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Prenatal Care, Son Preference, and the Sex Ratio at Birth

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ABSTRACT The sex ratio at birth (SRB) in Spain jumped abruptly in the late 1970s and temporarily reached values of more than 109 boys per 100 girls in the early 1980s. This article shows that health care system expansion increased the likelihood of male births in Spain between 1975 and 1995. By facilitating the delivery of preterm and dystocic babies and improving overall maternal conditions, these developments increased the survival chances of male fetuses, who are biologically weaker than females. However, biological factors alone cannot explain the biased SRB. Our analysis shows that the availability of prenatal sex determination technologies and a strong son preference nurtured by the Francoist dictatorship fostered gender-biased behaviors that resulted in an excessively high SRB. The lack of evidence on sex-specific abortions suggests that women took better care of themselves when carrying a son. The spread of gender-egalitarian values brought about by the end of the dictatorship and the transition to democracy undermined son preference and returned the SRB to normal levels.

KEYWORDS Sex ratio at birth • Son preference • Gender discrimination • Maternal health

Introduction

The sex ratio at birth (SRB) fluctuates around 105–106 boys per 100 girls in modern developed countries, a figure that remains relatively constant, at least in large populations (Chao et al. 2019; Hesketh and Xing 2006). An extensive literature has examined the biological conditions that might alter the SRB (James and Grech 2017; Long et al. 2021; Visaria 1967). The main channel through which these factors affect the SRB is reduced intrauterine and birth mortality, which would favor the most vulnerable fetuses. In this sense, maternal conditions (e.g., age and health), which are also shaped by socioeconomic conditions, influence the likelihood of giving birth to a boy rather than a girl. Likewise, recent studies have stressed how adverse circumstances (temperature, chemical pollutants, or even conflicts) reduce the SRB because male fetuses are more vulnerable to miscarriages (Bruckner and Catalano 2018; Morse and Luke 2021).

Biological mechanisms, however, leave a significant fraction of the observed variation in the SRB around the world unexplained, putting the focus on behavioral

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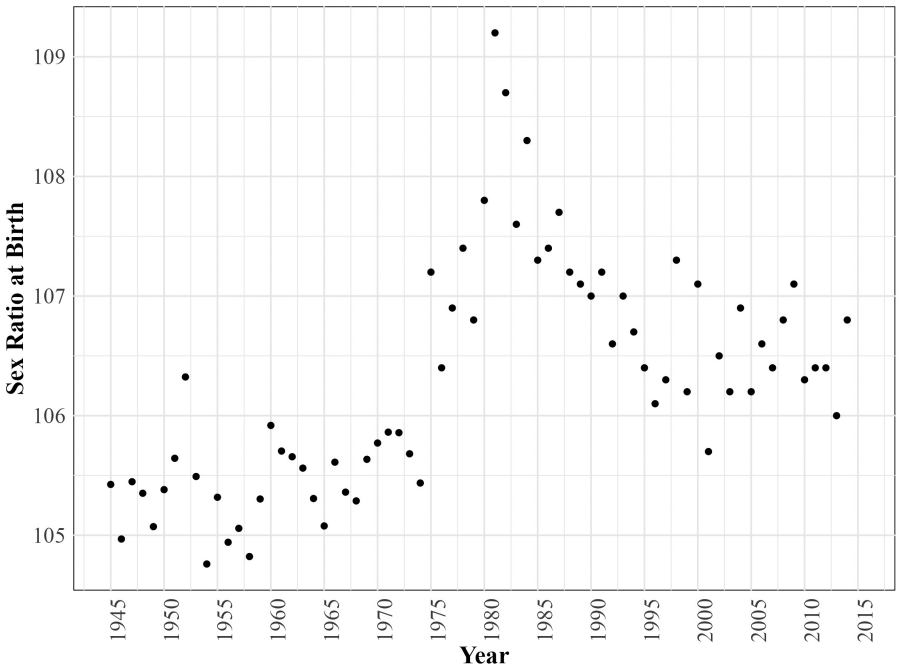

Fig. 1 Sex ratio at birth in Spain, 1945–2014. *Source:* Spanish vital statistics.

factors. Not only have female babies especially suffered from infanticide and neglect in some cultures (Sen 2003), but the advent of prenatal sex determination technologies in the late 1970s unleashed a dramatic increase in sex-selective abortions in low-income countries with a strong son preference (Chao et al. 2019; Das Gupta et al. 2003; Echavarri and Ezcurra 2010; Guilmoto 2018; Hesketh and Xing 2006; Jayachandran 2015). Interestingly, rapid economic growth does not necessarily mitigate this practice because it facilitates access to this technology and because declining fertility amplifies the pressure to have a son.

The abrupt SRB increase in Spain in the late 1970s and early 1980s poses a puzzle for biological and behavioral explanations. The SRB exceeded 109 before returning to biologically expected values at the end of that decade (see Figure 1).[1] This period was characterized by the end of a long dictatorship and the transition to democracy, which allowed the modernization of health services and a shift toward more gender-equal values. Although it is difficult to link this dramatic rise and its subsequent decline strictly to improvements in living standards and maternal health, the lack of anecdotal evidence on sex-selective abortions militates against a purely behavioral mechanism. Although temporary, this deviation from the biological benchmark

[1] Between 1870 and 2011, infants were counted as live births if they survived at least 24 hours separated from the mother (Brel-Cachón 1999; Echavarri 2022). Since 2011, infants are considered live births as soon as they are separated from the mother's womb (Civil Registry Law 2011, third provision). This legal change had hardly any effect on the reported SRB because neonatal mortality was already extremely low at that point.

is striking and implies that roughly 2% more boys (or fewer girls) were born in these years.[2]

Here, we seek to solve this puzzle by devising and testing a simple model that integrates the biological explanation with the possibility of prenatal discrimination: the (positive) biased care of pregnancies carrying a male fetus. The model shows how two radical changes in society—the expansion and modernization of health services, along with the shift toward more egalitarian values and attitudes—might produce an inverted U-shaped evolution of the SRB. Health system modernization significantly improves maternal health, thus reducing the incidence of miscarriages, a development that disproportionally benefits male fetuses because of their greater vulnerability and pushes the SRB upward. In the absence of son preference, modernization would lead the SRB to increase toward the biologically expected steady state of a society with full access to health care. On the other hand, son preference results in an inflated SRB, which deflates with the erosion of these biased values and beliefs. In a society with full access to maternal health care, the expansion of egalitarian values would lead the SRB to decrease toward the biologically expected steady state of a gender-equal society. The model shows how a faster pace in the modernization of health care services than in the expansion of egalitarian values produces a U-inverted evolution of the SRB.

This article also provides empirical support for the rapid spread of health services, the decline in son preference over the study period, and the link between these two changes and the evolution of SRB. On the one hand, using the census of health establishments published by the Instituto Nacional de Estadística (Spanish Statistical Agency), we show that the number of hospitals in areas with fewer than 25,000 inhabitants grew exponentially in Spain during these years. Likewise, relying on the full universe of births taking place between 1975 and 1995 (more than 10 million observations), we document an increased proportion of deliveries in hospitals and increasing survival rates of births that strongly depend on medical access, such as those born preterm or involving abnormal fetal size or position (labor dystocia). Additionally, estimates of the probability of a male birth show that the variables proxying for the modernization and expansion of the health system are associated with more male births, even after we account for a host of individual and contextual confounders.

On the other hand, examining individual-level data from the 1985 Fertility Survey, we show that expressed son preference sharply declined during our study period and how families' behavior changed over time after having a boy or a girl. Women initially had longer birth intervals and were more likely to stop working after bearing a son, but this behavior disappeared during the 1980s. These results therefore highlight how the end of the Francoist dictatorship and the transition to democracy led to the spread of gender-egalitarian values that eroded son preference.

Likewise, to better identify the effect of the change in preferences on the SRB, we devise an empirical strategy that exploits a quasi-exogenous variation in the exposure to societal values and beliefs. Crucially, the death of Francisco Franco in 1975 ended an extremely patriarchal dictatorship that had lasted for almost 40 years. This event

[2] This discrepancy implies that when the SRB peaked in 1981 (109.2; 533,008 births), 2,659 more boys (or fewer girls) were born (assuming 107 as the biological benchmark for comparison).

thus creates a quasi-natural experiment that allows us to compare the birth histories of two groups of young women based on their degree of exposure to the regime's values and beliefs and their openness to the new conditions arising during the transition to democracy. Specifically, we compare the birth histories of women who were adolescents and those who were relatively mature in the year of the dictator's death. Controlling for the expansion and modernization of health services and the mother's demographic and socioeconomic characteristics, we find that women who were less exposed to the traditional values and beliefs that characterized the Francoist regime were less likely to give birth to a boy. The estimates also show that this difference declined as egalitarian values spread throughout society and vanished by the mid-1980s. The results therefore imply the existence of sex-based prenatal discrimination in Spain in the late twentieth century.

Most studies explaining the inflated SRB in countries such as China, India, and South Korea have identified sex-selective abortions as the main driving factor (Bongaarts and Guilmoto 2015; Das Gupta et al. 2003; Echavarri and Ezcurra 2010; Lin et al. 2014; Sen 2003). The same is true for excess male births in migrant communities from those regions living in the United States, Canada, the United Kingdom, or Spain (Abrevaya 2009; Almond et al. 2013; Dubuc and Coleman 2007; González 2018). However, previous research has never considered the possibility that Spanish families resorted to this option to get rid of unwanted girls during this period. To explore this issue further, we perform an analysis of Spanish newspapers between 1975 and 1990 and find that the baby's sex was not mentioned as a motivation behind abortions. The high monetary and nonmonetary costs of abortion might have steered families toward other practices. We therefore argue that families behaved differently once they discovered their babies' sex. Caring differentially during pregnancies (e.g., deciding to stop working, engaging in better self-care) when carrying a boy would imply that more male fetuses would survive and therefore push the SRB upward. This article thus complements previous explanations by offering an additional behavioral mechanism that also biases SRB.

Beyond contributing to the literature on prenatal sex-based discrimination, this article speaks to the wider literature on the biological determinants of SRB (James and Grech 2017; Long et al. 2021; Visaria 1967). In particular, the article relates to the growing literature showing how contextual factors affect maternal health and reduce SRB owing to the greater vulnerability of male fetuses to fetal death (Bruckner and Catalano 2018; Chao et al. 2019; Hesketh and Xing 2006; Morse and Luke 2021). Recent research has argued that high-mortality environments in the past probably resulted in a "naturally" lower SRB, perhaps close to 104 (Beltrán Tapia and Marco-Gracia 2022; Beltrán Tapia and Szoltysek 2022). Interestingly, recent research links these dimensions with the relative number of male and female stillbirths (Rettaroli and Scalone 2021; Ruiu et al. 2022) and preterm births (Bruckner et al. 2024; Shaw et al. 2021). Our results stress that difficult birth conditions, such as preterm or dystocic births, are especially deleterious for male fetuses. The expansion in hospital deliveries, however, improves monitoring and reduces avoidable mortality, particularly benefitting male babies and thus pushing the SRB up. Our results also imply that the effect of discriminatory practices on the SRB can be offset by male biological vulnerability and therefore go unnoticed in areas experiencing poor maternal health.

Lastly, this article contributes to the literature on cultural persistence and change (Giuliano and Nunn 2021; Guiso et al. 2006; Miho et al. 2024). As mentioned earlier, son preference remains highly visible among second-generation South and East Asian immigrants. However, our results stress that even in a highly patriarchal society, gender norms can change rapidly in response to economic, social, and institutional transformations. Patriarchal values, including son preference, had long been part of the Spanish cultural system and resulted in "missing girls" until at least the 1940s.[3] The Francoist regime fed on these values and dramatically undermined the status of women, who were actively encouraged to focus on their roles as wives and mothers through legal measures, propaganda, fear, and repression (Cazorla Sánchez 2010; Nash 1991; Rubio-Marín 2003). The transition to democracy that followed the dictator's death in 1975 allowed citizens to question those values and resulted in dramatic social and cultural changes, as illustrated here. A similar, albeit more drastic, example can be found in South Korea, which shifted from a strong son preference that caused thousands of sex-selective abortions in the late 1980s and 1990s to preferring daughters in the 2010s (Chun and Das Gupta 2022). These two examples of rapid change in culturally driven fertility behavior contrast with the stickiness of other cultural attitudes affecting gender norms in marriage patterns, intrahousehold decision-making, and labor markets, which appear to be more persistent over time, sometimes spanning several generations (Alix-Garcia et al. 2022; Baranov et al. 2023; Grosjean and Khattar 2023; Malein and Beltrán Tapia 2022).[4] In the case of Spain, variation in historical gender norms is linked to different levels of intimate partner violence (Tur-Prats 2019, 2021). Our results align with recent research revealing that exposure to more gender-equal environments positively influences gender-related preferences (Carlana 2019; Dahl et al. 2021; Dhar et al. 2022; Fernández et al. 2004; Porter and Serra 2020).

Theoretical Model Shaping the Inverted U-Shaped Evolution of the SRB

In this section, we model the temporal coincidence of the modernization of health care services and the expansion of gender-egalitarian values and attitudes on the evolution of the SRB over time. The proportion of male births in a population, $p \in [0,1]$, depends on the relative survival of males and females from conception to birth, which is related to the level of prenatal care. We make two assumptions grounded in previous literature.

[3] As in other countries in Southern Europe (Beltrán Tapia and Szoltysek 2022), a nonnegligible fraction of girls were neglected right after birth and during infancy and childhood during the nineteenth century, especially in resource-constrained environments with limited wage labor opportunities for women (Beltrán Tapia and Gallego-Martínez 2017; Beltrán Tapia and Marco-Gracia 2022; Echavarri and Beltrán Tapia 2024). The status of women and girls improved significantly during the first decades of the twentieth century, accompanied by the expansion of female labor opportunities, better living standards, and rising educational levels. However, neonatal discrimination against girls resurfaced in the early 1940s owing to the widespread misery elicited by the Spanish Civil War and the autarchic period that followed (Echavarri 2022).

[4] Other research focused on gendered patterns in the labor market has stressed the importance of gradual changes (Fernández 2013; Fernández et al. 2004; Goldin 2021).

First, the underdevelopment of the health system does not increase the relative prenatal care that male fetuses receive. Our assumption is not demanding: it requires that the underdevelopment of the health system harms either males and females equally or especially the relatively weaker fetuses. Given the biological disadvantage in the survival rate of male fetuses (DiPietro and Voegtline 2017; Di Renzo et al. 2007), adverse economic and health circumstances harm a disproportionate number of male fetuses. The mechanism is conceptualized as a biological one because if modernization produces effective care differences, it is by affecting involuntary losses during pregnancy.

Second, son preference does not increase prenatal care of female relative to male fetuses. Again, this assumption is not demanding: it requires that son preference does not produce effective prenatal care differences, or it produces differences that pose more harm to those carrying a female fetus. Because the effect of son preference on SRB is channeled by parents' decisions, we conceptualize it as a behavioral mechanism.[5]

With these two assumptions in mind, we argue that the evolution in the proportion of male births over time depends on how the health system and son preference evolve in a society. Using fairly simple nonlinear specifications for the temporal evolution of the health care system and son preference,[6] we can relate the proportion of male births (p_t) at time t, with $t \in \mathbb{R}_+ \cup 0$, to the initial level of underdevelopment of the health care system ($\omega_0 \in [0,1]$) and son preference ($\bar{\mu}_0 \in [0,1]$) in a society. Thus, the probability of a male birth can be written as follows:

$$p_t\left(\omega_0, \bar{\mu}_0\right) = P - G_w \omega_0 \left(\frac{1}{t+1}\right) + G_{\bar{\mu}} \bar{\mu}_0 \left(\frac{1}{\gamma t+1}\right), \tag{1}$$

where P denotes the proportion of male births in a society with a fully developed health system and egalitarian values and beliefs. The parameters $G_w, G_{\bar{\mu}} \in \mathbb{R}_+ \cup 0$ capture the marginal deflation due to health system underdevelopment and the marginal inflation generated by son preference.

Equation (1) shows that the proportion of male births is time-invariant regardless of health care system underdevelopment and son preference when $G_w, G_{\bar{\mu}} = 0$ and otherwise varies over time. We next examine the evolution in the proportion of male

[5] For a formal analysis of a family's decisions in a context of son preference and prenatal sex-detection technologies, we consider the theoretical framework developed by Lin et al. (2014) and expanded by Echavarri and Beltrán Tapia (2024). In that model, families who exhibit son preference choose a level of effort that affects the probability of a male birth. A formal presentation of this model adapted to our context is developed in the online appendix (section B).

[6] We model the development of the health care system, w_t, and the erosion of son preference, $\bar{\mu}_t$, using the next specifications: $w_t = 1 - \omega_0 \left(\frac{1}{t+1}\right)$, where ω_0 measures the underdevelopment level of the health care system at $t = 0$; and $\bar{\mu}_t = \bar{\mu}_0 \left(\frac{1}{\gamma t+1}\right)$, where $\bar{\mu}_0$ signals son preference at $t = 0$. The absence of a health care gap and the absence of son preference are both normalized as 0; full development of the health system is normalized as 1. Parameter $\gamma \in \mathbb{R}_+$ represents potential pace differences in cultural and institutional evolution (Guiso et al. 2006).

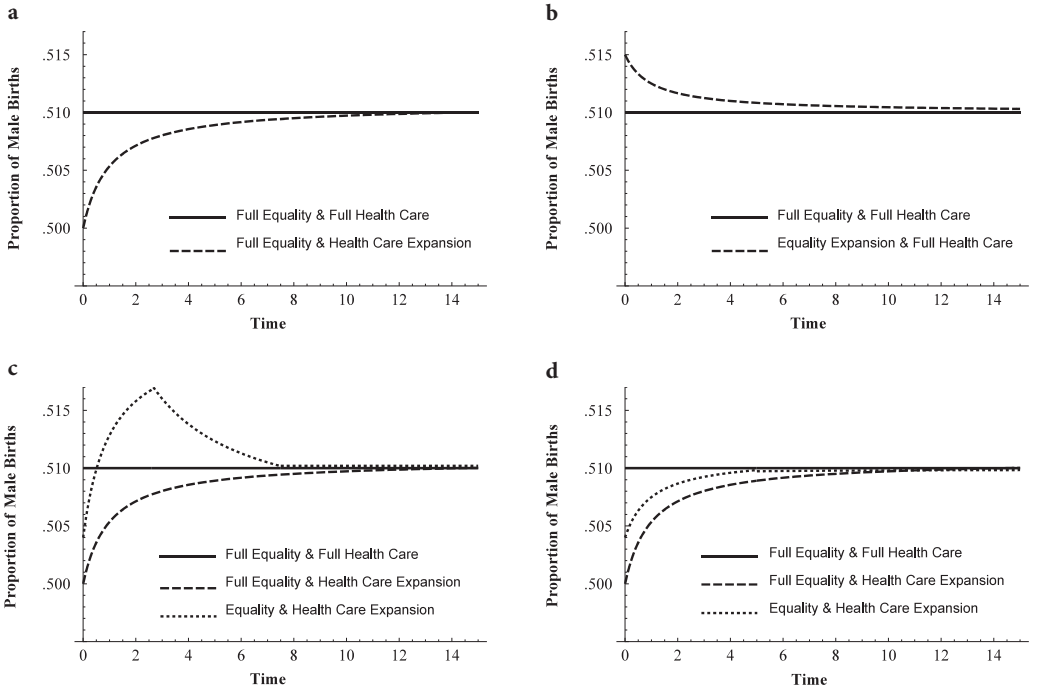

Fig. 2 Model-based evolution of the proportion of male births

births when this evolution can be affected by biological ($G_w > 0$), behavioral ($G_{\bar{\mu}} > 0$), or both factors.

Theoretical result 1: Biological mechanism. Consider a society where effective prenatal care does not depend on gender-biased family decisions ($G_{\bar{\mu}} = 0$) but does depend on health system development ($G_w > 0$) and where an initial health care gap ($\omega_0 > 0$) existed. The proportion of male births will increase over time with health system development until it converges from below to the biologically expected proportion of male births in a society with a fully developed health system. (For a proof, see the online appendix, section B.)

Theoretical result 1 presents the expected evolution in the proportion of male births under health care expansion without sex-biased prenatal care. Given that male fetuses are more vulnerable than female ones, if the health system underdevelopment harmed males disproportionately, health system modernization would increase the proportion of male births, increasing the SRB. However, Theoretical result 1 also highlights that the biologically driven SRB increase is unlikely to produce extreme (i.e., biologically unexpected) values. It thus implies that the biological mechanism alone cannot explain the inverted U-shaped evolution of the SRB because it cannot explain the extreme SRB increase, nor can it explain its posterior decrease. This theoretical result is illustrated in panel a of Figure 2 for a society that does not discriminate against female fetuses ($G_{\bar{\mu}} = 0$) but where effective prenatal care is affected by

health care system development ($G_w = 1$) and an initial health care gap ($\omega_0 = 0.01$) existed.

Theoretical result 2: Behavioral mechanism. Consider a society where effective prenatal care does not depend on health system development ($G_w = 0$) but does depend on gender-biased family decisions ($G_{\bar{\mu}} > 0$) and where an initial son preference ($\bar{\mu}_0 > 0$) existed. The proportion of male births will decrease over time with a decline in son preference until it converges from above to the biologically expected proportion of male births in a society with gender-egalitarian values and beliefs. (For a proof, see the online appendix, section B.)

Theoretical result 2 presents the expected evolution in the proportion of male births when gender-egalitarian values expand and health system effects are absent. If son preference results in parents providing additional maternal care when carrying a male fetus, the spread of egalitarian values would lead to reduced sex-based prenatal discrimination and then to a downward trend in the proportion of male births, which would eventually converge to the biologically expected values. This evolution is expected to follow a decreasing trend but not an inverted U-shape. Panel b of Figure 2 illustrates Theoretical result 2 for a society where gender-egalitarian values are expanding, with $G_{\bar{\mu}}$, $\gamma = 1$, and $\bar{\mu}_0 = 0.005$. However, effective prenatal care is not affected by health care system development ($G_w = 0$).

Theoretical result 3: Mixed mechanisms. Consider a society where effective prenatal care depends on family decisions and health system development ($G_w, G_{\bar{\mu}} > 0$) and where an initial health care gap and son preference ($\omega_0, \bar{\mu}_0 > 0$) existed. A faster pace of health system development than of son preference decline produces an inverted U-shaped evolution in the proportion of male births. (For a proof, see the online appendix, section B.)

Theoretical result 3 shows how an inverted U-shaped evolution in the proportion of male births could result from the coexistence of biological and behavioral mechanisms. The condition is that the pace at which the health system develops is faster than that at which son preferences decline; that is, γ is positive but small enough that for any t, the behavioral effects are larger than biological ones. The inflated proportion of male births because of gender discrimination then implies surpassing the biological benchmark of highly developed countries. When gender-egalitarian values spread throughout society, the proportion of male births decreases to biologically expected figures. Panel c of Figure 2 illustrates this situation for a society that combines the nonzero conditions in panels a and b, with $\gamma = 0.4$. Panel d of Figure 2 does the same for a society that does not satisfy this difference in pace condition ($\gamma = 1.4$).[7]

Following sections examine how the proportion of male births responded to both the expansion of the health system and the spread of gender equality in Spain between 1975 and 1995. These empirical exercises aim to uncover how the interaction between biological and behavioral mechanisms helps explain the U-shaped evolution of the SRB in Spain during the 1980s.

[7] Recent research has already noted the possibility of this last scenario in historical Europe (Beltrán Tapia and Marco-Gracia 2022; Beltrán Tapia and Szoltysek 2022).

Health Care System Expansion and the SRB

The SRB in Spain increased from the 1940s onward, especially in the late 1970s and early 1980s (see Figure 1). Given that living standards greatly improved from the 1960s onward, as reflected in many indicators of economic development (e.g., GDP per capita, education, heights; Carreras and Tafunell 2005), our theoretical analysis suggests that this evolution would be related to maternal health improvements that disproportionately helped the most vulnerable fetuses—that is, the male ones (Theoretical result 1).

The Spanish health care system further modernized in the 1970s onward, especially in the 1980s, coinciding with the substantial increase in SRB. This modernization process entailed a profound restructuring, which created a more concentrated sector with fewer but larger hospitals and an expansion into sparsely populated areas. Vilar-Rodríguez and Pons-Pons (2019) estimated that health coverage shifted from 85% in 1976 to universal coverage during this period. The expanding public health system affected childbirth and babies' subsequent survival. For instance, neonatal mortality declined from 12.6 to 3.5 deaths per 1,000 births between 1975 and 1995 (Carreras and Tafunell 2005). The expansion in hospital deliveries reduced avoidable mortality partly because of monitoring, especially for preterm births, births entailing abnormal fetal size or position, or other difficult conditions (Ezcurdia et al. 1979).

However, whether health system development boosted the survival chances of weaker (i.e., male) fetuses, thereby increasing the SRB, remains an empirical question. To assess this issue, we use individual-level data on all births in Spain in 1975–1995 (almost 10 million births).[8] These microdata contain information on the newborn's sex, the delivery type (hospital birth or not; normal, preterm, or dystocic birth), parental characteristics (e.g., mother's age and occupational category), and the child's birth order.

A descriptive analysis of these data shows that more than 80% of births in 1975 took place in hospitals. This percentage continued increasing throughout the study period, with an exponential rise in the late 1980s (see Figure A1, panel a; all figures and tables indicated with an "A" appear in the online appendix). Linked to the expansion in hospital deliveries, preterm and dystocic births also increased during these years (see Figure A1, panel b).

This wealth of information allows us to examine whether health system modernization and expansion are associated with an increasing SRB and how this association might have changed over time. We use a linear probability model to estimate the correlation of health conditions around birth and giving birth to a son, conditional on other family and contextual conditions. The full specification is as follows:

$$Y_{ist} = \alpha + \sum_{j=1}^{n} \beta_j h_{ist}^j + \sum_{j=1}^{n} \beta_{j,T} h_{ist}^j T_t + \mathbf{X}_{ist} B + \sigma T_t + \lambda_s + \lambda_t + \varepsilon_{ist}, \quad (2)$$

where Y_{ist} is an indicator for the newborn's sex, which equals 1 if child i born in province s in year t is a boy and 0 otherwise. Variables h_{ist}^j measure maternal and fetal health conditions around the birth of child i in province s in year t, thus constituting

[8] The data are available at https://www.ine.es.

proxies for health system development. Specifically, h_{ist}^{j} variables classify births according to whether they occurred at the hospital and whether they were identified as preterm or dystocic, which mirrors the availability of new and better health services. In addition, we include a province-year-level variable that measures the number of hospitals with maternity facilities in cities with fewer than 25,000 inhabitants.[9] Because of their greater vulnerability, male babies probably benefited more from health care system development and expansion. Thus, we expect that the coefficients β_j (with j referring to the variables *birth at hospital*, *preterm*, *dystocia*, and *number of hospitals in areas with small populations*) will be positively linked to the probability of being male.

The second set of terms in Eq. (2) includes the interaction between maternal and fetal health conditions (h_{ist}^{j}) and trend effects (T_t). Therefore, the interaction terms account for the possibility that the positive effect of health system modernization and expansion on the SRB weakens as the system approaches full development. Thus, we expect $\beta_{j,T} < 0$ if time-varying effects exist, and $\beta_{j,T} = 0$ otherwise.

The study period also witnessed important social changes that could have affected the SRB but were unrelated to health system development. For example, women's average age at first birth was just over 24 years at the end of the dictatorship. Although this figure decreased slightly during the first years of democracy, it increased significantly thereafter and reached almost 28 by 1995 (see Figure A3, panel a).[10] Women also began reducing fertility (Carreras and Tafunell 2005). This reduced fertility, together with the concentration of births in a healthier age range, probably benefited the most vulnerable (i.e., male) fetuses and therefore increased the SRB during the study period. Similarly, the mother's employment or occupation type could have also shaped maternal conditions.

Therefore, Eq. (2) includes $\mathbf{X}_{ist}$, a vector of variables measuring demographic and socioeconomic dimensions to control for potential confounders, such as the child's birth order, mothers' age at childbirth, and mother's occupational status. Lastly, the specification includes controls for province fixed effects (λ_s) to take into account time-constant characteristics in province s and year fixed effects (λ_t) to control for changes in the probability of a male birth that affect a particular birth cohort t and that would not be captured by the trend (T_t). ε_{ist} is the random error.

Table 1 reports the linear probability estimates of Eq. (2) and simpler specifications, with standard errors clustered at the province level. Columns 1–5 display the outcomes for specifications that assume time-invariant effects of maternal and fetal health conditions (i.e., $\beta_{j,T} = 0$); columns 1–4 consider a unique proxy for health care

[9] The number of hospitals with maternity wards in cities with fewer than 25,000 inhabitants was taken from the census of health facilities, which includes the identification of hospitals by postcode, allowing us to identify the hospital municipality's population. In addition, the hospitals' opening dates were cross-checked with contemporary press reports and anniversary celebrations. Figure A2 shows that the number of hospitals in small areas increased substantially beginning in the early 1980s.

[10] Although it remains an open debate, several studies found that delayed childbearing increases complications during and after childbirth, mostly stemming from age-risk pregnancies to women aged 40 or older (Londero et al. 2019). Interestingly, in Spain, delayed childbearing is not accompanied by an increase in age-risk pregnancies. The percentage of births to women older than 40 declined and dropped to less than 1% of births in the late 1970s (and continued decreasing in the 1980s; see panel b of Figure A3). Therefore, births to both younger and older women declined during the study period.

Table 1 Linear probability estimates of the effect of health system development on the probability of a male birth among all births in Spain, 1975–1995

	(1)	(2)	(3)	(4)	(5)	(6)
Preterm	0.019**				0.016**	0.378
	[0.001]				[0.002]	[0.478]
Dystocia		0.024**			0.023**	0.970**
		[0.001]			[0.001]	[0.358]
Birth at Hospital			–0.003**		–0.004**	–0.444†
			[0.001]		[0.001]	[0.254]
Number of Hospitals in Small Areas				–0.000	–0.000	0.057**
				[0.000]	[0.000]	[0.018]
Preterm and Trend						–0.018
						[0.024]
Dystocia and Trend						–0.048*
						[0.018]
Birth at Hospital and Trend						0.022†
						[0.013]
Number of Hospitals in Small Areas and Trend						–0.003**
						[0.001]
Number of Observations	10,282,491	10,282,491	10,282,491	10,282,491	10,282,491	10,282,491
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Clustered standard errors at the province level are shown in brackets. All the columns include the constant term and controls for trend, parity, maternal age, and maternal occupation type.

†$p < .10$; *$p < .05$; **$p < .01$

system development, and column 5 considers all the proxies simultaneously. Column 6 provides estimates of the full specification in Eq. (2). Taken together, the estimates for the variables reflecting health system modernization are in the expected direction. Preterm and dystocic babies are more likely to be males (columns 1, 2, and 5), with preterm effects being time-invariant and dystocia effects decreasing over time (column 6). The presence of hospitals in small areas also resulted in more boys being born. These empirical results suggest that health care system expansion and modernization disproportionately helped males, increasing the proportion of male births and thus the SRB. This effect weakened over time as returns to health system expansion diminished.

However, further exploration of the variable *birth at hospital* is warranted. Contrary to our expectations, babies born in hospitals are more likely to be females, a probability that decreased over time (see column 6 in Table 1). This seemingly contradictory outcome is likely explained by the nature of this subsample of births. Although some of the subsample births did not occur in a hospital because they were sudden or because of a lack of hospital access, most women could give birth in modern maternity facilities, which could be easily reached by car. Thus, it is worth noting that the

birth-at-home effect is robust in sign and significance, increasing when we control for the number of hospitals in small locations (columns 3 and 5). Therefore, choosing to give birth at home signals the presence of other factors that might confound this relationship. In particular, some of these families could have had more traditional preferences and attitudes and intentionally avoided the benefit of the spread of maternity wards. In addition, for cases with no nearby hospital facilities, the decision to deliver at home versus at the hospital could have been influenced by maternal conditions: risky pregnancies would be referred to a hospital, but other births would occur at home.

To examine these issues further, we explore the characteristics of the mothers who delivered at home (see Table A2): they tended to be older, lived in rural areas, did not work, and had shorter birth intervals. In addition, delivering at home is related to a lower probability of risky deliveries (*preterm* and *dystocia*) or with a fatal ending (*fatal complications*). The latter suggests that mothers who delivered at home were healthier (or lived in a healthier environment) or that the most difficult cases were sent to the hospital. Thus, the negative association between delivering at the hospital and the SRB captures relatively riskier pregnancies, which are more predominant among male fetuses.

Replicating regressions in Table 1, excluding births delivered at home, confirms the robustness of the previous findings (see Table A3). The estimates show that the coefficients on *preterm*, *dystocia*, and *hospitals in small areas* remain virtually unchanged, providing further evidence that health care system development positively affected maternal health and the survival chances of male fetuses, therefore increasing the SRB during our study period.

However, as Theoretical result 1 suggests, the Spanish SRB increase in the early 1980s—which peaked in 1981 at 109.2 boys per 100 girls—cannot be explained solely by this biological mechanism. The fact that these abnormal values were only transitory and soon declined to biologically expected values also reinforces the idea that behavioral factors likely help explain the SRB changes during this period. We therefore explore whether behavioral mechanisms fostered gender-biased behavior affecting the effective prenatal care of male and female fetuses (Theoretical result 2).

Conditions for Gender-Biased Behavior in Prenatal Care, 1977–1985

To explain the inverse U-shaped evolution of the SRB observed in Spain in the 1980s, we examine whether families made gender-biased decisions regarding their child's birth. The behavioral mechanism requires the existence of son preference and its subsequent decline over time. Importantly, in the absence of infanticide, gender-biased behavior can shape the SRB only if parents know the sex of the fetus. In this section, we provide evidence showing that Spain met the conditions for the functioning of this behavioral mechanism during the study period.

Prenatal Sex-Determination Technologies

The diffusion of prenatal sex-determination technologies in Spain occurred just before the SRB peaked. Health care system modernization during the 1970s involved

a stronger reliance on the international academic medical literature and a genetics-based approach to pregnancy that included the use of processes to identify fetal sex (García Nieto et al. 2013). Sex determination was initially based on amniocentesis. A medical report from 1975 analyzing 67 interventions stressed the technique's low risks for the mother and fetus (Lautre 1976). From the late 1970s onward, sex determination became less invasive and more widespread owing to the advent of ultrasound scanners (Santesmases 2008). Evidence from other countries indicates that women could access this service beginning in the late 1970s and early 1980s (Georges 1996; Junhong 2001; Ramanamma and Bambawale 1980). The Spanish press openly acknowledged the importance of amniocentesis and ultrasounds at least as early as 1981.[11] However, the availability of these procedures varied geographically. In Navarra, for example, the technological advances arrived in 1975, as reflected in an experimental study that examined the impact of the technology on reducing mortality around birth (Ezcurdia et al. 1979). As in India, China, and South Korea (George 2002; Park and Cho 1995), most sex-determination clinics in Spain were located in urban areas.

Son Preference

The Francoist dictatorship had been characterized by a strong gender inequality that subordinated women. Inspired by an ultraconservative view of Catholic social doctrine, the regime expected women to stay at home and focus on their roles as wives and mothers (Nash 1991; Reeser 2019; Rubio-Marín 2003). The dictatorship inculcated its values using legal measures, political indoctrination, and propaganda, as well as fear and repression (Cazorla Sánchez 2010). The regime proscribed contraceptive use, abortion, and divorce. Legal norms restricted women's employment opportunities, especially after marriage (Nash 1991). Women needed their father's or (if married) husband's permission to participate in many activities in the public sphere, including working outside the home (Rubio-Marín 2003). The husband was primarily responsible for managing the family economy and had parental authority over the children.[12]

Although these strict policies were relaxed before Franco's death, the arrival of democracy paved the way for increasing gender equality.[13] Full legal gender equality was not achieved until 1981, six years after Franco's death. Alongside this transition, it became feasible to rethink marriage, motherhood, and abortion; divorce was legalized in 1981, but abortion was not legal until 1985.[14]

[11] See, for instance, Ultrasonidos para la exploración automática del cuerpo humano, *El País,* March 27, 1981; El aborto es siempre una derrota, *El País,* December 13, 1981; and Importancia del diagnóstico prenatal para la población española, *El País,* August 31, 1982.

[12] Many fathers were authoritarian, and familial rules often mirrored the unequal gender patterns that characterized the public sphere (Cazorla Sánchez 2010:142–143).

[13] International pressures and economic factors forced the Francoist regime to relax its gender policies. The individual lives of women during the dictatorship were obviously more complex and often did not reflect the ideology the Francoist regime established (Nash 1991).

[14] Only 25.5% of respondents in a 1980 survey believed that a marriage could be ended by an agreement between the spouses (Centro de Investigaciones Sociológicas 1980). In a survey conducted three years

The gender attitudes nurtured by the dictatorship probably fostered son preference. Sociological studies conducted during the transition to democracy acknowledged this son preference in Spain in the late 1970s (de Miguel Rodriguez 1980). The transition toward democracy, however, witnessed a substantial spread of egalitarian values and attitudes, which might have curbed the preference for sons. The wealth of data released during this period can be exploited to evaluate this son preference and its change over time.

The Instituto Nacional de Estadística conducted two fertility surveys during our study period, in 1977 and 1985. Women's son preferences can be measured through survey questions asking them to indicate their reasons for wanting another child, with response options including the desire to have a boy or a girl (in 1977 and 1985) and their preferred sex for the next child (in 1985). Although the 1977 microdata were not preserved, a detailed study described the methodology and results (Instituto Nacional de Estadística 1978). In addition, we use the microdata from the 1985 Fertility Survey to (1) replicate the reported statistics in 1977, (2) evaluate assessed preferences in 1985, and (3) explore fertility behavior compatible with son preference.[15] Although these surveys provide cross-sectional information, we can study women's birth histories to assess how son preference evolved.

Table 2 presents data from the 1977 Fertility Survey (Instituto Nacional de Estadística 1978) and computations based on the 1985 microdata, showing the percentage of women who wanted to have another child for the primary reason of wanting to have a boy. Roughly 30% of the women surveyed in 1977 replied that their main reason for wanting another child was to try for a son. This percentage decreased to 6% in 1985 when the same survey question as in 1977 was used (column 2, Table 2) and to 17% when interviewers asked respondents to reflect on the ideal sex of the next child (column 3, Table 2). The table also shows the salience of son preference for families with no sons: the percentages of women with one, two, or at least three daughters who wished their next child would be a son were 46%, 80%, and 76%, respectively (column 1, Table 2). By 1985, these values decreased to 6%, 38%, and 29%, respectively, according to responses to a comparable survey question (column 2, Table 2).

The 1985 Fertility Survey microdata include responses to a question about the ideal sex of the next child. Notably, only approximately 44% of the women interviewed in 1985 declared a preference for a boy over a girl. Thus, on average, son preferences in Spain had virtually vanished by 1985. However, there is some interesting variation in their stated preferences. To examine this issue further, we estimate Eq. (2) using the ideal sex of the next child as the indicator for the child's sex. The dependent variable then equals 1 if the preferred sex is male and 0 otherwise. Because the information is hypothetical, the equation does not include health care conditions at birth (h^j) or time fixed effects, and it focuses on the role of the mother's demographic and socioeconomic characteristics (i.e., variables in vector **X**). Table 3 presents the linear probability estimates for the ideal sex of the next child. Crucially, son preference was stronger among older women, and this difference was statistically significant.

later, 68.5% of respondents were in favor of divorce (and 44.4% of the interviewees agreed that women should decide freely whether they wanted to abort; Centro de Investigaciones Sociológicas 1983).

[15] The microdata for the 1985 Fertility Survey are available at https://www.ine.es.

Table 2 Son preference in Spain, 1977–1985

	1977 (1)	1985 (2)	1985 (3)
Wish to Have a Boy (%)	30.0	5.9	16.7
Already Have 0 to 1 Child	31.7	5.8	16.7
0 boys	45.7	6.5	18.3
1 boy	5.1	0.0	3.9
Already Have 2 Children	25.0	8.6	19.5
0 boys	80.5	38.5	69.2
1 boy	12.0	1.8	12.5
2 boys	4.1	0.0	0.0
Already Have More Than 2 Children	29.9	7.7	3.8
0–1 boys	76.0	28.6	100.0
2 boys	2.8	0.0	0.0
3 or more boys	3.7	0.0	0.0
Number of Observations	1,058	3,022	3,022

Notes: Data for 1977 are from Instituto Nacional de Estadística (1978:116); data for 1985 are elaborated using the 1985 Fertility Survey microdata. Figures represent the percentage of women in each category (indicated by rows) who indicated wanting to have another child primarily to have a boy. The alternative response options in 1977 were wanting a girl, liking children, considering children as material support for the family, wanting siblings for previous children, God's will, wanting to increase the national population, and "other." For the 1985 survey, column 2 includes these same options as the 1977 survey and adds wanting to attain the ideal family size. Column 3 refers to the same question but includes "wanting a girl" as the only alternative response option, and missing otherwise. The number of observations is the number of women who wanted to have another child.

Table 3 Demographic and socioeconomic factors behind son preference, 1985

Age	0.007*
	[0.003]
Primary Education	0.023
	[0.059]
Secondary or More Education	0.130†
	[0.065]
Practicing Catholic	0.000
	[0.040]
Rural Roots	–0.061*
	[0.028]
Wealth	0.001†
	[0.000]
Constant	–0.117
	[0.167]
Number of Observations	1,143
Province Fixed Effects	Yes

Notes: Clustered standard errors at the province level are shown in brackets. The dependent variable indicates whether the ideal sex of the next child is male (=1) or not (=0). The sample is women who would like to have children in the future (1985 Fertility Survey).

†$p < .10$; *$p < .05$

Table 4 Birth spacing (in years), 1952–1985

	(1)	(2)	(3)	(4)
Female	–1.594*	–1.711*	–1.649*	–1.457*
	[0.699]	[0.707]	[0.684]	[0.678]
Trend	–0.032**	–0.035**	–0.025**	–0.057**
	[0.008]	[0.008]	[0.007]	[0.008]
Female and Trend	0.023*	0.024*	0.023*	0.021*
	[0.010]	[0.010]	[0.010]	[0.009]
Number of Observations	5,378	5,378	5,378	5,378
Province Fixed Effects	No	Yes	Yes	Yes
Birth Year Fixed Effects	No	No	Yes	Yes
Parity Fixed Effects	No	No	No	Yes

Notes: Clustered standard errors at the province level are shown in brackets. Sample of births to women with more than two children in the 1985 Fertility Survey. All the columns include a constant term and controls for maternal age at birth, education, religion, rural roots, and wealth.

*$p<.05$; **$p<.01$

Additionally, wealthier and more educated women, who lived in urban areas and therefore had more access to sex-detection technologies, also preferred boys.

The 1985 Fertility Survey includes birth histories, so apart from relying on stated preferences, son preference might also be elicited by studying gender bias in family decisions regarding their children's births and the evolution of those decisions over time. We can therefore study birth spacing and the possibility that fertility behavior depended on the sex of the previous child. Likewise, the 1985 survey inquired about whether women stopped working after their first birth, another decision that could have been influenced by the child's sex. Building on Eq. (2), we use the following full specification to study family decisions regarding the birth of child *i*:

$$D_{ist} = \alpha' + \beta_F Fem_i + \beta_{F,T} Fem_i T_t + \mathbf{X}_{ist} B' + \sigma' T_t + \lambda'_s + \lambda'_t + \varepsilon'_{ist}, \quad (3)$$

where the variable D_{ist} measures decisions that parents of child *i* born in province *s* in year *t* made regarding the child's birth. We study two decisions: (1) birth spacing, measured as years from the birth of *i* to the birth of the next sibling; and (2) stopping working, which equals 1 if the mother worked before but not after the birth of child *i* and 0 otherwise. Fem_i, an indicator for the sex of child *i*, equals 1 if the child is female and 0 otherwise. Because of lack of data availability, Eq. (3) incorporates the implicit assumption that family decisions regarding the birth of child *i* do not depend on health care system development (i.e., β_j, $\beta_{j,T} = 0$). The parameters of interest in Eq. (3) are β_F and $\beta_{F,T}$, which measure behavior differences after giving birth to a boy or a girl and the change of this behavior over time, respectively.

Table 4 presents Eq. (3) estimates for birth-spacing decisions among the subsample of births to women with more than two children, with standard errors clustered at the province level. Birth spacing was shorter after a female birth than after a male one, and this difference decreased over time. These empirical results are robust to including province, year, and parity fixed effects. In this regard, shorter birth spacing is related to greater health risks (Miller et al. 1992; Whitworth and Stephenson 2002),

Table 5 Stopping working after the first child, 1952–1985

	(1)	(2)	(3)
Female	–0.228*	–0.189†	–0.214†
	[0.102]	[0.107]	[0.107]
Trend	0.007**	0.006**	0.008*
	[0.002]	[0.002]	[0.003]
Female and Trend	0.003*	0.003†	0.003*
	[0.001]	[0.002]	[0.002]
Number of Observations	2,294	2,294	2,294
Province Fixed Effects	No	Yes	Yes
Year Fixed Effects	No	No	Yes

Notes: Clustered standard errors at the province level are shown in brackets. The sample is women having their first child in the 1985 Fertility Survey. All columns include the constant term and controls for maternal age, education, religion, rural roots, and wealth.

†$p < .10$; *$p < .05$; **$p < .01$

so it is plausible that son preference and families' behavior indirectly affected maternal and fetal health.

Regarding whether women stopped working after delivering a boy or a girl, Table 5 reports Eq. (3) estimates for the subsample of women of firstborn children, with standard errors clustered at the province level.[16] Interestingly, women were less likely to stop working after having a girl than after a boy, a behavior that disappeared over time. This pattern is arguably compatible with the idea that son preference led families to devote more resources to caring for their male offspring. Although we cannot observe whether this greater care also occurred while the child was in utero, our estimates show that families better organized to care for male newborns, suggesting that families would have also taken better care of pregnancies if they knew they were carrying a boy.[17]

Behavioral Biases and the SRB

In a context of maternal health improvements and the availability of prenatal sex-detection technologies, son preference would have inflated the SRB above what is biologically expected by inducing sex-selective abortions or shaping how pregnant mothers take care of themselves when bearing a boy. The subsequent decline in son preference and sex-biased prenatal care would return the SRB back to biologically expected values.

To explore the role of behavioral factors and the shift to gender-egalitarian values on the SRB, we exploit Franco's death in 1975 as a turning point for the spread of gender equality in Spain. This research strategy follows recent literature showing that

[16] The sample is constrained to women having firstborn children because these women were asked whether they worked between marrying and having their first childbirth and whether they worked after their first childbirth; these questions were not asked for the next offspring.

[17] Women with secondary or higher education were less likely to stop working.

exposure to more gender-equal environments positively influences gender-related preferences (Carlana 2019; Dahl et al. 2021; Dhar et al. 2022; Fernández et al. 2004; Porter and Serra 2020). Although it was not completely unexpected, this exogenous shock spurred rapid changes in social and cultural values in Spain. The transition from dictatorship to democracy changed women's expectations about their futures. We use the year of the dictator's death to implement an empirical strategy that distinguishes young women who were already relatively mature from those who were adolescents when Franco passed away. Most adult women (older than 18) had already finished their education and were therefore embedded in the values and preferences of the world they inhabited. These cultural values affected both their intended fertility and their preferences regarding the sex composition of their offspring. By contrast, those women who had not reached 18 in 1975 still had malleable preferences and values.

Our identification strategy compares the behavior of two groups of women who, except for the dictator's death, would have had the same behavioral patterns over time. Thus, we consider women who were young at the time of Franco's death (aged 13–23): relatively mature women aged 18–23 and adolescent women aged 13–17. We estimate the effect of the transition to gender-egalitarian values on the SRB through the difference in the probability of having a male child for these two groups by considering the differences in exposure to egalitarian values and beliefs (i.e., distance between the delivery year to 1975). Thus, we use Eq. (2) as the baseline and expand it to estimate the following difference-in-differences equation with continuous treatment:

$$Y_{ist} = \alpha'' + \beta_{Ad}\, Ad_i + \beta_{Ex} Ex_t + \beta_{Ad,\,Ex}\, Ad_i Ex_t + \mathbf{M}_{ist} A + \lambda''_s + \lambda''_t + \varepsilon''_{ist}, \tag{4}$$

where Ad_i is an indicator equal to 1 if the mother of child i was an adolescent (i.e., aged 13–17) in 1975. Ex_t captures the mother's years of exposure to egalitarian values (divided by 100) from 1975 to child i's birth. $\mathbf{M}_{ist}$ is a vector of control variables that includes maternal and fetal conditions (h^j_{ist}) and other potential confounders ($\mathbf{X}_{ist}$).

The parameter of interest, $\beta_{Ad,\,Ex}$, captures the different evolution in the probability of having a male birth between the adolescent women and the relatively mature women with exposure to gender-egalitarian values. Thus, this parameter captures the causal effect of changing values on the SRB. In the absence of behavioral effects on the SRB, we should expect no major differences between these two groups of women, and therefore $\beta_{Ad,\,Ex} = 0$. By contrast, if an additional behavioral mechanism operates, we would expect more rapid son preference declines for adolescent women at the time of the dictator's death and thus a reduced probability of giving birth to boys throughout their lives: $\beta_{Ad,\,Ex} < 0$. Note that as egalitarian values spread throughout society, the different behaviors of the two groups of women will shrink and eventually vanish. Given our previous finding that, on average, son preferences in Spain had vanished by 1985, we estimate Eq. (4) separately for 1975–1985 and 1986–1995.[18] Additionally, the analysis is restricted to families who might eventually benefit from social and institutional developments: those with hospital births.

[18] As expected, estimates for the pooled sample conceal the effect of a decline in son preference on the probability of male births.

Table 6 Difference-in-differences estimates (with continuous treatment) of the probability of a male birth in 1975–1995 in Spain to women aged 13–23 in 1975 (at first exposure to egalitarian values and beliefs)

	1975–1985 (1)	1975–1985 (2)	1986–1995 (3)	1986–1995 (4)
Adolescent (at first exposure)	0.004*	0.003*	–0.000	–0.001
	[0.001]	[0.001]	[0.004]	[0.005]
Exposure (length)	0.053†	0.007	–0.040	–0.061
	[0.030]	[0.031]	[0.040]	[0.043]
Adolescent and Exposure	–0.076**	–0.065**	0.025	0.030
	[0.025]	[0.021]	[0.029]	[0.030]
Number of Observations	2,670,393	2,670,393	1,659,885	1,659,885
Province Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	No	Yes	No	Yes

Notes: Clustered standard errors at the province level are shown in brackets. Data are from Spanish vital statistics (administrative data). The sample is births taking place at a hospital. All the columns include a constant term and controls for birth conditions (preterm and dystocia), the number of hospitals in small areas in the province, parity, maternal age, and maternal occupation type.

†$p < .10$; *$p < .05$; **$p < .01$

Table 6 presents the estimation results of Eq. (4) using clustered standard errors at the province level.[19] Columns 1 and 2 include the results for the subsample of births in 1975–1985, and columns 3 and 4 present the results for births in 1986–1995. Consistent with our expectations, a statistically significant difference in the evolution of the probability of having a son over time is observed for adolescent women at the time of first exposure to gender-egalitarian values compared with relatively mature women at that time (Adolescent and Exposure row, columns 1 and 2). These results rule out the possibility that biological mechanisms alone explain the evolution in the probability of having a son and are consistent with the coexistence of behavioral mechanisms. Women who were exposed to gender-egalitarian values in adolescence acquired them faster—with a subsequent erosion in son preference—than women who were young adults at the time of first exposure. Thus, for each level of expansion in health services, these younger women would have had a smaller bias in their attitudes toward having a boy or a girl while also moving more quickly toward the biologically expected probability of having a son than those who were a bit older.

As expected, the cutoff point matters because egalitarian values eventually spread to virtually the entire society. When we evaluate the probability of a male birth in 1986–1995 (Adolescent and Exposure row, columns 3 and 4), we find no differences in the evolution of the probability of giving birth to a son between those who were adolescents and those who were young adults at the time of first exposure to egalitarian values and beliefs. The convergence toward biologically expected values progressed at a similar pace for the two groups of women from the mid-1980s onward. The results in Table 6 are robust to measuring the young women's malleability as years remaining before age 18 in 1975 (see Table A6).

[19] Table A4 displays summary statistics for the sample used to estimate Eq. (4), and Table A6 shows the estimates for the control variables.

The key assumption of our identification strategy is that women in the treated and control groups would have behaved the same if there had been no exposure to egalitarian values and beliefs. This assumption would not be satisfied if (for biological reasons) women aged 13–17 and aged 18–23 had different probabilities of having a male birth in the following 10 years (note that all specifications include the mother's age as a control variable). To test this assumption, we set a placebo cutoff at 1985. Following our empirical design, we compare relatively mature women (aged 18–23) in 1985 with adolescent women (aged 13–17) in that year. Estimations of Eq. (4) using this sample and cutoff show no difference in the probability of having a son with length of exposure to the placebo event between these two groups (see Table A7). This exercise rules out the possibility that our findings arise because adolescent and relatively mature women have different probabilities of giving birth to a son at the beginning of their birth histories.

Likewise, women who gave birth at home were a special group (see Table A2). Because such women include families who might have avoided maternity wards for ideological or cultural reasons, these births include families fairly unaffected by the emergence of modern values and beliefs. Therefore, estimating Eq. (4) for births at home constitutes an additional placebo test to check the assumptions underlying our research strategy. Given that this group was not likely to alter their behavior, we expect no differences in the probability of a male birth between adolescent women and relatively mature women at the time of the dictator's death. As shown in Table A8, the results confirm that the probability of delivering a son did not differ between these two groups of women.

Sex-Selective Abortions or Sex-Biased Care of Pregnancies?

In a context of strong son preference, the emergence of prenatal sex-determination technologies pushed the SRB significantly above the biological norm. This phenomenon was only transitory because the gradual spread of gender-egalitarian values that followed the end of the Francoist dictatorship undermined son preference. Sex-selective abortions had a crucial effect on the extreme SRB found in other contexts—notably, in South and East Asia (Das Gupta et al. 2003; Echavarri and Ezcurra 2010; Guilmoto 2018; Hesketh and Xing 2006; Jayachandran 2015). However, to our knowledge, there is no quantitative or qualitative evidence that abortions especially targeted girls in Spain during this period.

Voluntary abortions were condemned by the Catholic Church and banned by law until 1985. Certainly, the religious and legal barriers were not enough to curb the social need for controlling reproduction (Reeser 2019), especially given that accessing contraceptives was not easy. In 1974, the prosecutor's office of the supreme court estimated that approximately 300,000 clandestine abortions were performed in Spain each year (Herrero Tejedor 1974:76). Other reports provided more conservative figures of roughly 100,000 annual abortions around the same period (Hernández Rodríguez 1979). Illegal abortions took place in secrecy and were extremely costly, and they were performed under unhygienic conditions involving considerable health risks. Cazorla Sánchez (2010:173) argued that illegal abortions might have killed approximately 1% of the female population. Conditional on having a passport, some women opted to travel to countries where abortion was legal. Between 1975 and

1978, more than 30,000 women traveled to the United Kingdom to interrupt their pregnancies (Hernández Rodríguez 1979).

Although abortions were relatively widespread, no previous research has suggested that families might have considered this option to get rid of unwanted girls. To provide further evidence on this issue, we analyzed the CREA dataset (Real Academia Española 2023), a textual dataset containing a representative sample of more than 111,000 documents written in Spanish between 1975 and 2000. In a restricted sample containing newspaper articles published between 1975 and 1990, the term "abortion" was mentioned 328 times, but the baby's sex was never mentioned as the motivation for abortion. All these mentions refer to the legal and societal debate about legalizing abortion and to news about those prosecuted or condemned for practicing abortion. Obviously, the absence of discussion on sex-selective abortions does not eliminate this possibility, given that abortion itself was banned. In this regard, the political and cultural environment in the early 1970s—a strong Catholic dictatorship that heavily penalized abortions—shaped the tone of contemporary medical reports (Santesmases 2008). Instead of discussing how these techniques could prevent defective births, these texts stressed the increased knowledge about the pregnancy. Nevertheless, the same kind of social and cultural taboos might have also prevented explicit references to sex-selective abortions.

In any case, the behavioral mechanism outlined here does not necessarily require the existence of sex-selective abortions. The high cost of this practice in Spain during the study period probably steered families toward other practices. Differentiated care during pregnancies depending on fetal sex could also result in a biased SRB if families behaved differently upon discovering the sex of their babies. The decision about whether to stop working during pregnancy was probably the most relevant in this regard. Several studies have suggested that women exposed to heavy lifting, prolonged standing, walking, bending, and heavy physical workloads are more likely to suffer adverse pregnancy outcomes, such as miscarriages, preterm deliveries, and low birth weights (Cai et al. 2020; Juhl et al. 2013; Knudsen et al. 2018). If women were more likely to stop working (or start taking better care of themselves) when they were carrying a boy, more male fetuses would have survived, increasing the SRB. Our analysis further supports this hypothesis. On the one hand, the positive effect of health system expansion and modernization on the SRB stresses the link between maternal care and the probability of delivering a son (Table 1). On the other hand, our results also show that son preferences had shaped women's maternal decisions: birth spacing was longer after a male birth (Table 4), and women were more likely to stop working after having a boy (Table 5). Therefore, the available evidence suggests that the way families organized to take care of pregnant women known to be carrying a boy increased the likelihood of successful childbirth, helping explain the inflated SRB observed in our data. These behavioral biases gradually disappeared as the spread of gender-egalitarian values during this period eliminated son preference (Table 6).

Conclusion

This article shows that health care system expansion increased the likelihood of male births in Spain between 1975 and 1995. By facilitating the delivery of preterm

and dystocic babies and improving overall maternal conditions, these developments increased the survival chances of male fetuses, who are biologically weaker than females. However, the biased SRB temporarily observed in Spain in the early 1980s poses a fascinating puzzle that has gone unnoticed for decades and cannot be explained by biological factors alone. The results reported here suggest that the availability of prenatal sex-determination technologies and a strong son preference nurtured by the Francoist regime fostered gender-biased behaviors that resulted in an excessively high SRB.

Although abortions were widespread, the lack of quantitative or qualitative evidence suggesting that women choosing to terminate their pregnancies especially targeted girls implies that the nature of the specific behavior behind the excess male births lies elsewhere. We argue that women took better care of themselves when carrying a son. Given that we cannot completely disregard the possibility that sex-selective abortion contributed to the pattern observed here, the two decision types—sex-selective abortions and biased prenatal care—could have coexisted. The cultural change elicited by the end of the dictatorship, and especially the spread of gender-egalitarian values, undermined son preference and returned the SRB to normal levels.

Nonetheless, more research is needed to better document the practices unveiled here, including the motivations that moved so many women to change their fertility behavior depending on the sex of the baby they were carrying. Son preference was present in Spain at least until the 1940s because of the central role of male labor in a context where women employment opportunities outside agriculture were lacking, and widespread poverty imposed significant constraints to familial resources (Beltrán Tapia and Gallego-Martínez 2020; Beltrán Tapia and Marco-Gracia 2022; Echavarri 2022). However, by the 1970s, Spain was a very different place: high rates of economic growth and internal migration had fundamentally changed the economic structure. Thus, it is plausible to hypothesize that the practices observed here reflect deep-rooted cultural norms (Giuliano and Nunn 2021; Miho et al. 2024). It is striking though that after Franco's death, son preference vanished within less than a generation, making it crucial to shed more light on the nature of the behaviors behind this rapid cultural change. ■

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