalized Linear Model (GLM) that considers the varying uncertainty associated to each location. While the first column presents the baseline specification, the second and third columns extend the model to sequentially include geo-climatic controls and district fixed-effects, respectively. In order to test whether the results also hold for older cohorts, the empirical exercise is implemented for both the age-groups 0–7 (columns 1–3) and 8–15 (columns 4–6). In addition, Table A4 in the appendix reports the results of estimating equation 1 using Ordinary Least Squares (OLS).

Despite the intrinsic noise arising from the small sample size that characterises most of our locations (as indicated by the high residual deviance), this exercise confirms that part of the regional variation in the relative number of boys and girls is clearly linked to local features. Comparing the results obtained using a GLM or an OLS estimation also stress the need of using the former when analysing differences in sex ratios when the size of the location varies significantly (see Table 2 and Table A4). As already explained, while child

Table 2. Co-variates of local child sex ratios.

	Dep. variable: Proportion male					
	Aged 0–7			Aged 8–15		
	(1)	(2)	(3)	(4)	(5)	(6)
Population (ln)	0.001	0.001	0.006*	−0.000	0.001	−0.000
	(0.003)	(0.002)	(0.004)	(0.003)	(0.002)	(0.004)
City status	−0.005	−0.015	−0.013	−0.015	−0.026**	−0.027*
	(0.012)	(0.010)	(0.013)	(0.013)	(0.012)	(0.014)
Liberal occupations	0.002**	0.002**	0.001*	0.003**	0.003**	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Manufacturing	0.001**	0.001***	0.000*	−0.000	0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Labourers and servants	0.000	0.000***	0.000***	−0.000***	−0.000***	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Crown of Aragon	0.015	−0.025**	0.790	0.019	−0.008	−11.815
	(0.012)	(0.010)	(14.504)	(0.013)	(0.012)	(16.996)
Kingdom of Navarre	0.020*	−0.041***	0.751	0.042***	−0.014	−11.812
	(0.011)	(0.012)	(14.497)	(0.012)	(0.016)	(16.976)
Lordship	0.027	0.032*	0.017	0.022*	0.028**	0.017
	(0.019)	(0.017)	(0.019)	(0.013)	(0.013)	(0.025)
Military Order	0.060***	0.062***	0.043*	0.031**	0.031**	0.014
	(0.020)	(0.018)	(0.023)	(0.015)	(0.016)	(0.026)
Female early marriage	0.001***	0.001***	0.001***	0.001***	0.001***	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Male early marriage	−0.002***	−0.002***	−0.001***	−0.002***	−0.002***	−0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Celibacy (men)	0.000	0.001	0.000	−0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Celibacy (women)	−0.001*	−0.001**	−0.000	−0.001***	−0.002***	−0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Children per married woman	−0.002	−0.002	−0.001	−0.005**	−0.003*	−0.004**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Elderly population	0.001	0.001	0.000	−0.003***	−0.003***	−0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Priests	−0.003	−0.003	−0.001	0.000	−0.001	−0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Geo-climatic Controls	No	Yes	Yes	No	Yes	Yes
Region Fixed-Effects	No	No	Yes	No	No	Yes
Obs.	14,257	14,189	14,189	14,268	14,200	14,200
Deviance	18,714.7	18,394.6	17,174.9	19,368.2	19,019.8	17,696.6

Note: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$. All specifications are estimated using a GLM model that takes into account the sample size behind the proportion of male children. A positive coefficient is associated to a relatively higher survival of boys. The geo-climatic dimensions refer to a set of variables capturing the presence of both main or secondary rivers and distance to coast, big cities and provincial capital, as well as elevation, ruggedness, temperature and rainfall. Longitude and latitude (and their squares) are also considered in all specifications to account for other spatial dimensions. Robust standard errors, reported betweeen brackets, are clustered at the district level.

sex ratios obtained from large locations are relatively accurate, those resulting from small sample sizes are highly unstable and can therefore bias the coefficients if these locations are also different in other dimensions. This is clearly visible not only in the coefficients of the variable that captures the size of each location (their effect is much less clear in the GLM regressions), but also when analysing the link between the other variables and child sex ratios: while some coefficients become statistically significant, other are no longer different from zero, statistically speaking. What follows therefore relies on the results from the GLM models.

Economic dimensions, on the one hand, appear to be associated to child sex ratios in different ways. More economically complex locations (as measured by the importance of manufacturing and liberal occupations) exhibit a larger number of boys. Rather than the

effect of son preference, this result can perhaps be explained by the higher incomes that these locations enjoyed. This prosperity probably resulted in lower mortality rates and therefore in less boys dying due to their higher biological vulnerability. However, the importance of labourers and servants is also linked to higher child sex ratios. This indicator reflects more unequal societies where a larger part of the population lives close to subsistence levels,[37] a circumstance that should result in lower child sex ratios due to the male biological vulnerability. Yet, our exercise shows the opposite result, which suggests that the need to resort to hard choices when allocating limited household resources was higher in these locations, a circumstance that may have negatively affected girls' survival. A similar interpretation can perhaps arise from the positive coefficients found in those locations under the jurisdiction of lordships and especially military orders, institutional regimes that have been found to be detrimental to living standards, at least in comparison to royal domains (Beltrán Tapia et al., 2024; Chaney & Hornbeck, 2016; Oto-Peralías, 2019).

It should be noted that the size of these locations does not seem to be associated with the relative number of boys and girls. As explained above, urban areas could exhibit a lower number of boys due to higher female labour opportunities and/or an adverse disease environment. Given that we are comparing locations with similar economic structures, it is plausible that size itself does not exert an independent effect. The number of older girls was actually higher in cities. However, interpreting this coefficient on the variable *city* is not straightforward. While it could capture a higher administrative capacity and the ability of the census enumerators to register all the population, including girls, the fact that this pattern is only visible among the 8–15 age-group suggests that it is arising from sex-specific migratory flows. These cities are probably attracting young women from nearby rural areas in search of employment.

Demographic features, on the other hand, played an even more crucial role, especially those related to the marriage market. In particular, child sex ratios are especially high in those locations where women married early and men did not. Similarly, the effect of male and female celibacy also underlies the importance of unbalances in the marriage market: while low female celibacy (that is, universal female marriage) is associated with a larger number of male children, a low male celibacy acts in the opposite direction. Likewise, it seems that demographic pressures, measured by the number of children per married women or the relative importance of the elderly, also matter but these results are less consistent across the different specifications and less visible in the younger cohort (0–7). Lastly, the relative importance of priests does not seem to be associated with child sex ratios.

As mentioned above, the lack of direct information on the underlying mortality context is an important limitation of this analysis because low mortality rates could result in more boys surviving and the mortality environment could be related to other features analysed here. This issue however should not affect the reported results because the econometric exercise effectively controls for unobserved regional differences using district fixed-effects. Moreover, within-district differences in mortality rates are further captured by the size of the location and other geographic characteristics (altitude, ruggedness, temperature, rainfall, etc.). Likewise, the results reported here are robust to replicating this exercise but excluding (1) the smallest locations (with less than 50 children in the corresponding age-group; Table A5), (2) those with more extreme child sex ratios,

which are arguably more subject to random noise (Table A6), and (3) locations in Northwestern Spain (Galicia and Asturias) that, contrary to the rest of Spain, present a extremely dispersed settlement pattern (Table A7). In addition, we also estimate the model excluding those explanatory variables relying on occupational categories. That information was recorded less systematically which not only reduces the sample size, but it could also bias the results due to the selective nature of the locations that reported occupations consistently.[38] The coefficients of the other variables remain virtually unchanged (Table A8).

5. Heterogeneities

In order to better understand what is behind our results, we have conducted the analysis separately for different types of locations.

5.1. Population size

Table 2 shows that there is no direct link between the size of the location and child sex ratios once controlling for the varying uncertainty associated with sample size. It is however possible that the patterns observed here are driven by the behaviour of a particular group of locations. The constraints faced by families in these settings are very different, so the role of economic and demographic factors might vary accordingly. We have therefore replicated our main specification splitting the locations according to their population size: 0–250, 250–1,000 and above 1,000 inhabitants (Table A9 in the Appendix). Although the smaller sample size reduces the accuracy of the estimates, the results are qualitatively similar to those arising from the main specification, especially regarding the association between child sex ratios and both early marriage and inequality. In this regard, while the significance of early marriage is visible regardless of the size of the location, the role played by the importance of landless labourers holds in smaller locations (below 1,000 inhabitants). The effect of other variables is less clear. It should be mentioned that controlling for district fixed-effects makes the coefficient of some variables not statistically significant. This is expected since these controls take away most of the variation of the variable at play.

5.2. Latitude

Northern and Southern Spain were characterised by widely different contexts. These disparities not only reflected climatic or geographic considerations but encompassed a wide variety of economic, social and cultural dimensions, ranging from the inheritance patterns and family type, institutions (e.g. the importance of military orders), settlement patterns, access to land, etc. We have therefore divided our observations into three groups depending on which area of the Iberian Peninsula they are located (North, Middle and South; see Figure A9). Although the main results reported above remain, these exercises help clarifying those analyses and detecting other dimensions that were probably important. By comparing more homogeneous territories, they arguably constitute a more adequate approximation to the subject of study.

On the one hand, demographic dimensions are crucial in shaping child sex ratios across the Peninsula (Table A10 in the Appendix). It is true however that, while differences in the prevalence of early marriage matter more in the North, child sex ratios in Southern Spain are strongly associated to the importance of female celibacy. Likewise, variations in the importance of labourers and servants are only associated to child sex ratios in the North. However, the economic, social and cultural conditions that lordships and military orders imposed on the Southern territories also have a clear influence on the excess of male children in this region. Given that inequality levels were also higher under these institutions, multicolinearity may explain why the coefficient on labourers is no longer significant. It is difficult in any case to pinpoint the underlying mechanism but precarious economic conditions and a frontier culture may have fostered patriarchal norms benefiting boys (Oto-Peralías & Romero-Ávila, 2017a, 2017c). It is important to stress that, despite the lower number of locations existing in Southern Spain, these exercises have a much higher explanatory power (lower deviance). This results both from the greater explanatory power of the variables included in the model and the larger size of these settlements, which reduces the role of chance driving child sex ratios. These results are also especially relevant because, as shown above in Figure 2, child sex ratios were especially high in Southern Spain.

5.3. Aragon vs Castile

The main specification does not detect differences in child sex ratios between these two territories. It is however possible that, despite having controlled for many other features characterising each location, some unobserved factor is biasing these results. In order to better substantiate this claim, we have performed a comparison of locations near the border (within 25 or 50 kilometers at either side; see Figure A10). This exercise assumes that this set of locations are similar except for the Crown they formerly belonged to (note that this exercise also takes into account the range of controls used throughout the article). Although the locations within the former Kingdom of Aragon exhibit higher child sex ratios, the differences are not statistically significant (Table A11). The importance of the different factors behind child sex ratios also seems similar across both territories (Table A12). It is true nonetheless that more variables turn out to be statistically related to the number of male children in the Kingdom of Aragon but these findings should be taken with caution due to the abnormally low child sex ratios resulting from the Census in North-eastern Spain (which constitutes an important fraction of the Aragon sample).

5.4. Unexplained variation

The high residual deviance indicates that our models only explain a small part of the variation in child sex ratios.[39] This arises either from the small sample size of most of our locations (a feature that results in a high degree of random variability) or from the fact that we are probably not capturing all the relevant variables that may affect our variable of interest (despite the large number of variables included in our model). Regarding the latter, it is very difficult to account for differences in economic development or income levels across our locations. However, the inclusion of population size, the importance of different occupational groups and other variables such as *lordship* and *military orders* was

intended to mitigate this problem (accounting for geo-climatic factors also helps discriminating between areas with different agricultural productivity). It is even more challenging to capture social and cultural dimensions. However, the inclusion of district dummies in our regression models allows capturing the unobserved heterogeneity. As Table 2 shows, including regional dummies (columns 3 and 6) only slightly increases the explanatory power of the model (reduced deviance). The information contained in these coefficients can theoretically be extremely suggestive because it captures the effect of unobserved features that are shaping the relative number of boys and girls in the different areas. Figure A11 in the Appendix depicts this information and shows that, generally speaking, territories belonging to the former Kingdom of Aragon exhibited slightly higher child sex ratios even after controlling for the set of variables employed here. These patterns however are not statistically significant. Only a few districts stand out from the rest, a result that can just arise by chance. Notice also that the exercises comparing the outcomes of these two kingdoms did not show any significant difference between them. These results suggest that the unexplained variation is thus mostly coming from the intrinsic noise that arises from the small size of our locations.

6. Concluding remarks

The Census of Floridablanca (1787) reports an extremely unbalanced number of boys aged 0–7. Our estimations, based on the underlying mortality environment, suggest that around 4–5% of girls were 'missing'. Although we cannot completely rule out the possibility that female under-registration may partly explain this result, the quality of this enumeration makes this very unlikely. In fact, the patterns found here are also visible for older children (aged 7–16), which are less suspect of not being counted by the authorities (if anything, families having older boys may want to hide them from the census enumerators to avoid conscription or further taxes). These findings are in line with recent research that shows that gender discrimination against girls was affecting sex-specific mortality rates around birth and during infancy and childhood in 19th-century Spain (Beltrán Tapia & Gallego-Martínez, 2017; Beltrán Tapia & Marco-Gracia, 2022; Marco-Gracia & Beltrán Tapia, 2021), so they therefore suggest that these practices, stemming from son preference and the relative value attached to boys and girls, were also in place during the late 18th century. Given that the Census studied here groups together all children aged 0–7, it is not possible to gauge whether female neglect was taking place right after birth and/or during infancy and childhood. The studies mentioned above suggest that both practices could have coexisted, together with a slightly higher propensity to abandon girls, especially by married couples.

This behaviour, however, does apply to all territories within the Iberian Peninsula but exhibited wide spatial variations. The local-level information contained in this source (almost 17,500 locations) evidences clear-cut patterns, both between and within regions. Generally speaking, the 'missing girls' phenomenon was especially evident in southern Spain.[40] Compared to an average of 101.6 boys per hundred girls aged 0–7 in the North, the territories south of Madrid reported a sex ratio of 106.3. Although not as marked, the South itself also presented internal differences. Economic, social, and cultural dimensions thus surely played a relevant role in driving the observed differences in gender discrimination. Our econometric analysis indeed shows that those regions showing relatively high

child sex ratios are associated with precarious economic conditions and a particular marriage market, results that hold under many different specifications.

On the one hand, areas exhibiting a large proportion of the population living close to subsistence levels were probably forced to make hard choices when allocating limited household resources, a circumstance that seems to have increased female unexplained mortality during infancy and childhood. On the other hand, the different features defining the marriage system also played a crucial role in the regional patterns observed here. Both early and (almost) universal marriage for women, together with a later marriage and higher celibacy rates for men, are negatively related to girls' survival chances. The existence of strong social norms for sticking to this behaviour effectively limited the range of options available to women outside marriage and reinforced patriarchal attitudes. These forces were also at play in other societies in historical Europe (Beltrán Tapia & Raftakis, 2022; Kalaitzidou, 2024; Szoltysek, Beltrán Tapia, et al., 2022), which further supports the link between marriage practices and the way parents treated their sons and daughters.

It is important to stress that we are only reporting partial correlations, so these results cannot be interpreted causally. Not only these results are based on observational evidence, but the nature of the underlying source, the Census of Floridablanca, also makes it difficult to capture important dimensions that could have also contributed to shape son preference and female neglect. In this regard, the existence of female labour opportunities and the family type dominating in each location are probably two crucial unobserved factors (Beltrán Tapia & Szoltysek, 2022, pp. 637–39). We know however very little about regional disparities on female waged labour or on how women labour was perceived. Likewise, we could not classify locations depending on the prevailing family type: nuclear versus complex families. The former predominated in Southern Spain, which according to our results exhibited a larger number of missing girls. This is consistent with other studies focusing on 19th- and early-20th-Spain (Beltrán Tapia & Gallego-Martínez, 2020; Echavarri, 2022; Echavarri & Beltrán Tapia, 2024) and therefore challenges the prevailing view that (neo-local) nuclear household structures are historically conducive to gender-equal practices (Beltrán Tapia and Szoltysek, 2022).[41]

Likewise, these exercises only explain a small part of the variation in child sex ratios, thus suggesting that unobserved economic, social and cultural factors were also playing a role. For instance, child sex ratios could be influenced by differences in the quality of the registration and the underlying mortality environment (Beltrán Tapia, 2019; Szoltysek, Ogórek, et al., 2022). Southern Spain could also be different in other ways, such as the levels of violence, the intensity of religious beliefs or the importance attached to the dowry system or the concept of honour and shame, features that have been linked to patriarchal values. The long Reconquest and the insecurity characterising the moving frontier not only gave rise to an unequal allocation of economic and political power in these regions, but it probably affected other cultural traits (Oto-Peralías & Romero-Ávila, 2017a, 2017b, 2017c), including patriarchal norms. Son preference, for instance, tends to be stronger in conflict-ridden areas because the fear of conflict affects the relative value of boys and girls: while males are perceived as useful defenders, females are considered as liabilities that need to be protected (Golli et al., 2022; Mavisakalyan & Minasyan, 2023). It is also possible that the concept of honour and shame, characteristic of other Mediterranean countries

(Peristiany, 1965), was also stronger in the South. Where the familial honor depends heavily on women's behaviour, they need to be carefully monitored and protected, which also increases the relative cost of raising daughters (Beltrán Tapia & Szoltysek, 2022, p. 641). Discussing the low literacy rates existing in Southern Spain, Reher (2023) stresses the importance of cultural factors and familial structures, dimensions that have deep historical roots and are poorly understood. There is however limited systematic information on how these dimensions may have varied across Spain. Including any of these hypotheses formally in the analysis would shed more light on why these families attached a different value to their sons and daughters.

Notes

1. For more details, see Hanlon (2016); Beltrán Tapia (2019); Beltrán Tapia and Raftakis (2022); Szoltysek, Ogórek, et al. (2022); Hanlon (2023); or Beltrán Tapia and Cappelli (2024). These studies follow the tradition of Tabutin (1978), Johansson (1984), Pinnelli and Mancini (1997), Tabutin and Willems (1998), Alter et al. (2004) and McNay et al. (2005) who put the focus on the excess female mortality during childhood in several European regions before 1930.
2. For a survey of the literature on the Spanish case, see Beltrán Tapia (2026).
3. Relying also on parish registers from nine locations in Central Spain during the 19th century, Llopis Agelán et al. (2022) show that sex ratios at baptism did not significantly deviate from the 105 benchmark commonly used to assess the presence of female neglect around birth. These authors, however, argue that female mortality rates in infancy and childhood are likely to be under-estimated, thus suggesting that parents may have treated sons and daughters differently during the first years of life. Sex ratios at birth increased above normal values in the Basque Country during the late 19th century hand-in-hand with the rapid industrialisation that this region was undergoing (Catalán Martínez, 2024).
4. Son preference was still visible during the 1980s, after the Francoist dictatorship, in the way that women took care of their pregnancies when carrying a male foetus (Echavarri and Beltrán Tapia, 2025).
5. Although it only attains to the Crown of Castile, the individual-level information provided by the Catastro of Ensenada is also especially valuable (Álvarez & Palencia, 2018; Sarasúa, 2018).
6. These entities also often kept their own records, commonly known as *padrones*. Information for the Census of Godoy (1797) is only available for the whole country at the province-level.
7. The digitization of this population count was carried out by the *Instituto Nacional de Estadística* (INE, 1987). The conversion of text into structured data has been a long-term endeavour that has greatly benefited from the efforts of Vicente Pérez Moreda, David Reher, and Alfonso Herranz, as well as our own. The georeferencing of the entities was undertaken within the ESPAREL project (Beltrán Tapia et al., 2023).
8. The source offers information for more than 20,000 singular places (or locations) but systematic and reliable information is not available for all of them.
9. For more details, see Pérez Moreda (1980), Dopico and Reher (1998), Reher et al. (1997), Ramiro Fariñas and Sanz Gimeno (2000), Reher and Sanz-Gimeno (2004), Pérez Moreda et al. (2015), Marco-Gracia (2017) and Llopis Agelán et al. (2015).
10. We have digitised the version of the census published by the *Instituto Nacional de Estadística* (INE, 1987).
11. The census does not provide information for some specific locations (e.g. San Sebastian) and in some cases presents aggregated information for a few districts, as in the case of Barcelona, Tortosa, and Daroca.
12. The census classifies the population into 6 age-groups (0–7, 7–16, 16–25, 25–40, 40–50, +50), which are then differentiated accorded to marital status (single, married and widowed). Although the classification by age is very crude, the overall population pyramid shows the expected shape (see Figure A2 in the Appendix).

13. The figure for 1787 number does not include those who live in religious institutions, foundling hospitals or other collective institutions. The previous census, commissioned by the *Conde Aranda* and conducted in 1768–1769, yielded sex ratios of 102.3 (aged 0–7) and 105.9 (aged 7–16). The *Vezindario* of Zaragoza in 1723, an extraordinary source for this particular city in North-eastern Spain, provides household-level information, including the sex composition of surviving children. Computing sex ratios using the number of surviving sons and daughters yields a figure as high as 133 boys for hundred girls. This number is even higher if we only focus on poor families (153 boys per hundred girls).
14. Previous studies however do not discuss gender differences in infant and child mortality during this period.
15. Available information on the relative number of boys and girls in other European settings prior to 1840 is scarce. Figure 1 only includes child sex ratios for Sweden (every decade since 1751), France (1830, 1840) and the Netherlands (1840). Szoltysek, Ogórek, et al. (2022) have gathered information from different European locations but lower sample sizes subjects those values to considerable random noise when treated individually.
16. See also Carreras and Tafunell (2005), Duran Herrera (2014) and Sánchez Barricarte (2023) for similar arguments applied to later enumerations. It should also be noted that both practices, under-registration and female neglect, do not preclude each other, so they could have co-existed together.
17. The census was also carried out during a long period of peace, which also mitigates population's concerns about using the enumeration to help raising new taxes and military obligations (Livi Bacci, 1987, p. 44).
18. The source reports 47,500 males and 22,155 females living in communities and hospices without having taken religious vows (Floridablanca, 1787). This group comprises 0.67% of the total population. Unfortunately, their age is not determined.
19. As discussed above, given the high-mortality environment prevailing during this period, values above 102 boys (per hundred girls) could be indicative of the presence of discriminatory practices that penalised girls' survival.
20. For instance, Eiras Roel (1991, p. 74) warns about serious deficiencies in registration found in the province of *Jaen*.
21. Infant mortality rates in these areas revolved around 300 deaths per 1,000 live births in the 1780s (Ferrer-Alós, 2023; Torrents, 1996).
22. A small settlement with only 8 boys and 4 girls aged 0–7 yields a child sex ratio of 200 boys per hundred girls. This extreme figure however falls within what it is statistically plausible due to the small sample size underlying the sex ratio.
23. Assuming that the sex of an individual is a random draw, the proportion of males follows a binomial distribution that can be approximated by a normal distribution, which is symmetrical and bounded between 0 and 1 (Garenne, 2008; Wilson & Hardy, 2002).
24. Given the high-mortality environment existing in late 18th-century Spain, it is assumed that the benchmark for comparison in absence of gender discrimination is around parity. Figure A5 also depicts the range of values that would be compatible with that figure depending on the underlying sample size.
25. These geo-referenced settlements contain 95.8% of the total population. The location of a few settlements could not be identified. Likewise, the census failed to record information on a small number of locations and only presented aggregated information for a few districts, so those settlements could not be geo-refererenced either. Due to their particular juridical status, the census registered settlements differently in north-western Spain and aggregated them into *concejos* in *Asturias* and *parroquias* in *Galicia*. This issue results in a less dispersed population than it was actually the case, a problem that is specially acute in *Asturias*.
26. Not only the prevalence of infectious diseases increases with population density but rural areas may have enjoyed a better access to animal proteins. It should nonetheless be stressed that the urban penalty might be an artifact of the existence of particular

institutions that inflated mortality rates such as hospitals, foundling homes, etc (Ramiro-Fariñas, 2007).

27. While manufacturing is captured by the presence of *fabricantes* and *artesanos*, liberal professions include *abogados*, *escribanos*, *estudiantes* and *comerciantes*.
28. Apart from potential starvation, food deprivation reduces the capacity to survive infectious diseases. Indeed, malnourishment as a factor contributing to mortality rates in Spain did not disappear until the twentieth century (Dopico & Reher, 1998; Reher et al., 1997).
29. Lordships who were subject to the expulsion of Moriscos in 1609 and then repopulated appear to have suffered especially extractive conditions (Beltrán Tapia et al., 2020, 2024; Chaney & Hornbeck, 2016).
30. On the impact of dowries on sex ratios in contemporary low-income countries such as India, see Bhalotra et al. (2020).
31. As well the the priests themselves (*curas*), we have considered *beneficiados* and *tenientes de cura*.
32. While elevation is taken from the Shuttle Radar Topography Mission (SRTM), temperature and rainfall refer to annual averages for the period 1970–2000 (Fick & Hijmans, 2017). These sources provide high-resolution measures at 90-meter and 1-kilometer, respectively. Our measures average the corresponding values within a 10-kilometer radius from each settlement.
33. These shapefiles are available through the *Instituto Geográfico Nacional*.
34. The loss of information is also unevenly distributed across space, being the north-western provinces the most affected by this issue (Basque country, Asturias and Cantabria).
35. See Figure A11 to have a sense of the size of these districts and the spatial variation of these coefficients.
36. This procedure has the added advantage of not losing any observation due to have a value of 0 females in the denominator (this increases our sample size by 185 observations).
37. Likewise, being labourer also implied more uncertainty about future incomes due to their reliance on the availability of waged labour, a feature that especially affected females (Borderías & Martini, 2020).
38. The variable capturing the relative importance of priests, which is also problematic because it may not effectively capture religiosity, is also excluded from this exercise.
39. See also the R-squared from the OLS specifications: the explanatory power of those models ranges from 1.3 to 6% of the total variation in child sex ratios (Table A4).
40. Further research is however needed to elucidate why the relative number of male children was so low in North-eastern Spain.
41. Catalán Martínez (2024) argues that the abnormal increase in sex ratios at birth that took place in the Basque Country during the late 19th century is connected to processes of impoverishment and marginalisation brought about by rapid industrialisation, as well as changes in family structures. The negative role that nuclear families play in gender outcomes has also been explored in Tur-Prats (2019), Tur-Prats (2021) and Gallego et al. (2023).

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