DEMOGRAPHIC RESEARCH
A peer-reviewed, open-access journal of population sciences

DEMOGRAPHIC RESEARCH

VOLUME 51, ARTICLE 40, PAGES 1257–1298
PUBLISHED 20 NOVEMBER 2024
https://www.demographic-research.org/Volumes/Vol51/40
DOI: 10.4054/DemRes.2024.51.40

Research Article

Social-class differences in spacing and stopping during the historical fertility transition: Insights from cure models

Edoardo Redivo

Martin Dribe

Francesco Scalone

Contents

Demographic Research: Volume 51, Article 40
Research Article

Social-class differences in spacing and stopping during the historical fertility transition: Insights from cure models

Edoardo Redivo[1]

Martin Dribe[2]

Francesco Scalone[3]

Abstract

BACKGROUND
There is a long-standing debate about the role of spacing and stopping in the fertility transition, fueled by a lack of methods to appropriately model spacing and stopping. Traditional event-history analysis cannot distinguish between the two processes in analyzing the determinants of birth risks, and attempts to separately model spacing and stopping have been criticized from a methodological point of view.

OBJECTIVE
Our aim is to assess the role of spacing and stopping in the historic fertility transition generally, and the role of social-class differences in the fertility decline more specifically.

METHODS
We use cure models, which are extensions of traditional survival analysis, to distinguish the impact of stopping and spacing on fertility. The models are applied to individual-level data for a region in southern Sweden between 1813 and 1967.

RESULTS
Both spacing and stopping played a role in the fertility transition, but stopping emerged earlier for all parities after the first and had a greater effect on the reduction in fertility. Higher social classes were forerunners in the fertility transition but we do not find that spacing and stopping operated in different ways by social class.

CONCLUSIONS
Our findings indicate that stopping had an earlier and more substantial impact on the fertility transition than spacing. However, the patterns of the two behaviors were very similar between social classes.

[1] Università di Bologna, Italy. Email: edoardo.redivo@unibo.it.
[2] Lund University, Sweden.
[3] Università di Bologna, Italy.

CONTRIBUTION
Our study is one of very few that applies cure models to distinguish spacing and stopping in the fertility transition, and the first to our knowledge that uses this approach to study class differences in the fertility decline.

1. Introduction

The fertility decline is a global process that started in most Western countries in the late 19^{th} century (Coale and Watkins 1986). During the transition the number of children per woman dramatically declined, with profound effects on economy and society. From a historical perspective, the fertility transition represented one of the most significant changes in the human condition and has attracted a lot of research in demography, sociology, and economics. Nevertheless, the reproductive strategy of family limitation remains an important research area. The role of ‘spacing’ and ‘stopping’ in the fertility transition has been debated for a long time (see, e.g., Bengtsson and Dribe 2006). By spacing we mean the intervals between births, while stopping is the termination of childbearing when the fertility target has been reached. As much research on the fertility transition has been based on aggregated data, there is a lack of conclusive evidence on which of these mechanisms was most important in the decline.

It is often assumed that pre-transitional fertility was not controlled deliberately but was ‘natural’ (Henry 1961). Natural fertility is defined as the absence of parity-specific control (i.e., no stopping); in other words, the probability of having another child does not depend on the number of previous births. Hence, the fertility transition started when families began to limit family size after having reached their fertility target. This new behavior was a major innovation and was linked to broader cultural change in society at this time in history (e.g., Carlsson 1966; Cleland and Wilson 1987; Coale and Watkins 1986).

However, it is quite evident that couples in the natural fertility regime also knew how to control their fertility (McLaren 1990; Santow 1995; Van de Walle 2000; Van de Walle and Muhsam 1995), and studies of Rouen (France), Geneva, and a set of German parishes show strong indications of fertility control before the start of fertility decline (Bardet 1990; Knodel 1988: 289; Perrenoud 1990). Other studies have indicated that pre-transitional fertility control was not parity-dependent but related to spacing (e.g., Bean, Mineau, and Anderton 1990; David and Mroz 1989a, 1989b; Van Bavel 2004a), and that spacing was also important in the fertility decline (Anderson 1998; Bean, Mineau, and Anderton 1990; David and Sanderson 1986; Haines 1989a, 1989b; Szreter 1996).

There is ample evidence in widely different contexts that the timing of the fertility transition differed by socioeconomic status. Even if there was no universal association between socioeconomic status and marital fertility before the fertility transition, the middle and upper classes were vanguard groups in the transition, with the working class, and especially the rural working class and farmers, being laggards (e.g., Cummins 2013; Dribe and Scalone 2021; Dribe et al. 2017; Haines 1989a; Skirbekk 2008). It remains unclear whether socioeconomic differences in fertility decline were connected to changed economic incentives or a result of cultural innovation spreading from high status to low status groups (see, e.g., Klüsener, Dribe, and Scalone 2019).

We do not know much about the relative importance of spacing and stopping across socioeconomic groups during the transition. In order to improve the understanding of the behavioral changes underlying the onset of the historical fertility decline, we aim to assess the socioeconomic differences in spacing and stopping during the demographic transition in Sweden. To our knowledge this has never been done in previous literature on the historical transition. We do this by employing cure models to statistically separate stopping and spacing, and assessing their relative importance in the fertility transition in general and for the class-specific decline in fertility more specifically.

We study a population in southern Sweden during the period 1813–1967. The data consist of longitudinal population registers and annual tax registers providing time-varying information about births and occupation, as well as necessary control variables. The registers allow a precise measurement of time at risk by following individuals from first marriage to the end of the reproductive period or censoring following death, union dissolution, out-migration, or the end of the observation period. The rest of the article is organized as follows. We first present some background to the study of stopping and spacing, and then turn to the cure models, followed by data and variables, before presenting the empirical results.

2. Measuring stopping and spacing

The debate about the relative importance of spacing and stopping has, at least partly, been fueled by a lack of methods to distinguish between the two mechanisms (e.g., Alter 2019; Van Bavel 2004b). As part of the European Fertility Project, Coale and Trussell (1974, 1978) proposed estimating the degree of parity-specific control using a model of age-specific marital fertility. In this model, the measure of fertility control, *m*, detects how much the observed age-specific marital fertility rates deviate from a standard age pattern of natural fertility. Increasing deviations with age reveal practices of parity-specific fertility control. The faster fertility falls with age, the higher the value of the *m* index, and the greater the importance of stopping in the population (Knodel 1987). Using a set of standard marital fertility schedules, the *m* parameter can be estimated by linear regression using aggregate age-specific marital fertility rates (see Preston, Heuveline, and Guillot 2001: 204–208).

This measure has been widely used to compare fertility behavior in different populations but has also been extensively criticized (Bean, Mineau, and Anderton 1990; Broström 1985; Guinnane, Okun, and Trussell 1994; Knodel 1987; Okun 1994; Page 1977; Wilson, Oeppen, and Pardoe 1988). Because of the methodological difficulties in detecting spacing, too much emphasis has been put on stopping as the most important strategy of fertility control in the transition.

While the dominant view is that there was not much stopping in pre-transitional populations, some studies have demonstrated that deliberate spacing, or postponement of births, was important before the transition. By measuring the timing of the fertility response to short-term economic stress in pre-transitional southern Sweden, Bengtsson and Dribe (2006) found strong indications of non-parity-specific deliberate adjustment of the timing of births. Similar findings were later made for parts of Germany using the same empirical design and similar data (Dribe and Scalone 2010). Identification of deliberate postponement in these models rests completely on the timing of the response to fluctuations in food prices; i.e., it is too rapid to be an unintended consequence of poor nutrition, prolonged breastfeeding, or spousal separation following seasonal migration.

A significant reason for the inadequate measuring of stopping and spacing in the fertility decline is the lack of detailed data. As already mentioned, aggregate data, like those used by the European Fertility Project, are not ideal for disentangling these mechanisms, which instead requires longitudinal data at the individual level. From the 1990s a new wave of historical fertility studies adopted the event-history approach to advance the understanding of the determinants of both pre-transitional fertility and the fertility decline (e.g., Alter 1988, 2019; Tsuya et al. 2010; Van Bavel 2004a).

David Reher and his collaborators (Reher and Sanz-Gimeno 2007; Reher et al. 2017) analyzed spacing and stopping in the fertility transition in different contexts using parity progression ratios and mean birth intervals by parity. Using Kaplan–Meier survival functions, the probability of having another birth can be assessed and the length of birth intervals can then be computed for closed intervals. The proportion who never have another birth corresponds to the height of the Kaplan-Meier curve at the end of the reproductive period, while birth intervals are separated by parity in a multivariate analysis based on Cox proportional hazard models. Their findings indicate that families deliberately adjusted their childbearing in relation to child death and the sex composition of siblings.

Jan Van Bavel proposed modeling spacing and stopping separately (e.g., Van Bavel 2004a, 2004b; Van Bavel and Kok 2004). Stopping was modeled with a logit model and spacing with a Cox proportional hazards model using only closed birth intervals in the analysis. However, this approach to modeling spacing has been criticized by Alter (2019) for violating basic assumptions of the Cox model and leading to biased results. In short, according to Alter, Cox regression is used to model transition rates, not length of intervals, and the model cannot separate the processes of stopping and spacing. Moreover, only limiting the analysis to closed intervals (i.e., to those individuals who we know will continue to the next birth) implies a selection bias, given that information about censored intervals is discarded. In effect, the estimates will not reflect effects on length of intervals, but (biased) effects on hazards (risks) of another birth, assuming proportional hazards over the entire duration time.

The Cox model cannot identify stopping and spacing separately. As an alternative, Alter proposed using cure models to simultaneously model spacing and stopping using birth history data and allowing for the inclusion of covariates to explain the two processes (Alter, Oris, and Tyurin 2007; Alter 2019). Among the alternative definitions of cure models, which all have the goal of separating the two effects, mixture cure models, or split-population models, are based on the assumption that the study population can be divided into two subpopulations: cured and non-cured, or susceptible and non-susceptible. In fertility analysis, this means that at a given parity the population can be divided between those intending to have another birth and those who stop. The two processes are modeled simultaneously using two sub-models (see below for further details).

Following Alter, Oris, and Tyurin's initial paper on the topic (2007), as well as some research on contemporary fertility behavior (e.g., Bremhorst, Kreyenfeld, and Lambert 2016; Li and Choe 1997), a few studies have applied cure models in analyses of historical fertility patterns (Cilliers and Mariotti 2021; Gortfelder and Puur 2020; Janssens 2014). In this study we extend this research by employing cure models to assess the role of spacing and stopping for the social-class-specific decline in fertility in Sweden.

3. Cure models

In fertility analysis, parametric survival models are only appropriate for evaluating the time between two consecutive births if all women under observation eventually have another child, because an implicit assumption of such a model is that eventually all observations will undergo the event under study, even censored observations for which this has not been the case during the follow-up period (Li and Choe 1997). Therefore, such an approach inadequately models the duration between subsequent births, since not all women continue to have another birth. However, the main issue with conventional survival models, an issue that also involves the more flexible semiparametric Cox proportional hazards model, is that they cannot distinguish between the transition speed to a subsequent parity and the proportion of women who have another birth. Indeed, some women stop having children after reaching a given parity. Hence, these models cannot disentangle the effect of the covariates that determine the propensity and the timing of having another child.

Therefore, we adopt an extension of conventional survival models, namely mixture cure models, as proposed in several previous studies (e.g., Alter 2019; Cilliers and Mariotti 2021; Yamaguchi and Ferguson 1995).[4] These models allow for a proportion of the population not to be at risk of experiencing the event under study (in our case, childbirth), contrary to classical survival models in which all individuals are expected to undergo the event, provided that the time under observation is long enough. Therefore, in this modeling framework we assume the presence of two groups, of which only one will experience the event. The assumption is that among the censored individuals only some will eventually go on to have another child. Thus, the duration estimation is not based on those women who have stopped having children. By formulating two different equations, the cure model estimates the proportion of women who stopped having another child after *n* births and the distribution of waiting times for women who had at least *n* + 1 births. In the two sub-models, the propensity to stop having children and the speed of having another birth depend on a set of covariates with a vector of parameters. From this point of view, the mixture cure model more clearly separates the effects of the coefficients on the stopping and spacing, which also results in generally more interpretable estimates. An alternative to the mixture approach to cure models is given by promotion time cure models, which introduce a lower bound in the survival function (Tsodikov 1998).

Adopting a mixture cure model framework leads to the following survivor function, which models the proportion of women who have not given birth at time *t* depending on three sets of covariates x, y, and z:

$$S(t|x,y,z) = [1-\pi(x)]S_m(t|y,z) + \pi(x) \quad (1)$$

where $S_m(t|y,z)$ is the proportion of women who have not given birth before time *t* and will eventually progress to the next parity, and $\pi(x)$ is termed the ‘cure fraction,’ which represents the proportion of ‘stoppers’ (women who will never have another birth):

$$\pi(x) = \frac{\exp(\beta_x x)}{1+\exp(\beta_x x)}. \quad (2)$$

[4] For a preliminary overview of this class of survival models, see Amico and Van Keilegom (2018) and Klein et al. (2014).

The β_x coefficient estimates the effects of a set of variables in x using a link function, such as the logit. Thus, it is interpretable in the same way as in logistic regression.

Following Yamaguchi (1992), we use an accelerated failure time (AFT) model to estimate the duration to the next parity. Probability distributions with the AFT property can be written in a log-linear form (Collett 2015: chapter 6):

$$\log T = \mu + \sigma\epsilon \tag{3}$$

which shows the logarithm of time being a transformation of a random quantity ϵ, scaled by parameter σ and with the addition of parameter μ. If the latter is modeled via covariates, then they will have a linear effect on the logarithm of time. To ensure identifiability, the random variable ϵ is assumed to have location and scale parameters fixed at 0 and 1 respectively, so that for $\log T$ these two characteristics will depend on μ and σ respectively. Moreover, if the median of ϵ is equal to 0, T will have the median at $\exp(\mu)$.

Among distributions that possess the AFT property, the log-normal probability function for the time distribution has received particular attention (Cilliers and Mariotti 2021; Yamaguchi and Ferguson 1995) since, thanks to its two parameters, it can reflect the slow progression to a subsequent birth at the beginning of each birth interval. The log-normal distribution is obtained when, in Equation (3), ϵ is assumed to be normally distributed. Its survival function is equal to:

$$S_m(t \mid y, z) = 1 - \Phi\left(\frac{\ln(t) - \mu}{\sigma}\right) \tag{4}$$

where we can model both parameters with – possibly different – sets of covariates:

$$\mu = \beta_y y \tag{5}$$

$$\sigma = \exp(\beta_z z). \tag{6}$$

In this framework, t represents the length of time to a subsequent birth. The function $\Phi()$ refers to the cumulative distribution for a standard Gaussian (normal) distribution. The central tendency μ and the dispersion σ are respectively known as the scale and shape parameters of the log-normal distribution. In this framework, the parameter vectors β_y and β_z estimate the effects of two sets of covariates y and z on μ and σ, respectively. Other common AFT models include the Weibull, the Gamma, and the log-logistic. The latter, just as the log-normal, can be characterized as a special case of Equation (3), that is when ϵ follows a logistic distribution it results in the following survival function:

$$S_m(\, t \mid y, z\,) = \frac{1}{1+(t\,exp(-\mu))^{\frac{1}{\sigma}}} \tag{7}$$

As in Equations (5) and (6), the two parameters can be modeled with the two sets of covariates. As with the log-normal distribution, $exp(\mu)$ is the median of the distribution so exponentiated coefficients can be interpreted as multiplicative effects on the median.

Regardless of the distributional form chosen for the time-to-event variable, the likelihood function for the mixture cure model can be constructed in the following way. Having n observations in our sample, for each of them we have an observed time (t_i), a variable that is equal to 1 if we do not observe the event (the birth) and 0 otherwise, the so-called censoring indicator (c_i), covariates that influence the probability of experiencing the event (x_i), and covariates that influence the two parameters of the time distribution (y_i, z_i).

$$L(\beta_x, \beta_y, \beta_z) = \prod_{i=1}^{n}\left[\left(1-\pi(x_i)\right) f(t_i \mid y_i, z_i)\right]^{1-c_i} \cdot \left[\left(1-\pi(x_i)\right) S_m(t_i \mid y_i, z_i) + \pi(x)\right]^{c_i} \tag{8}$$

This likelihood implies that observations for which we observe the childbirth (value of $1 - c_i = 1$) contribute to the likelihood via the density function $f(\cdot)$, while censored observations contribute via their survivor function. The intuition is that uncensored observations are certainly uncured because the event has been observed, while censored observations can be either uncured with a time-to-event at least as large as the one observed, thus modeled with the survival function, or cured, with probability $\pi(x)$. The parameters $(\beta_x, \beta_y, \beta_z)$ can be estimated by maximizing this likelihood function.

Interpreting μ as a measure of parity-dependent birth spacing has been proposed (e.g., Cilliers and Mariotti 2021). In these terms, μ reveals the length of birth interval that could be considered acceptable among the couples of the studied population depending on the parity they have already reached. The y vector represents the observed determinants and β_y evaluates their effects on the decision to have a further child.

Furthermore, β_z measures the impact of the z variables on the σ parameter related to the standard deviation of the $\log T$. Since σ implies a change in the $\log T$ distribution to the next birth that is not associated with a change in the median birth interval, Cilliers and Mariotti (2021) propose interpreting σ as an indication of non-parity-specific postponement. Changes in reproductive behavior unrelated to parity-specific decisions could be due to temporary situations such as individual circumstances, economic conjuncture, or health status. Due to these circumstances, some couples could decide to postpone their next birth, no matter the age of their previous child, without having either an intention to ultimately limit the family size or a new attitude toward the ideal birth interval. Parity-independent postponement generally affects the variance of the distribution of birth intervals without any fundamental shift involving a society's reproductive choices (Timæus and Moultrie 2008). However, a problem with interpreting the shape parameter as an indicator of postponement is that the dispersion will also increase when a subset of the population (the forerunners) has changed its fertility behavior permanently, while another group (the laggards) has not changed at all. Another problem with modeling the parameter σ with covariates in the log-normal or log-logistic distributions is that the parameter appears in the expressions for both the mean and variance. Thus, interpreting covariate effects becomes very difficult, especially if relying only on estimated coefficients. For this reason, we do not consider the modeling of the σ parameter through covariates.

We estimate a first set of models separately, considering the progressions from the first to second parity, from the second to the third, from the third to the fourth, and finally from the fourth to the fifth. The two sets of covariates x and y pertain basically to the same variables, including an interaction between the father's socioeconomic status and the time period as the main effect, and the parish, mother's age at marriage and at the age of the last child, and survivor status of the previous child as control variables.

4. Data and variables

The data we use come from the Scanian Economic-Demographic Database (SEDD) and cover the period 1813–1967 (Bengtsson et al. 2021). The SEDD contains longitudinal information at the individual level for five largely rural parishes and a town in southern Sweden (Dribe and Quaranta 2021). Data for the town begin in 1905. It is a unique feature of the database that we can study the whole period from pre-transition to post-transition, with detailed information on occupation and fertility. The database also includes information about migration, which is important to precisely measure exposure time. The study area reflects conditions shared by populations in other similar areas, but the study population is not a random sample of the Swedish population (see Bengtsson and Dribe 2021). Sweden urbanized quite late and until about 1930 more than half of the population lived in rural areas. From 1905, the addition of the urban area makes the study population more urban than the Swedish population on average.

We use social class to measure socioeconomic status. Social class is based on the occupation of the family head, usually the husband. Occupations in SEDD are coded in HISCO (Van Leeuwen et al. 2002), and classified using HISCLASS (Van Leeuwen and Maas 2011).[5] We use the following classes: elite (HISCLASS 1–2), middle class (HISCLASS 3–5), skilled workers (HISCLASS 6–7), lower-skilled workers (HISCLASS 9–10), unskilled workers (HISCLASS 11–12), and farmers (HISCLASS 8).

[5] The occupational coding has been harmonized with other Swedish historical population data within the data infrastructure SwedPop (http://www.swedpop.se).

We analyze five sub-periods: 1813–1879 (pre-transition), 1880–1904 (early transition), 1905–1919 (mid-transition), 1920–1939 (late transition), and 1940–1967 (post-transition). For the first two periods we only have data for the rural area. In some analyses we only use three sub-periods to get more stable estimates (for analyses of class differences in marital fertility in the area using conventional methods, see Bengtsson and Dribe 2014; Dribe et al. 2017; Dribe and Smith 2021). The final period includes the baby boom of the second half of the 1940s and another peak in the mid-1960s (e.g., Sandström 2014). In fact, since the end of the fertility transition in the early 1930s, Swedish fertility has varied markedly in longer cycles, what has been referred to as "roller-coaster fertility" (Hoem and Hoem 1996).[6]

We used data from SEDD in episode format with most variables pre-defined and an indicator variable for birth (Quaranta 2015, 2016). Because episodes were already defined and given the presence of a variable indicating a birth event, only limited pre-processing was needed before analysis.

With the goal of analyzing fertility, only women between ages of 15 and 49 were included. Moreover, some filters were applied to remove observations or individuals with outlying, and very probably erroneous, characteristics, which are likely the result of the digitizing process of the old paper registers from which the SEDD is derived. We excluded women who gave birth at a too young (less than 12) or too old (greater than 60) age, who had an interval between two births of less than 8 months without a stillbirth, or who had a date of marriage preceding their birth date.

In estimating the cure models, we used the Stata package *cureregr* (Buxton 2013), which requires that episodes are contiguous; i.e., without gaps. This made it necessary to close gaps when the length was not enough for an unregistered pregnancy (less than 8 months) and the date of the last birth has not changed. Thus, with mild assumptions less of the data needed to be discarded.

For carrying out parity-specific analysis, we have to know the parity (birth order). In the version of SEDD we used (ver. 7.2) there is a parity variable, which is derived as the known number of children in the family. This variable was used for selecting data in parity-specific models.

Given the choice of studying marital fertility, only currently married women were retained. Moreover, only women with a proper end of follow-up were considered, with at least one of these conditions met: observed up to age 50, observed death, or end of data period (the end of 1967). At the end of the selection process, 16,838 women were included in the final analytical sample.

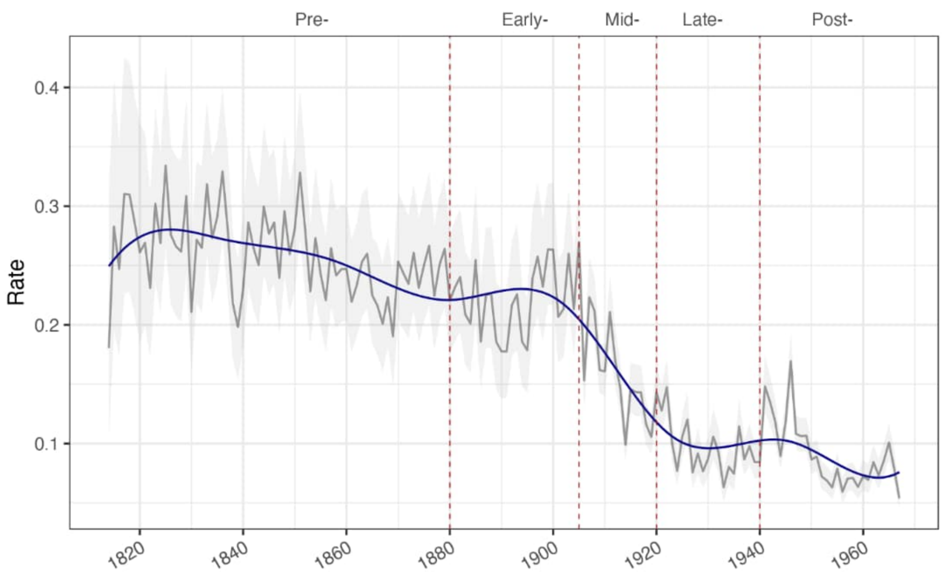
[6] The contraceptive pill was approved by Swedish authorities in 1964 and sales started the following year (Stanfors 2003: 224); hence its potential effect on fertility mostly comes after the end of our study period.

5. Results

5.1 Descriptive analysis of marital fertility

As a preliminary exploration of the fertility transition, we analyze the development of marital fertility rates over time (see Figure 1). It is well established that to a large extent the fertility decline was due to a decline in marital fertility, rather than being connected to nuptiality or to non-marital fertility (for Sweden, see, e.g., Dribe 2009). The great impact of the fertility transition in the study region is clearly visible. The periodization used throughout this study is shown in Figure 1 with the prefixes referring to the different stages of the transition.

Figure 1: Marital fertility rates 15–49 years, 1813–1967



Source: SEDD.

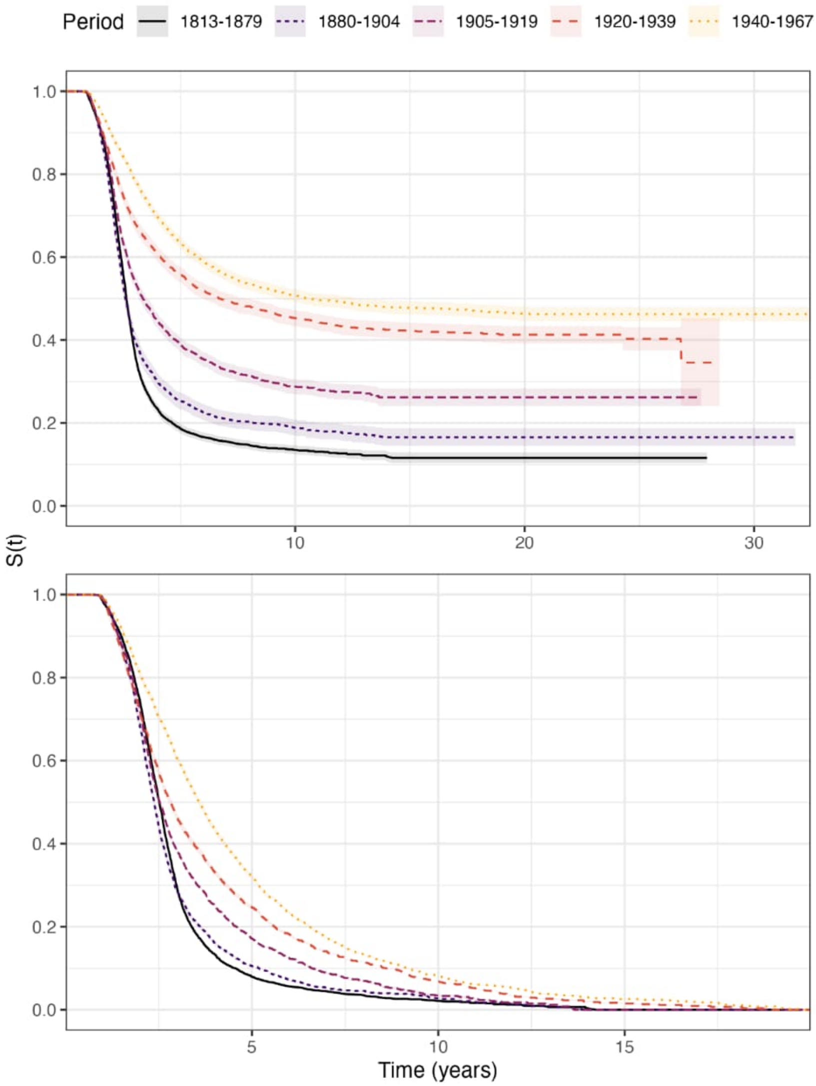
Marital fertility declined with age within each period, with younger married women having the highest rates (see Appendix, Figure A-1). In the first two periods, 1813–1879 and 1880–1904, marital fertility was higher than in the later periods. Even though the fertility rates in the period 1813–1879 were higher than in 1880–1904, the fertility schedules have the typical convex pattern of a natural fertility regime. From the 1905–

1919 period, marital fertility dropped in the age group 25–29, demonstrating the characteristic age profile underlying controlled reproductive behavior. In these terms, the marital fertility rates by age group confirm the timing of fertility decline in the population under study (pre-, early-, middle-, late and post-transition). However, it is impossible to distinguish the relative importance of spacing and stopping from simply looking at the age pattern of marital fertility.

Next, we explore Kaplan–Meier estimates of survival functions, stratified by covariates of interest. They show the proportion of women progressing from one birth to the next. Figure 2 displays the estimated survival curves for the periods of the fertility transition identified previously. The top panel shows that the plateau level of the survival functions increases with the periods: before the fertility transition the proportion of intervals that did not end with a birth event was around one-third of that in the later period, 15% as opposed to 45%. The bottom panel instead shows an estimate of survival curves conditional on having a birth (the procedure is described in detail in the following section). These conditional survival curves allow us to visually compare the length of closed intervals: The curves for the earlier periods (1813–1904) have a steeper drop in the beginning and maintain this higher speed for longer, indicating a different spacing behavior to the other periods; that is, a higher prevalence of short birth intervals.

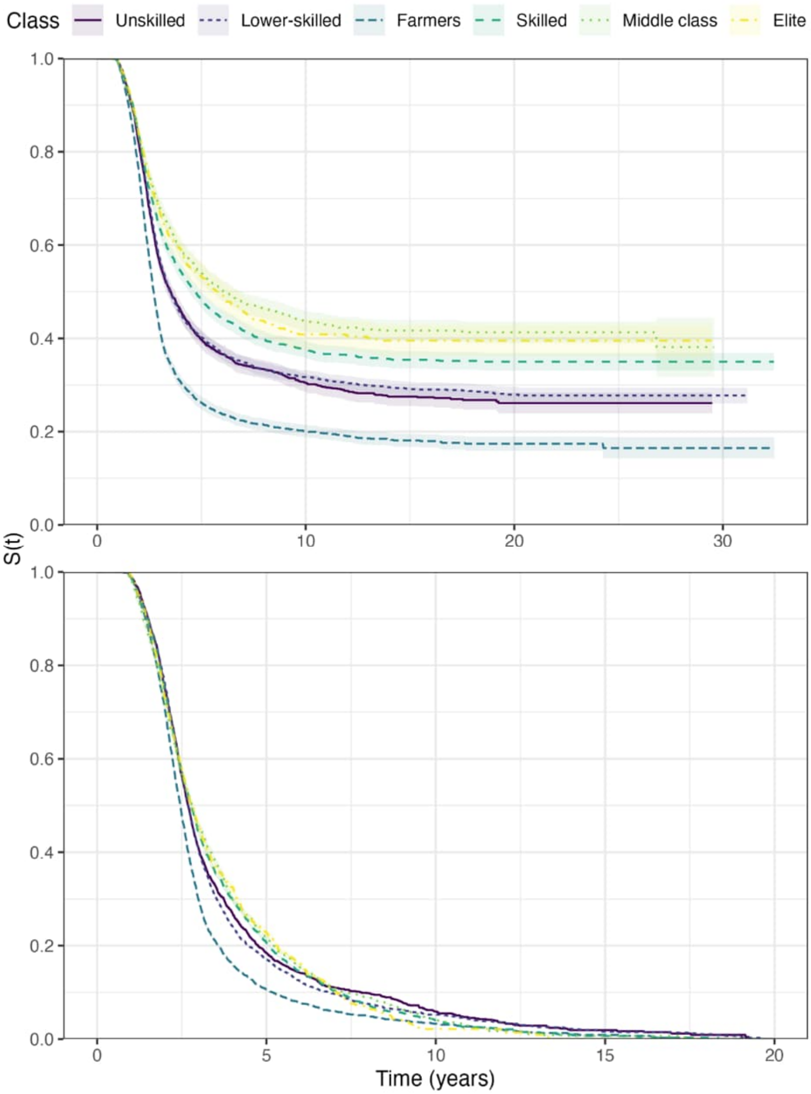
In Figure 3 we again show survival curves (top panel) and survival curves conditional on a birth (bottom panel) by social class. An interesting characteristic is that spacing and stopping are again intertwined: curves are non-intersecting and those which have the greatest speed (least spacing) in the bottom panel also reach the lowest value in the top panel (least stopping). Moreover, the order of the classes in terms of these fertility control behaviors closely matches the social hierarchy of the classes. In general, higher classes have a higher incidence of spacing and stopping behaviors. One exception is that the middle class has higher fertility control than the elite, although with overlapping confidence intervals (cf. Bengtsson and Dribe 2014; Dribe and Scalone 2014). The most notable deviation from this tendency is the behavior of farmers and fishermen, who exhibit the least fertility control in both spacing and stopping by far, which is commonly observed across populations.

Figure 2: Kaplan–Meier estimates of survival functions by period, 1813–1967



Note: The upper panel shows the complete range of duration time for the estimates, while the lower panel shows survival curves conditional on an event (operationalized as having a survival time of less than 20 years, see Equation 10). Estimates based on all birth intervals after the first birth.
Source: SEDD.

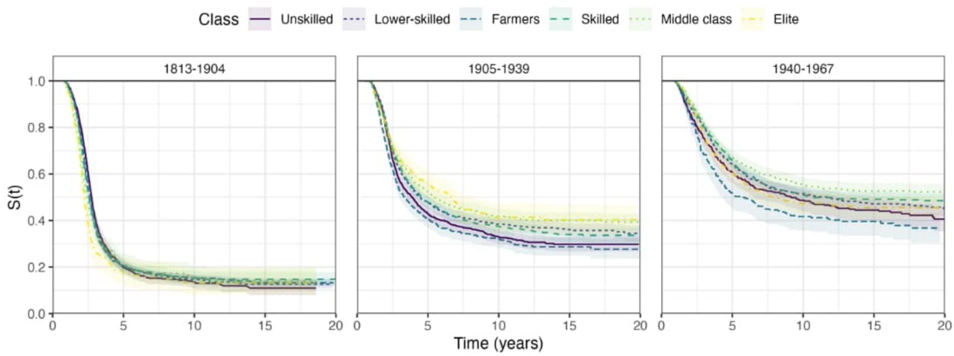
Figure 3: Kaplan–Meier estimates of survival functions by social class, 1813–1967



Note: Estimates based on all birth intervals after first birth.
Source: SEDD.

To better analyze the previous association, Figure 4 shows survival curves for each social class in three periods – before, during, and after the fertility transition (1813–1904, 1905–1939, 1940–1967). The graphs point to the fact that the association between birth intervals and social class was not there in the pre-transition period. During the transition the spread of the curves is largest, with farmers and unskilled workers trailing behind in the adoption of fertility control. There is some convergence in the post-transition period, with the ranking changing and the elite not being the class with the highest survival curve as it had been during the transition. The evidence suggests that in the 19th century, fertility control behavior was limited and with little variation between social classes (the confidence intervals for the curves intersect almost everywhere). This pattern is in line with previous research on social-class differences in the fertility decline (Bengtsson and Dribe 2014; Dribe and Scalone 2014).

Figure 4: Kaplan–Meier estimates of survival functions by period and social class



Note: Estimates based on all birth intervals after first birth.
Source: SEDD.

5.2 Descriptive analysis of stopping and spacing

George Alter recently introduced an analysis – which we will term descriptive – in which both the stopping proportion and the average length of completed intervals can be derived (Alter 2019). This is a first fruitful way of gauging and estimating the separate roles of stopping and spacing during the fertility transition. This method does not assume a distributional model for the data and is based on Kaplan–Meier estimates of the survivor function. By stratifying these measures by other variables, we can start exploring associations.

The main assumption required is that there exists a threshold, $t_{\max}$, such that all censored times greater than it will be considered to belong to 'cured' individuals; that is, individuals who will never experience another birth even if observed for an arbitrary long period of time. There is no strict definition on how to estimate $t_{\max}$, but, from an intuitive point of view, it is reasonable to define it as the time at which the survival curve reaches its plateau and does not decline any further. The stopping proportion can then be defined as $S(t_{\max})$, the value of the Kaplan–Meier estimate of the survivor function at the threshold time.

The average length of completed birth intervals is the area under a corrected survival curve. In general, the expected value of the time variable is the integral of the survival function:

$$E(T) = \int S(t)\ dt \tag{9}$$

In our case, we want the conditional expectation given 'uncured status':

$$E(T \mid d = 1) = \int S^{*}(t)\ dt \tag{10}$$

The corrected survival curve, $S^{*}(t)$, is the conditional survival curve given the uncured status. The uncured status is defined as having a censored survival time less than $t_{\max}$ (all uncensored episodes have uncured status).

$$S^{*}(t) = P(T > t \mid d = 1) = P(T > t \mid T < t_{\max}) = \frac{P(t<T<t_{\max})}{P(T<t_{\max})} = \frac{S(t)-S(t_{\max})}{1-S(t_{\max})} \tag{11}$$

$$E[T \mid d = 1] = \int_{0}^{t_{\max}} S^{*}(t)\ dt \tag{12}$$

Following this approach, there is a simple way to estimate both the mean time for intervals that end or could end in an event (uncured observations) and the proportion of events that could not end in an event (cure probability).

Table 1 shows the proportions stopping and average birth intervals by parity after the first birth, stratified by three periods (before, during, and after the transition). The survival curves are those previously shown in Figure 2 (with some of the periods pooled together), and the threshold time has been set at 20 years. Looking first at all parities together it seems clear that in the fertility transition both spacing – a longer average interval between successive births – and stopping – a greater proportion of intervals which would never lead to a birth – play an important role.

Table 1: Mean birth intervals and stopping proportions by parity

A. Mean birth intervals

	1–2	2–3	3–4	4–5	5–6	6–7	All intervals
1813–1904	2.59	2.83	2.83	2.95	3.24	3.35	2.95
1905–1939	3.62	3.46	3.83	3.47	3.46	3.35	3.67
1940–1967	4.03	4.66	4.84	4.13	4.27	3.66	4.65

B. Proportions stopping

	1	2	3	4	5	6	All parities
1813–1904	6%	7%	11%	12%	14%	18%	13%
1905–1939	30%	38%	32%	40%	29%	31%	34%
1940–1967	31%	59%	59%	59%	53%	49%	46%

Note: Descriptive measures derived from Kaplan-Meier survivor functions, following Alter (2019).
Source: SEDD.

Turning to the patterns by parity, it is clear that the stopping proportion in the pre-transition period increases with parity, while for the later periods the maximum stopping proportion is reached after two births and stays similar for the successive ones.

Regarding the average length of birth intervals (Table 1, Panel A), we see two different trends for the periods: Before the transition, birth intervals got longer at higher parities, which may reflect deliberate spacing with increasing family size, failed attempts to limit family size through stopping, or declining fecundity at higher ages. In the post-transition period the length of intervals after the third birth began to decline, with the means converging to the pre-transition levels for higher parities (5+). Most likely, this points to the fact that those individuals who decided to stop having children were no longer part of the higher parity intervals and for higher parities only individuals with higher fertility propensity are present. Although measuring stopping as a proportion and spacing as birth intervals offers clear and interpretable trends for the two behaviors, they are not strictly comparable and thus we cannot determine which of the two had a larger effect on the fertility decline. One way to do this is to relate changes in the two measures to changes in the fertility rate.

The proportion of non-stoppers estimated from parity-specific models can be interpreted as a parity progression ratio (PPR); i.e., the percentage of women who go on to have an additional child. If the PPR declines, then there is an additional proportion of stoppers that will decrease the fertility rate by the initial fertility rate net of the parity that has already been reached. This reasoning allows us to translate an increase in stopping into a decline in fertility:

$$TMFR_0 - TMRF_1 = (PPR_{0i} - PPR_{1i})(TMFR_0 - i) \tag{12}$$

where 0 and 1 indicate two values being compared, and can refer, for instance, to two time points; *i* refers to the parity; and TMFR stands for Total Marital Fertility Rate, given our sample selection only includes married couples. This formula assumes that women who continue childbearing have on average the same fertility as at point 0, the earlier period in our example, or in other words that except for the increase in the proportion of stoppers for parity *i*, everything else stays constant. This means that Equation (12) estimates parity-specific effects on the change in fertility, which cannot be added together to obtain an overall effect as each is computed without considering the effects of changes at earlier parities.

A similar reasoning can be made to tie the lengthening of birth intervals to a decline in fertility. Given an increase in the length of the interval, there is a reduction in the total time at risk of having a child, which can be measured as an age specific fertility rate ($ASFR_x$), where age *x* should be representative of the age at birth, and can for instance be the mean age at birth for a specific parity:

$$TMFR_0 - TMFR_1 = (L_1 - L_0)ASFR_x \tag{13}$$

Using the previous two formulas we compute the influence on TMFR of changes in stopping and spacing between successive periods shown in Table 1. Average TMFR for the two initial periods (1813–1904, 1905–1939) have been computed from the sample as a weighted sum of ASFR referring to age intervals (shown in Figure A-1 in the Appendix). Results are presented in Table 2, whose key takeaway is that the influence of stopping on fertility is much greater than that of spacing. For instance, the 24 percentage point decrease in PPR between 1813–1904 and 1905–1939 for the first parity translates to a decrease of 2.1 in the TMFR, while the respective increase in the birth interval of 1.02 years translates to a decrease of 0.38 in TMFR. The greater effect of stopping is there for all parities and for both period comparisons; however, most of the decline in fertility is attributable to the decline in PPR for parities 1 to 4 in the first time period.

Table 2: Estimates of the decrease in the total marital fertility rate attributable to changes in mean birth intervals and stopping proportions at each parity, holding fertility at other parities fixed

A. Mean birth intervals

	1–2	2–3	3–4	4–5	5–6	6–7
From 1813–1904 to 1905–1939	0.38	0.23	0.32	0.16	0.06	0.00
From 1905–1939 to 1940–1967	0.08	0.25	0.15	0.10	0.09	0.04

B. Proportions stopping

	1	2	3	4	5	6
From 1813–1904 to 1905–1939	2.10	2.41	1.46	1.64	0.77	0.50
From 1905–1939 to 1940–1967	0.09	0.82	0.78	0.38	0.22	–0.01

Note: These are parity-specific estimates so they cannot be added together to get overall effects across parities. For the effect of stopping for instance, Equation (12), fertility at other parities is kept fixed in the computation, so a decrease in PPR at lower parities is not reflected in a reduced effect for higher parities.

5.3 Results from parity-specific models

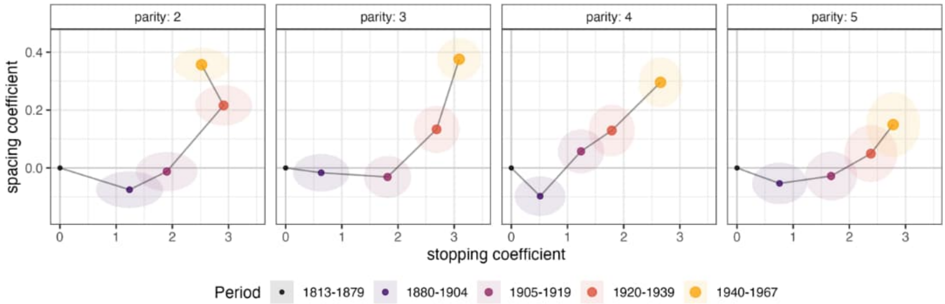
In this section we explore the timing of the fertility transition in terms of spacing and stopping. Parity-specific cure models have been fitted in which the only covariate of interest is period, which has been inserted in the model as a 5-level categorical variable (1813–1879, 1880–1904, 1905–1915, 1920–1939, 1940–1967). The controls included in the model are parish and age (age at marriage for first parity and age at previous birth for successive parities).

In Panel A of Figure 5 the coefficients for the period variable are presented in a visualization that combines the stopping coefficient (on the x-axis) and the spacing coefficient (on the y-axis). Thus, a positive value in a coordinate indicates a greater incidence of the respective fertility-reducing behavior.[7] The full set of coefficients from these models are shown in Table A-1. The distributional form for the time-to-event distribution is for all models a log-logistic selected among other AFT models based on information criteria shown in Table A-2.

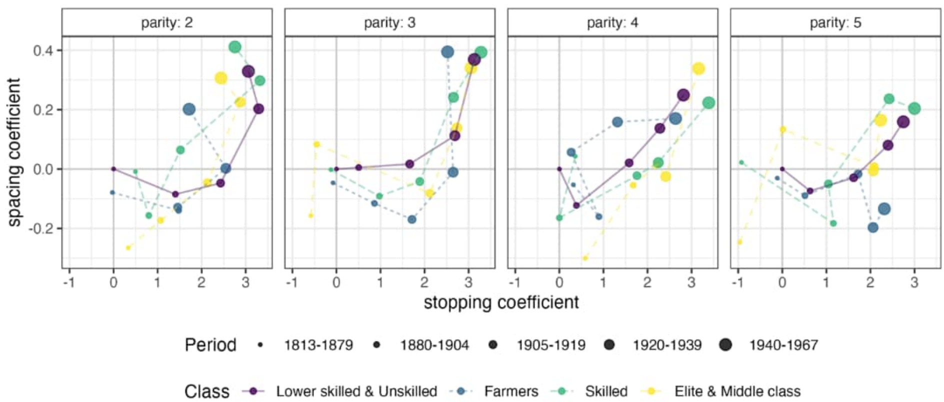
[7] The signs of the coefficients for the spacing part have been reversed with respect to the output from the package *cureregr*, as it uses a parametrization for the 'scale' parameter which translates to $-\mu$ in Equations (4) and (7). This graphical representation was inspired by Alter and Hacker (2022).

Figure 5: Cure model coefficients for spacing and stopping

A. Period (reference category: 1813–1879)



B. Period and social class (reference category: Lower skilled and Unskilled for the period 1813–1879)



Note: Estimates based on parity-specific models. Full estimates in Appendix Table A-1 (Panel A) and A3 (Panel B). In Panel A the axis lengths of the ellipses represent 95% confidence intervals.
Source: SEDD.

From these results we can note that there is evidence that stopping started earlier than spacing: for all parities considered, the lines in Panel A follow a J-shaped pattern. Compared to the reference period 1813–1879, in the two periods from 1880 to 1919 the stopping behavior saw a progressive increase, while in the 1880–1904 interval the spacing propensity remained constant or slightly reduced in the cases of parities 2 and 4. Put differently, stopping and spacing accelerated for the last two periods after 1920, except for the stopping fraction that slightly decreased in the 1940–1967 interval for parity 2, which is a reflection of the relatively high fertility in the period from the mid-1940s to the mid-1960s during the baby boom.

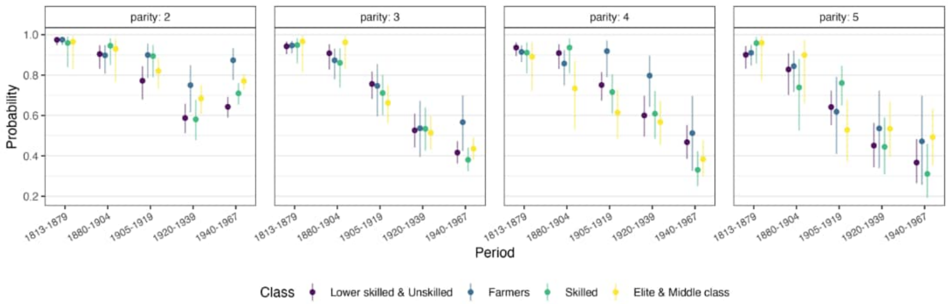
We now consider the interaction between social class and period. The coefficients shown in Figure 5 Panel B come from other parity-specific models with class–period interactions, using the same 5-level period variable as in the previous models and a 4-level social class scheme (elite and middle class, skilled, farmers, lower skilled, and unskilled workers). The full set of estimates are shown in Appendix Table A-3. A log-logistic distribution has again been chosen, based on the information criteria shown in Table A-4.

As in the previous figure we use a two-dimensional representation for showing both the spacing and stopping coefficients while also looking at the interactions between the two covariates of interest. A less compact visualization of the same coefficients but with uncertainty quantification is available in Figure A-2 in the Appendix. The reproductive developments of the classes are generally quite similar, and a J-shaped pattern over time is present for many parity–class combinations, as evidenced from Panel B.

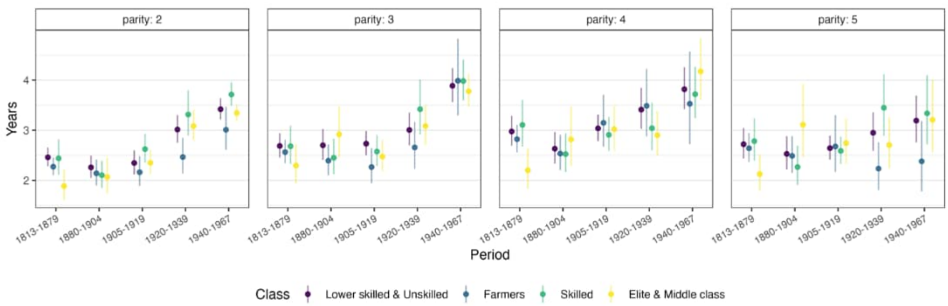
From these models we also derived more measures which are possibly more intuitive than spacing and stopping coefficients, namely parity progression ratios (PPR) and median birth intervals, which are shown in Figure 6. Considering the pre-transition period 1813–1879 in Panel A, all classes exhibit very similar and very high PPR, going from above 0.95 in parity 2 to above and around 0.9 in later parities. When focusing on the fertility transition periods, in the earlier part (1880–1904) the decline in the PPR is minimal from parities 2 to 4 (except for the elite in the higher parities), while most of the decline happens in the following two periods (1905–1919 and 1920–1939), with higher parities declining earlier than lower ones. For instance, most of the decline in PPR for parity 2 happens in the period 1920–1939, reaching a level between 0.6 and 0.7, which parity 3 already exhibited during 1905–1919. The class that mostly sets itself apart from the others is that of farmers, who experienced higher values at parity 2 and 4. Interestingly, in the post-transition phase (1940–1967) the PPRs further declined for parities 3, 4, and 5, and the variance between the different classes increased. Farmers were laggards in the fertility transition, as during the final stage (1940–1967) they had the highest PPRs from parity 2 to 4, and were on par with the elite class at parity 5, for which probably there is a selection effect for having reached a high parity.

Figure 6: Parity progression ratios and median birth intervals by social class and period

A. Parity progression ratios



B. Median birth intervals



Note: Estimates based on parity-specific models with interactions between period (5 levels) and class (4 levels). The parity progression ratios are calculated as predicted probabilities of stopping from the logistic part of the cure models. The birth intervals are calculated as medians of fitted log-logistic distribution from the time-to-event part of the cure models. The other variables have been set at their reference value. Full estimates in Appendix Table A-3.
Source: SEDD.

Before the fertility transition (1813–1879) the median birth intervals were similar across the different classes with limited variability, with only the elite having shorter intervals for all parities considered (see Figure 6, Panel B). In the following period median birth intervals increased for the elite, who catch up and even go past the other classes in parities 3 to 5. The general increase in birth intervals happens instead in the following two periods, and in contrast to the PPR showing earlier, the trend also continues in the final stage at parity two. The size of the effect is generally highest for parity 3 at around 1.5 years, while it is very limited at parity 5, where for farmers there is no lengthening at all. Farmers also lag in terms of effect size at parity 2 and during the transition at parity 3. We can also see an increase in the dispersion among the social classes as we move through periods.

In previous studies on the same area (Bengtsson and Dribe 2010, 2014), first and successive births are studied separately, and different patterns emerge, pointing to the fact that the determinants of timing for the first birth are different from those of successive births (see also Tsuya et al. 2010). We replicate their study, which uses Cox proportional hazards models, using a newer expanded version of the same data (SEDD), and our results are consistent with that study (see Appendix Table A-5 for the model coefficients).

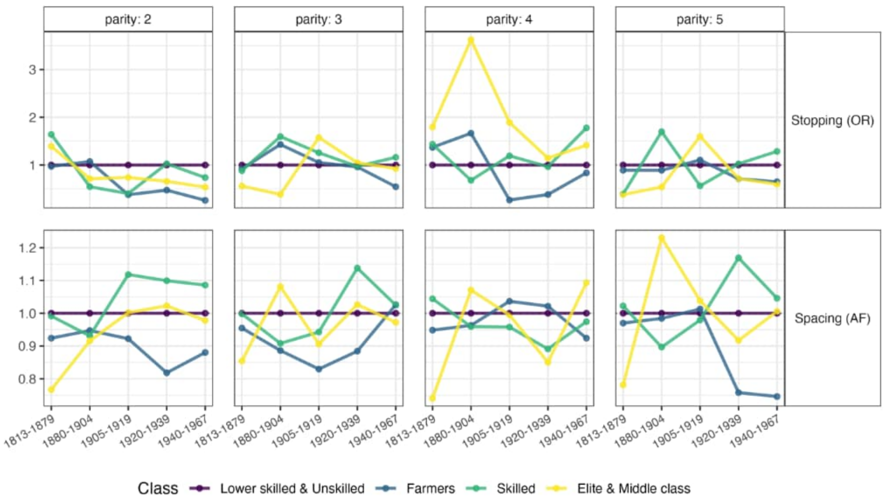
In the same article, for the analysis of the class–period interaction, two sets of contrasts were derived from the model coefficients (replicated in Appendix Figures A-3 and A-4), which we also compute for the parity-specific cure models presented earlier. The first relates to the effect of period on each class: for each class, period coefficients (for both parts of the model) have been divided by their first period coefficient, so that results can be compared to the first period. This allows a comparison of the timing between the classes and the relative change in birth control practices during the transition for each class. The second set of contrasts is the net effects of class by period, derived by dividing the coefficients for each period by their value for the class of lower-skilled and unskilled workers. For every period we can then compare the rank and effect size of the classes.

Comparing classes within each period (Panel A), we note that before the transition the ranking of classes regarding stopping was very volatile, while during the transition the elite group was a forerunner, with the highest propensity to stop among the classes for at least one period between 1880 and 1919 for all parities from 3 to 5. Farmers instead are consistently among the groups with lowest odds ratios for stopping after the transition. For spacing, in the pre-transition period the elite have on average the shortest birth intervals for all parities, but again during the transition they reach and overtake the other classes. The farmers have the lowest propensities for spacing during the transition for parities 2 and 3, and after the transition for all parities except the third one.

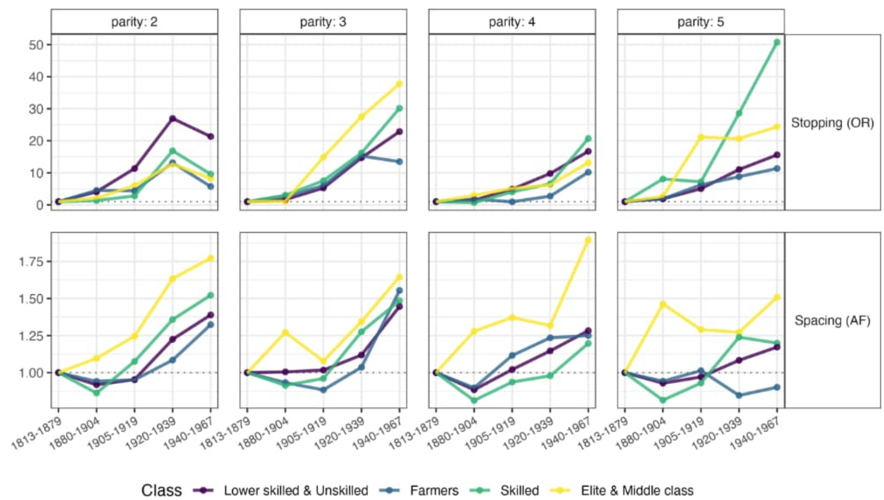
Turning to the net effects of period (Panel B), we can note that the elite already showed a great increase in stopping by 1905–1919; however, the total increase in the odds ratios at the end of the study period varies a lot based on the class and the parity. The leading role of the elite is most evident for spacing: they were the first to increase the length of their birth intervals, with the other classes following from the 1905–1919 or 1920–1939 periods; their effect size is also higher for all periods and all parities.

Figure 7: Net effects of stopping and spacing from parity-specific interaction models

A. Class by period (reference category: Lower skilled and Unskilled)



B. Period by class (reference category: 1813–1879)



Note: OR=Odds ratios, AF=acceleration factors. Full estimates in Appendix Table A3.
Source: SEDD.

6. Conclusion

Our aim is to contribute to the understanding of the fertility transition by examining the relative importance of stopping and spacing, both overall and between social classes. The findings from the descriptive analysis and the cure models show that both spacing and stopping played a role during the fertility transition and thus contributed to its decline. However, the evidence suggests a two-stage process: an initial phase where only stopping mattered, followed by a later period in which both stopping and spacing played a role. Moreover, the effect of stopping in the decline in fertility is much greater than that of spacing, especially at lower parities.

These findings do not contradict previous research stressing the role of spacing – and not only stopping – as an important mechanism in the fertility transition, but they are not consistent with spacing playing a significant role at the onset of the transition (e.g., Bean, Mineau, and Anderton 1990; David and Sanderson 1986; Haines 1989b; Szreter 1996). Following a combination of cultural innovation, mortality decline, and socioeconomic transformation in the 19th century, families became 'ready, willing, and able' to deliberately control fertility to a much greater extent than before (Coale 1973; Easterlin and Crimmins 1985; Guinnane 2011; Lesthaeghe and Vanderhoeft 2001). In this process, when individuals made decisions about fertility they not only considered the final number of children but also when to have the children. This led to a combination of stopping and spacing, which together greatly reduced marital fertility.

It is well established in previous research, both in the same study area and other contexts, that the higher social classes (the elite and the educated middle class) were forerunners in the fertility transition (e.g., Dribe et al. 2017; Dribe and Scalone 2014; Haines 1989a; Klüsener, Dribe, and Scalone 2019; Molitoris and Dribe 2016). Our analysis confirms this. However, we did not find a consistent pattern of differential importance of spacing and stopping across social classes in the decline.

Together with some recent research on other historical contexts, our study highlights the usefulness of cure models in fertility analysis to distinguish spacing and stopping mechanisms. This class of models is not only useful for fertility studies but also applies to other processes where not all individuals at risk eventually experience the event: for instance, union formation or dissolution.

References

Amico, M. and Van Keilegom, I. (2018). Cure models in survival analysis. *Annual Review of Statistics and Its Applications* 5(1): 311–342. doi:10.1146/annurev-statistics-031017-100101.

Alter, G. (1988). *Family and the female life course: The women of Verviers, Belgium, 1849–1880*. Madison, WI: University of Wisconsin Press.

Alter, G.C. (2019). The evolution of models in historical demography. *Journal of Interdisciplinary History* 50(3): 325–362. doi:10.1162/jinh_a_01445.

Alter, G. and Hacker, J.D. (2022). *The impact of multiple births on fertility in the United States, 1885–1910*. Paper presented at the meeting of the European Society for Historical Demography (ESHD), Madrid.

Alter, G., Oris, M., and Tyurin, K. (2007). *The shape of a fertility transition: An analysis of birth intervals in eastern Belgium*. Paper presented at the annual meeting of the Population Association of America (PAA), New York.

Anderson, M. (1998). Highly restricted fertility: Very small families in the British fertility decline. *Population Studies* 52(2): 177–199. doi:10.1080/0032472031000150366.

Bardet, J-P. (1990). Innovators and imitators in the practice of contraception in town and country. In: van de Woude, A., de Vries, J., and Hayami, A. (eds.). *Urbanization in history: A process of dynamic interactions*. Oxford: Clarendon Press: 264–281.

Bean, L.L., Mineau, G.P., and Anderton, D.L. (1990). *Fertility change on the American frontier: Adaptation and innovation*. Berkeley, CA: University of California Press. doi:10.1525/9780520377660.

Bengtsson, T. and Dribe, M. (2006). Deliberate control in a natural fertility population: Southern Sweden, 1766–1864. *Demography* 43(4): 727–746. doi:10.1353/dem.2006.0030.

Bengtsson, T. and Dribe, M. (2010). Agency, social class, and fertility in southern Sweden 1766–1865. In: Tsuya, N.O., Feng, W., Alter, G., and Lee, J.Z. (eds.). *Prudence and pressure. Reproduction and human agency in Europe and Asia, 1700–1900*. Cambridge, MA: MIT Press.

Bengtsson, T. and Dribe, M. (2014). The historical fertility transition at the micro level: Southern Sweden 1815–1939. *Demographic Research* 30(17): 493–534. doi:10.4054/DemRes.2014.30.17.

Bengtsson, T. and Dribe, M. (2021). The long road to health and prosperity, Southern Sweden, 1765–2015. Research contributions from the Scanian Economic-Demographic Database (SEDD). *Historical Life Course Studies* 11: 74–96. doi:10.51964/hlcs10941.

Bengtsson, T., Dribe, M., Quaranta, L., and Svensson, P. (2021). The Scanian Economic Demographic Database: Version 7.2 (Machine-readable database). Lund: Lund University, Centre for Economic Demography.

Bremhorst, V., Kreyenfeld, M., and Lambert, P. (2016). Fertility progression in Germany: An analysis using flexible nonparametric cure survival models. *Demographic Research* 35(18): 505–534. doi:10.4054/DemRes.2016.35.18.

Broström, G. (1985). Practical aspects on the estimations of the parameters in Coale's model for marital fertility. *Demography* 22(4): 625–631. doi:10.2307/2061592.

Buxton, A. (2013). CUREREGR8: Stata module to estimate parametric cure regression (version 8.2).

Carlsson, G. (1966). The decline of fertility: Innovation or adjustment process. *Population Studies* 20(2): 149–174. doi:10.1080/00324728.1966.10406092.

Cilliers, J. and Mariotti, M. (2021). Stop! Go! What can we learn about family planning from birth timing in settler South Africa, 1835–1950? *Demography* 58(3): 901–925. doi:10.1215/00703370-9164749.

Cleland, J. and Wilson, C. (1987). Demand theories of the fertility transition: An iconoclastic view. *Population Studies* 41(1): 5–30. doi:10.1080/0032472031000142516.

Coale, A.J. (1973). The demographic transition reconsidered. In: International Union for the Scientific Study of Population (IUSSP) (ed.). *Proceedings of the International Population Conference 1973* (Vol. 1). Liege, Belgium: International Union for the Scientific Study of Population: 53–72.

Coale, A.J. and Trussell, T.J. (1974). Model fertility schedules: Variations in the age structure of childbearing in human populations. *Population Index* 40(2): 185–258. doi:10.2307/2733910.

Coale, A.J. and Trussell, T.J. (1978). Finding the two parameters that specify a model schedule of marital fertility. *Population Index* 44(2): 203–213. doi:10.2307/2735537.

Coale, A.J. and Watkins, S.C. (eds) (1986). *The decline of fertility in Europe*. Princeton: Princeton University Press.

Collett, D. (2015). *Modelling survival data in medical research*. Boca Raton, FL: CRC Press. doi:10.1201/b18041.

Cummins, N. (2013). Marital fertility and wealth during the fertility transition: Rural France, 1750–1850. *Economic History Review* 66(2): 449–476. doi:10.1111/j.1468-0289.2012.00666.x.

David, P.A. and Mroz, T.A. (1989a). Evidence of fertility regulation among rural French villagers, 1749–1789: A sequential econometric model of birth-spacing behavior (part 1). *European Journal of Population* 5(1): 1–26. doi:10.1007/BF01796786.

David, P.A. and Mroz, T.A. (1989b). Evidence of fertility regulation among rural French villagers, 1749–1789: A sequential econometric model of birth-spacing behavior (part 2). *European Journal of Population* 5(2): 173–206. doi:10.1007/BF01796900.

David, P.A. and Sanderson, W.C. (1986). Rudimentary contraceptive methods and the American transition to marital fertility control, 1855–1915. In: Engerman, S.L. and Gallman, R.E. (eds.). *Long-term factors in American economic growth*. Chicago, IL: University of Chicago Press: 307–390.

Dribe, M. (2009). Demand and supply factors in the fertility transition: A county-level analysis of age-specific marital fertility in Sweden, 1880–1930. *European Review of Economic History* 13(1): 65–94. doi:10.1017/S1361491608002372.

Dribe, M., Breschi, M., Gagnon, A., Gauvreau, D., Hanson, H.A., Maloney, T.N., Mazzoni, S., Molitoris, J., Pozzi, L., Smith, K.R., and Vézina, H. (2017). Socioeconomic status and fertility decline: Insights from historical transitions in Europe and North America. *Population Studies* 71(1): 3–21. doi:10.1080/00324728.2016.1253857.

Dribe, M. and Quaranta, L. (2021). The Scanian Economic-Demographic Database (SEDD). *Historical Life Course Studies* 9: 158–172. doi:10.51964/hlcs9302.

Dribe, M. and Scalone, F. (2010). Detecting deliberate fertility control in pre-transitional populations: Evidence from six German villages, 1766–1863. *European Journal of Population* 26(4): 411–434. doi:10.1007/s10680-010-9208-8.

Dribe, M. and Scalone, F. (2014). Social class and net fertility before, during and after the demographic transition: A micro-level analysis of Sweden 1880–1970. *Demographic Research* 30(15): 429–464. doi:10.4054/DemRes.2014.30.15.

Dribe, M. and Scalone, F. (2021). SES differences in marital fertility widened during the fertility transition – Evidence from global micro-level population data. *SN Social Sciences* 1(21): 1–17. doi:10.1007/s43545-020-00028-y.

Dribe, M. and Smith, C.D. (2021). Social class and fertility: A long-run analysis of southern Sweden, 1922–2015. *Population Studies* 75(3): 305–323. doi:10.1080/00324728.2020.1810746.

Easterlin, R.A. and Crimmins, E.M. (1985). *The fertility revolution: A supply-demand analysis*. Chicago, IL: University of Chicago Press.

Gortfelder, M. and Puur, A. (2020). Survival and sex composition of offspring: Individual-level responses in the quantum and tempo of childbearing during the demographic transition. *Population Studies* 74(2): 161–177. doi:10.1080/00324728.2020.1721736.

Guinnane, T.W. (2011). The historical fertility transition: A guide for economists. *Journal of Economic Literature* 49(3): 589–614. doi:10.1257/jel.49.3.589.

Guinnane, T.W., Okun, B.S., and Trussell, J. (1994). What do we know about the timing of fertility transitions in Europe? *Demography* 31(2): 1–20. doi:10.2307/2061905.

Haines, M.R. (1989a). Social class differentials during fertility decline: England and Wales revisited. *Population Studies* 43(2): 305–323. doi:10.1080/0032472031000144136.

Haines, M.R. (1989b). American fertility in transition: New estimates of birth rates in the United States, 1900–1910. *Demography* 26(1): 137–148. doi:10.2307/2061500.

Henry, L. (1961). Some data on natural fertility. *Eugenics Quarterly* 8(2): 81–91. doi:10.1080/19485565.1961.9987465.

Hoem, B. and Hoem, J.M. (1996). Sweden's family policies and roller-coaster fertility. *Journal of Population Problems* 52: 1–22.

Janssens, A. (2014). *Labouring lives. Women, work and the demographic transition in the Netherlands, 1880–1960*. Bern: Peter Lang.

Klein, J.P., Van Houwelingen, H.C., Ibrahim, J.G., and Scheike, T.H. (eds.) (2014). *Handbook of survival analysis*. Boca Raton, FL: CRC Press.

Klüsener, S., Dribe, M., and Scalone, F. (2019). Spatial and social distance in the fertility transition: Sweden 1880–1900. *Demography* 56(1): 169–199. doi:10.1007/s13524-018-0737-9.

Knodel, J. (1987). Starting, stopping, and spacing during the early stages of fertility transition: The experience of German village populations in the 18th and 19th centuries. *Demography* 24(2): 143–162. doi:10.2307/2061627.

Knodel, J. (1988). *Demographic behavior in the past: German village populations in the 18th and 19th centuries*. Cambridge: Cambridge University Press. doi:10.1017/CBO9780511523403.

Lesthaeghe, R. and Vanderhoeft, C. (2001). Ready, willing, and able: A conceptualization of transitions to new behavioral forms. In: Casterline, J. (ed.). *Diffusion processes and fertility transition: Selected perspectives*. Washington, D.C.: National Research Council: 240–264.

Li, L. and Choe, M.K. (1997). A mixture model for duration data: Analysis of second births in China. *Demography* 34(2): 189–197. doi:10.2307/2061698.

McLaren, A. (1990). *A history of contraception: From antiquity to the present*. Oxford: Basil Blackwell.

Molitoris, J. and Dribe, M. (2016). Ready to stop: Socioeconomic status and the fertility transition in Stockholm, 1878–1926. *Economic History Review* 69(2): 679–704. doi:10.1111/ehr.12275.

Okun, B.S. (1994). Evaluating methods for detecting fertility control: Coale and Trussell’s model and Cohort Parity Analysis. *Population Studies* 48(2): 193–222. doi:10.1080/0032472031000147766.

Page, H.J. (1977). Patterns underlying fertility schedules: A decomposition by both age and marriage duration. *Population Studies* 30(1): 85–106. doi:10.1080/00324728.1977.10412749.

Perreound, A. (1990). Aspects of fertility decline in an urban setting: Rouen and Geneva. In: van de Woude, A., de Vries, J., and Hayami, A. (eds.). *Urbanization in history: A process of dynamic interactions*. Oxford: Clarendon Press: 243–263.

Preston, S., Heuveline, P., and Guillot, M. (2001). *Demography: Measuring and modeling population processes*. Oxford: Blackwell.

Quaranta, L. (2015). Using the Intermediate Data Structure (IDS) to construct files for statistical analysis. *Historical Life Course Studies* 2: 86–107. doi:10.51964/hlcs9360.

Quaranta, L. (2016). STATA programs for using the Intermediate Data Structure (IDS) to construct files for statistical analysis. *Historical Life Course Studies* 3: 1–19. doi:10.51964/hlcs9350.

Reher, D.S. and Sanz-Gimeno, A. (2007). Rethinking historical reproductive change: Insights from longitudinal data for a Spanish town. *Population and Development Review* 33(4): 703–727. doi:10.1111/j.1728-4457.2007.00194.x.

Reher, D.S., Sanz-Gimeno, A., van Poppel, F.W., and Sandström, G. (2017). Agency in fertility decisions in Western Europe during the demographic transition: A comparative perspective. *Demography* 54(1): 3–22. doi:10.1007/s13524-016-0536-0.

Sandström, G. (2014). The mid-twentieth century baby boom in Sweden – changes in the educational gradient of fertility for women born 1915–1950. *The History of the Family* 19(1): 120–140. doi:10.1080/1081602X.2013.871317.

Santow, G. (1995). Coitus interruptus and the control of natural fertility. *Population Studies* 49(1): 19–43. doi:10.1080/0032472031000148226.

Skirbekk, V. (2008). Fertility trends by social status. *Demographic Research* 18(5): 145–180. doi:10.4054/DemRes.2008.18.5.

Stanfors, M. (2003). *Education, labor force participation and changing fertility patterns. A study of women and socioeconomic change in twentieth century Sweden*. Stockholm: Almqvist and Wiksell International.

Szreter, S. (1996). *Fertility, class and gender in Britain, 1860–1940*. Cambridge: Cambridge University Press. doi:10.1017/CBO9780511582240.

Timæus, I.M. and Moultrie, T.A., (2008). On postponement and birth intervals. *Population and Development Review* 34(3): 483–510. doi:10.1111/j.1728-4457.2008.00233.x.

Tsodikov, A. (1998). A proportional hazards model taking account of long-term survivors. *Biometrics* 54(4). doi:10.2307/2533675.

Tsuya, N.O., Wang, F., Alter, G., and Lee, L.Z. (2010). *Prudence and pressure. Reproduction and human agency in Europe and Asia, 1700–1900*. Cambridge, MA: MIT Press. doi:10.7551/mitpress/8162.001.0001.

Van Bavel, J. (2004a). Deliberate birth spacing before the fertility transition in Europe: Evidence from nineteenth-century Belgium. *Population Studies* 58(1): 95–107. doi:10.1080/0032472032000167706.

Van Bavel, J. (2004b). Detecting stopping and spacing behavior in historical demography. A critical review of methods. *Population (English edition)* 59(1): 117–128. doi:10.3917/pope.401.0117.

Van Bavel, J. and Kok, J. (2004). Birth spacing in the Netherlands. The effects of family composition, occupation and religion on birth intervals, 1820–1885. *European Journal of Population* 20(2): 119–140. doi:10.1023/B:EUJP.0000033860.39537.e2.

Van de Walle, E. (2000). 'Marvellous secrets': Birth control in European short fiction, 1150–1650. *Population Studies* 54(3): 321–330. doi:10.1080/713779097.

Van de Walle, E. and Muhsam, H.V. (1995). Fatal secrets and the French fertility transition. *Population and Development Review* 21(2): 261–279. doi:10.2307/2137494.

Van Leeuwen, M.H.D. and Maas, I. (2011). *HISCLASS. A historical international social class scheme*. Leuven: Leuven University Press.

Van Leeuwen, M.H.D., Maas, I., and Miles, A. (2002). *HISCO: Historical international standard classification of occupations*. Leuven: Leuven University Press.

Wilson, C., Oeppen, J., and Pardoe, M. (1988). What is natural fertility? The modelling of a concept. *Population Index* 54(1): 4–20. doi:10.2307/3644106.

Yamaguchi, K. (1992). Accelerated failure-time regression models with a regression model of surviving fraction: An application to the analysis of 'permanent employment' in Japan. *Journal of the American Statistical Association* 87(418): 284–292. doi:10.1080/01621459.1992.10475207.

Yamaguchi, K. and Ferguson, L.R. (1995). The stopping and spacing of childbirths and their birth-history predictors: Rational-choice theory and event-history analysis. *American Sociological Review* 60(2): 272–298. doi:10.2307/2096387.

Appendix

Table A-1: Coefficients from parity-specific models: parametric mixture cure models with logistic link function and log-logistic time-to-event distribution. Model with 5-level categorical period variable. Covariates are included in the cure fraction and the scale parameter of the time-to-event distribution

	Second births		Third births		Fourth births		Fifth births	
Cure fraction								
Parish								
Hög	–0.16	[–0.70, 0.39]	–0.01	[–0.50, 0.48]	–0.45	[–1.02, 0.12]	–0.15	[–0.78, 0.49]
Kävlinge	0.06	[–0.16, 0.28]	0.15	[–0.08, 0.37]	–0.04	[–0.34, 0.26]	0.08	[–0.30, 0.46]
Halmstad	–0.69	[–1.29, –0.09]	–0.86	[–1.41, –0.32]	–0.44	[–0.94, 0.05]	–0.62	[–1.19, –0.04]
Sireköpinge	0.01	[–0.38, 0.39]	–0.14	[–0.52, 0.24]	–0.6	[–1.05, –0.15]	–0.6	[–1.11, –0.10]
Kågeröd	–0.78	[–1.10, –0.46]	–0.49	[–0.75, –0.22]	–0.71	[–1.05, –0.37]	–0.49	[–0.88, –0.09]
Landskrona	0	–	0	–	0	–	0	–
Mother's age	0.15	[0.14, 0.17]	0.18	[0.16, 0.19]	0.23	[0.21, 0.26]	0.29	[0.26, 0.33]
Last child dead								
Yes	0	–	0	–	0	–	0	–
No	–0.98	[–1.39, –0.57]	–0.99	[–1.38, –0.60]	–0.37	[–0.74, 0.01]	–0.4	[–0.81, 0.01]
Period								
1813–1879	0	–	0	–	0	–	0	–
1880–1904	1.24	[0.65, 1.82]	0.63	[0.14, 1.12]	0.51	[0.07, 0.96]	0.76	[0.28, 1.24]
1905–1919	1.9	[1.36, 2.44]	1.81	[1.40, 2.23]	1.24	[0.84, 1.64]	1.68	[1.22, 2.13]
1920–1939	2.91	[2.41, 3.41]	2.69	[2.29, 3.09]	1.79	[1.39, 2.19]	2.38	[1.92, 2.84]
1940–1967	2.52	[2.03, 3.01]	3.09	[2.70, 3.47]	2.66	[2.28, 3.04]	2.78	[2.31, 3.25]
Constant	–3.45	[–3.94, –2.95]	–2.75	[–3.14, –2.36]	–2.2	[–2.59, –1.81]	–2.32	[–2.77, –1.86]
Scale								
Parish								
Hög	0.01	[–0.08, 0.10]	0.09	[–0.01, 0.19]	0.01	[–0.09, 0.12]	–0.05	[–0.18, 0.07]
Kävlinge	0.02	[–0.04, 0.07]	0.06	[–0.01, 0.13]	0.07	[–0.01, 0.15]	–0.01	[–0.10, 0.08]
Halmstad	0.08	[0.00, 0.16]	0.03	[–0.06, 0.12]	0.12	[0.02, 0.22]	–0.02	[–0.13, 0.09]
Sireköpinge	0.12	[0.05, 0.19]	0.1	[0.02, 0.18]	0.11	[0.02, 0.20]	0.07	[–0.03, 0.16]
Kågeröd	0.08	[0.02, 0.14]	0.08	[0.01, 0.16]	0.06	[–0.02, 0.14]	0.07	[–0.02, 0.16]
Landskrona	0	–	0	–	0	–	0	–
Mother's age	0	[–0.01, 0.00]	0	[–0.01, 0.00]	0	[–0.01, 0.00]	–0.01	[–0.01, –0.00]
Last child dead								
Yes	0	–	0	–	0	–	0	–
No	0.44	[0.39, 0.50]	0.36	[0.29, 0.42]	0.47	[0.40, 0.54]	0.44	[0.37, 0.51]
Period								
1813–1879	0	–	0	–	0	–	0	–
1880–1904	0.08	[0.01, 0.14]	0.02	[–0.05, 0.08]	0.1	[0.03, 0.16]	0.05	[–0.02, 0.12]
1905–1919	0.01	[–0.05, 0.08]	0.03	[–0.04, 0.10]	–0.06	[–0.13, 0.02]	0.03	[–0.05, 0.11]
1920–1939	–0.22	[–0.28, –0.15]	–0.13	[–0.21, –0.05]	–0.13	[–0.22, –0.04]	–0.05	[–0.15, 0.05]
1940–1967	–0.36	[–0.41, –0.30]	–0.38	[–0.45, –0.30]	–0.3	[–0.38, –0.21]	–0.15	[–0.26, –0.04]
Constant	–0.89	[–0.96, –0.83]	–0.99	[–1.06, –0.92]	–1.04	[–1.12, –0.96]	–1	[–1.10, –0.91]
Shape								
Constant	1.21	[1.18, 1.24]	1.19	[1.16, 1.22]	1.24	[1.20, 1.28]	1.32	[1.27, 1.36]

Notes: Mother's age refers to marriage or last child. 95% confidence intervals in brackets

Table A-2: Information criteria (Akaike Information Criterion and Bayesian Information Criterion) for different distributional forms for the time-to-event distribution in parity-specific mixture cure models with a 5-level categorical period variable

	Second births		Third births		Fourth births		Fifth births	
	AIC	BIC	AIC	BIC	AIC	BIC	AIC	BIC
Weibull	15,657	15,875	13,172	13,392	9,479	9,689	6,635	6,837
Log-logistic	14,714	14,932	12,495	12,715	8,961	9,171	6,191	6,392
Gamma	15,098	15,316	12,791	13,012	9,200	9,410	6,384	6,585
Log-normal	14,790	15,008	12,547	12,768	9,032	9,242	6,236	6,438

Table A-3: Coefficients from parity-specific models: parametric mixture cure models with logistic link function and log-logistic time-to-event distribution. Model with interaction terms between a 4-level class variable and 5-level period variable. Covariates are included in the cure fraction and the scale parameter of the time-to-event distribution

	Second births		Third births		Fourth births		Fifth births	
Cure fraction								
Parish								
Hög	0.11	[–0.47, 0.70]	0.06	[–0.45, 0.58]	–0.15	[–0.75, 0.46]	–0.11	[–0.77, 0.56]
Kävlinge	0	[–0.23, 0.22]	0.18	[–0.05, 0.41]	0.12	[–0.20, 0.44]	0.07	[–0.32, 0.47]
Halmstad	–0.45	[–1.09, 0.19]	–0.76	[–1.33, –0.18]	–0.12	[–0.64, 0.40]	–0.59	[–1.21, 0.02]
Sireköpinge	0.19	[–0.23, 0.60]	–0.09	[–0.50, 0.32]	–0.36	[–0.84, 0.12]	–0.62	[–1.16, –0.08]
Kågeröd	–0.64	[–0.99, –0.30]	–0.39	[–0.69, –0.09]	–0.37	[–0.76, 0.01]	–0.47	[–0.92, –0.03]
Landskrona	0	–	0	–	0	–	0	–
Mother's age	0.16	[0.14, 0.18]	0.18	[0.16, 0.20]	0.24	[0.21, 0.26]	0.3	[0.27, 0.33]
Last child dead								
Yes	0	–	0	–	0	–	0	–
No	–1.02	[–1.44, –0.61]	–0.95	[–1.34, –0.55]	–0.35	[–0.74, 0.04]	–0.37	[–0.78, 0.05]
*SES * Period*								
Elite and Middle class#1813–1879	0.33	[–1.49, 2.15]	–0.58	[–2.48, 1.32]	0.59	[–0.58, 1.75]	–0.96	[–2.89, 0.96]
Skilled#1813–1879	0.5	[–1.09, 2.08]	–0.13	[–1.30, 1.04]	0.36	[–0.55, 1.27]	–0.93	[–2.26, 0.40]
Farmers#1813–1879	–0.03	[–0.97, 0.91]	–0.08	[–0.78, 0.62]	0.32	[–0.26, 0.89]	–0.11	[–0.73, 0.50]
Lower–skilled and Unskilled#1813–1879	0	–	0	–	0	–	0	–
Elite & Middle class#1880–1904	1.07	[–0.44, 2.57]	–0.45	[–2.14, 1.23]	1.67	[0.75, 2.60]	0.02	[–1.49, 1.52]
Skilled#1880–1904	0.8	[–0.47, 2.06]	0.97	[0.09, 1.86]	0	[–1.26, 1.26]	1.16	[0.20, 2.12]
Farmers#1880–1904	1.48	[0.53, 2.42]	0.86	[0.09, 1.63]	0.9	[0.16, 1.63]	0.51	[–0.25, 1.28]
Lower–skilled and Unskilled#1880–1904	1.4	[0.51, 2.29]	0.5	[–0.32, 1.33]	0.39	[–0.37, 1.14]	0.63	[–0.12, 1.38]
Elite and Middle class#1905–1919	2.13	[1.28, 2.98]	2.12	[1.46, 2.77]	2.22	[1.52, 2.92]	2.09	[1.27, 2.91]
Skilled#1905–1919	1.52	[0.47, 2.57]	1.89	[1.19, 2.59]	1.76	[1.08, 2.44]	1.05	[0.29, 1.80]
Farmers#1905–1919	1.46	[0.39, 2.52]	1.71	[0.92, 2.51]	0.27	[–0.85, 1.38]	1.72	[0.83, 2.61]
Lower–skilled and Unskilled#1905–1919	2.43	[1.61, 3.25]	1.66	[1.05, 2.28]	1.58	[0.98, 2.18]	1.62	[0.99, 2.24]
Elite and Middle class#1920–1939	2.88	[2.10, 3.65]	2.73	[2.13, 3.34]	2.42	[1.76, 3.07]	2.07	[1.32, 2.81]
Skilled#1920–1939	3.32	[2.52, 4.13]	2.66	[1.98, 3.33]	2.24	[1.54, 2.95]	2.42	[1.64, 3.21]

Table A-3: (Continued)

	Second births		Third births		Fourth births		Fifth births	
*SES * Period*								
Farmers#1920–1939	2.55	[1.69, 3.41]	2.65	[1.95, 3.35]	1.32	[0.50, 2.14]	2.06	[1.22, 2.90]
Lower–skilled and Unskilled#1940–1967	3.29	[2.55, 4.04]	2.69	[2.09, 3.28]	2.28	[1.65, 2.91]	2.4	[1.72, 3.08]
Elite and Middle class#1940–1967	2.44	[1.71, 3.17]	3.05	[2.49, 3.62]	3.16	[2.54, 3.78]	2.23	[1.45, 3.01]
Skilled#1940–1967	2.75	[2.02, 3.49]	3.28	[2.71, 3.85]	3.39	[2.75, 4.03]	3	[2.19, 3.81]
Farmers#1940–1967	1.71	[0.80, 2.63]	2.52	[1.82, 3.23]	2.64	[1.81, 3.46]	2.32	[1.36, 3.27]
Lower–skilled and Unskilled#1940–1967	3.06	[2.34, 3.78]	3.13	[2.58, 3.68]	2.82	[2.25, 3.38]	2.75	[2.07, 3.42]
Constant	–3.65	[–4.36, –2.93]	–2.79	[–3.33, –2.25]	–2.69	[–3.23, –2.15]	–2.2	[–2.79, –1.61]
Scale								
Parish								
Hög	–0.05	[–0.15, 0.04]	0.05	[–0.05, 0.16]	0.02	[–0.10, 0.13]	–0.08	[–0.21, 0.05]
Kävlinge	0	[–0.06, 0.05]	0.06	[–0.02, 0.13]	0.09	[0.00, 0.17]	–0.02	[–0.12, 0.07]
Halmstad	0.04	[–0.05, 0.12]	0	[–0.10, 0.09]	0.15	[0.04, 0.25]	–0.04	[–0.16, 0.07]
Sireköpinge	0.08	[0.00, 0.15]	0.07	[–0.02, 0.16]	0.13	[0.03, 0.23]	0.03	[–0.07, 0.14]
Kågeröd	0.04	[–0.03, 0.10]	0.05	[–0.03, 0.13]	0.08	[–0.01, 0.17]	0.03	[–0.07, 0.13]
Landskrona	0	–	0	–	0	–	0	–
Mother's age	–0.01	[–0.01, –0.00]	0	[–0.01, 0.00]	0	[–0.01, 0.00]	–0.01	[–0.01, –0.00]
Last child dead								
Yes	0	–	0	–	0	–	0	–
No	0.44	[0.38, 0.50]	0.37	[0.30, 0.43]	0.48	[0.40, 0.55]	0.45	[0.38, 0.53]
*SES * Period*								
Elite and Middle class#1813–1879	0.27	[0.11, 0.42]	0.16	[0.00, 0.31]	0.3	[0.13, 0.47]	0.25	[0.10, 0.40]
Skilled#1813–1879	0.01	[–0.13, 0.15]	0	[–0.12, 0.13]	–0.04	[–0.17, 0.09]	–0.02	[–0.15, 0.10]
Farmers#1813–1879	0.08	[0.01, 0.15]	0.05	[–0.02, 0.12]	0.05	[–0.02, 0.12]	0.03	[–0.04, 0.10]
Lower–skilled and Unskilled#1813–1879	0	–	0	–	0	–	0	–
Elite and Middle class#1880–1904	0.17	[0.01, 0.34]	–0.08	[–0.25, 0.08]	0.05	[–0.14, 0.25]	–0.13	[–0.35, 0.08]
Skilled#1880–1904	0.16	[0.03, 0.28]	0.09	[–0.04, 0.22]	0.16	[0.03, 0.30]	0.18	[0.03, 0.33]
Farmers#1880–1904	0.14	[0.03, 0.25]	0.12	[0.00, 0.23]	0.16	[0.04, 0.28]	0.09	[–0.03, 0.21]
Lower–skilled and Unskilled#1880–1904	0.09	[–0.01, 0.18]	–0.01	[–0.10, 0.09]	0.12	[0.02, 0.22]	0.07	[–0.03, 0.18]
Elite and Middle class#1905–1919	0.05	[–0.07, 0.16]	0.08	[–0.06, 0.22]	–0.02	[–0.18, 0.15]	–0.01	[–0.19, 0.17]
Skilled#1905–1919	–0.06	[–0.19, 0.06]	0.04	[–0.09, 0.18]	0.02	[–0.11, 0.16]	0.05	[–0.09, 0.19]
Farmers#1905–1919	0.13	[–0.00, 0.26]	0.17	[0.03, 0.31]	–0.06	[–0.21, 0.09]	0.02	[–0.18, 0.21]
Lower–skilled and Unskilled#1905–1919	0.05	[–0.06, 0.16]	–0.02	[–0.12, 0.08]	–0.02	[–0.13, 0.08]	0.03	[–0.08, 0.14]
Elite and Middle class#1920–1939	–0.23	[–0.34, –0.11]	–0.14	[–0.28, 0.01]	0.03	[–0.14, 0.19]	0.01	[–0.19, 0.20]
Skilled#1920–1939	–0.3	[–0.44, –0.15]	–0.24	[–0.41, –0.07]	–0.02	[–0.19, 0.15]	–0.24	[–0.42, –0.05]
Farmers#1920–1939	0	[–0.14, 0.13]	0.01	[–0.15, 0.18]	–0.16	[–0.34, 0.02]	0.2	[0.01, 0.39]
Lower–skilled and Unskilled#1940–1967	–0.2	[–0.31, –0.10]	–0.11	[–0.23, 0.01]	–0.14	[–0.27, –0.01]	–0.08	[–0.22, 0.06]
Elite and Middle class#1940–1967	–0.31	[–0.39, –0.22]	–0.34	[–0.46, –0.23]	–0.34	[–0.51, –0.17]	–0.16	[–0.40, 0.07]
Skilled#1940–1967	–0.41	[–0.50, –0.32]	–0.39	[–0.52, –0.27]	–0.22	[–0.38, –0.07]	–0.2	[–0.42, 0.01]
Farmers#1940–1967	–0.2	[–0.34, –0.06]	–0.39	[–0.57, –0.21]	–0.17	[–0.42, 0.08]	0.13	[–0.14, 0.41]
Lower–skilled and Unskilled#1940–1967	–0.33	[–0.41, –0.25]	–0.37	[–0.47, –0.27]	–0.25	[–0.36, –0.14]	–0.16	[–0.31, –0.01]
Constant	–0.9	[–0.98, –0.83]	–0.99	[–1.08, –0.90]	–1.09	[–1.19, –0.99]	–1	[–1.11, –0.89]
Shape								
Constant	1.23	[1.20, 1.26]	1.2	[1.16, 1.23]	1.25	[1.21, 1.29]	1.33	[1.29, 1.38]

Note: Mother's age refers to marriage or last child. 95% confidence intervals in brackets

Table A-4: Information criteria (Akaike Information Criterion and Bayesian Information Criterion) for different distributional forms for the time-to-event distribution in parity-specific mixture cure models with interaction terms between a 4-level class variable and 5-level period variable

	Second births		Third births		Fourth births		Fifth births	
	AIC	BIC	AIC	BIC	AIC	BIC	AIC	BIC
Weibull	15,450	15,929	13,008	13,493	9,360	9,821	6,597	7,041
Log–logistic	14,526	15,005	12,348	12,833	8,853	9,314	6,158	6,601
Gamma	14,909	15,388	12,639	13,125	9,087	9,548	6,351	6,795
Log–normal	14,612	15,091	12,387	12,872	8,926	9,387	6,210	6,654

Table A-5: Coefficients from Cox proportional hazards models for time to first birth and time between successive higher order births. For both models there are two versions: with and without interaction terms between class and period

	First births		Higher order		First births		Higher order	
Class								
Elite	0	–	0	–	0	–	0	–
Middle class	–0.15	[–0.25, –0.04]	–0.19	[–0.29, –0.09]	–0.12	[–0.85, 0.61]	0.03	[–0.23, 0.29]
Skilled	–0.03	[–0.13, 0.07]	–0.11	[–0.21, –0.02]	0.05	[–0.59, 0.70]	–0.4	[–0.63, –0.16]
Farmers	–0.23	[–0.36, –0.09]	–0.04	[–0.13, 0.06]	–0.35	[–0.96, 0.25]	–0.32	[–0.53, –0.10]
Lower–skilled	–0.13	[–0.23, –0.02]	–0.14	[–0.24, –0.05]	–0.12	[–0.73, 0.48]	–0.4	[–0.62, –0.19]
Unskilled	0.08	[–0.04, 0.20]	–0.12	[–0.22, –0.02]	0.3	[–0.31, 0.92]	–0.5	[–0.73, –0.27]
Period								
1813–1879	0	–	0	–	0	–	0	–
1880–1904	–0.2	[–0.33, –0.08]	–0.08	[–0.14, –0.02]	–0.68	[–1.63, 0.26]	–0.56	[–0.94, –0.17]
1905–1919	–0.42	[–0.55, –0.30]	–0.35	[–0.41, –0.28]	–0.53	[–1.17, 0.11]	–1	[–1.33, –0.68]
1920–1939	–0.77	[–0.89, –0.65]	–0.93	[–0.99, –0.86]	–0.94	[–1.56, –0.31]	–1.37	[–1.65, –1.08]
1940–1967	–0.76	[–0.87, –0.65]	–1.22	[–1.28, –1.15]	–0.75	[–1.36, –0.15]	–1.4	[–1.65, –1.16]
Mother's Age								
15–24	0	–	0	–	0	–	0	–
25–29	–0.36	[–0.42, –0.29]	–0.21	[–0.28, –0.13]	–0.36	[–0.43, –0.30]	–0.21	[–0.29, –0.14]
30–34	–0.65	[–0.74, –0.56]	–0.4	[–0.47, –0.33]	–0.65	[–0.74, –0.56]	–0.42	[–0.49, –0.34]
35–39	–1.11	[–1.25, –0.96]	–0.63	[–0.70, –0.55]	–1.11	[–1.26, –0.97]	–0.65	[–0.72, –0.57]
40–44	–2.34	[–2.65, –2.02]	–1.31	[–1.40, –1.23]	–2.34	[–2.66, –2.03]	–1.34	[–1.42, –1.25]
45–49	–4.52	[–5.54, –3.50]	–3.18	[–3.37, –3.00]	–4.53	[–5.55, –3.51]	–3.21	[–3.39, –3.03]
Parish								
Hög	–0.02	[–0.18, 0.15]	–0.07	[–0.16, 0.02]	–0.06	[–0.23, 0.11]	–0.09	[–0.18, –0.00]
Kävlinge	0	–	0	–	0	–	0	–
Halmstad	0.06	[–0.11, 0.23]	0.15	[0.08, 0.23]	–0.01	[–0.18, 0.17]	0.14	[0.07, 0.22]
Sireköpinge	0.06	[–0.09, 0.22]	0.17	[0.11, 0.24]	0.01	[–0.14, 0.16]	0.17	[0.10, 0.24]
Kågeröd	0.15	[0.05, 0.25]	0.24	[0.18, 0.30]	0.11	[0.01, 0.21]	0.21	[0.15, 0.27]
Landskrona	–0.12	[–0.19, –0.04]	–0.1	[–0.16, –0.04]	–0.1	[–0.18, –0.03]	–0.07	[–0.13, –0.01]
Last child dead								
Yes			0	–			0	–
No			0.62	[0.56, 0.67]			0.62	[0.56, 0.67]

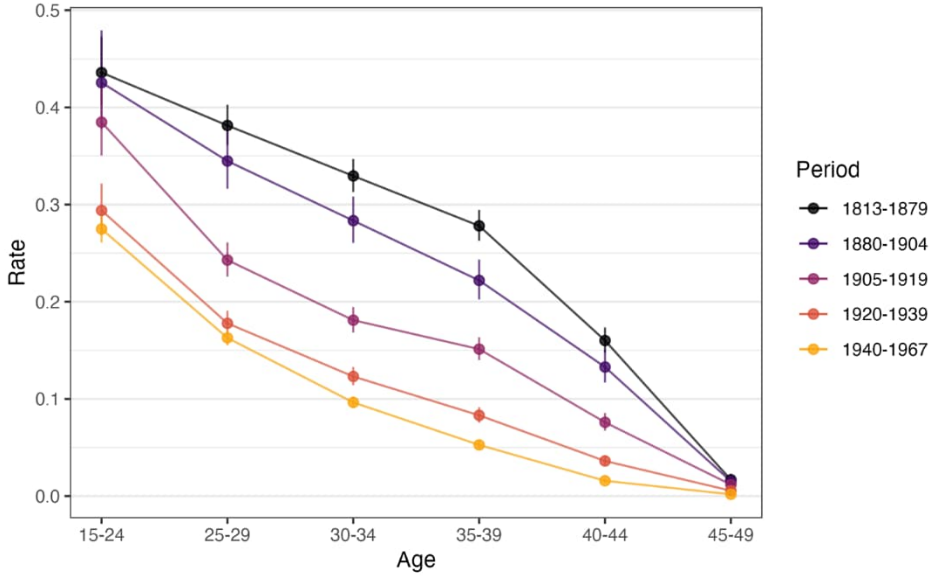
Table A-5: (Continued)

	First births	Higher order	First births		Higher order	
*Period * SES*						
1813–1879 # Elite			0	–	0	–
1813–1879 # Middle class			0	–	0	–
1813–1879 # Skilled			0	–	0	–
1813–1879 # Farmers			0	–	0	–
1813–1879 # Lower–skilled			0	–	0	–
1813–1879 # Unskilled			0	–	0	–
1880–1904 # Elite			0	–	0	–
1880–1904 # Middle class			0.38	[–0.71, 1.47]	–0.1	[–0.55, 0.36]
1880–1904 # Skilled			0.41	[–0.59, 1.42]	0.66	[0.25, 1.08]
1880–1904 # Farmers			0.58	[–0.40, 1.55]	0.41	[0.02, 0.81]
1880–1904 # Lower–skilled			0.52	[–0.46, 1.49]	0.63	[0.23, 1.03]
1880–1904 # Unskilled			0.21	[–0.79, 1.21]	0.48	[0.07, 0.89]
1905–1919 # Elite			0	–	0	–
1905–1919 # Middle class			–0.01	[–0.80, 0.77]	0.09	[–0.29, 0.46]
1905–1919 # Skilled			–0.03	[–0.74, 0.67]	0.68	[0.33, 1.03]
1905–1919 # Farmers			0.59	[–0.10, 1.28]	0.68	[0.33, 1.03]
1905–1919 # Lower–skilled			0.11	[–0.56, 0.79]	0.56	[0.22, 0.90]
1905–1919 # Unskilled			–0.37	[–1.07, 0.32]	0.87	[0.52, 1.21]
1920–1939 # Elite			0	–	0	–
1920–1939 # Middle class			0.03	[–0.74, 0.80]	–0.12	[–0.47, 0.22]
1920–1939 # Skilled			0.1	[–0.58, 0.79]	0.39	[0.07, 0.71]
1920–1939 # Farmers			0.44	[–0.23, 1.11]	0.59	[0.28, 0.90]
1920–1939 # Lower–skilled			0.04	[–0.60, 0.69]	0.41	[0.10, 0.72]
1920–1939 # Unskilled			0.01	[–0.66, 0.68]	0.56	[0.24, 0.88]
1940–1967 # Elite			0	–	0	–
1940–1967 # Middle class			–0.06	[–0.80, 0.69]	–0.36	[–0.66, –0.06]
1940–1967 # Skilled			–0.17	[–0.83, 0.48]	0.09	[–0.18, 0.37]
1940–1967 # Farmers			0.16	[–0.52, 0.84]	0.4	[0.11, 0.69]
1940–1967 # Lower–skilled			–0.07	[–0.69, 0.56]	0.12	[–0.14, 0.38]
1940–1967 # Unskilled			–0.34	[–0.98, 0.29]	0.34	[0.06, 0.62]
Individuals	10,375	23,274	10,375		23,274	
Events	5,074	11,960	5,074		11,960	
Time at risk (years)	23,103.83	10,6391	23,103.83		106,391	

Table A-6: Description of survival-time data used in the models

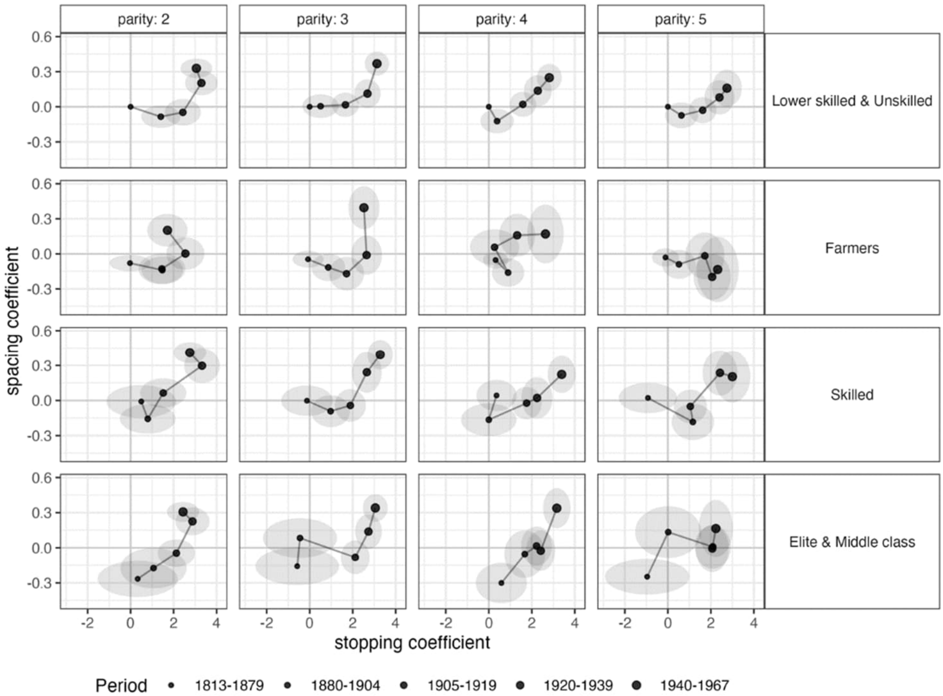
	First births	Second births	Third births	Fourth births	Fifth births	All births after the first
Individuals	10,713	6,334	5,575	3,748	2,668	11,440
Events	5,201	3,207	2,484	1,905	1,396	12,070
Time at risk (years)	23,571	24,610	27,832	17,145	11,817	107,241

Figure A-1: Age-specific marital fertility rates by period



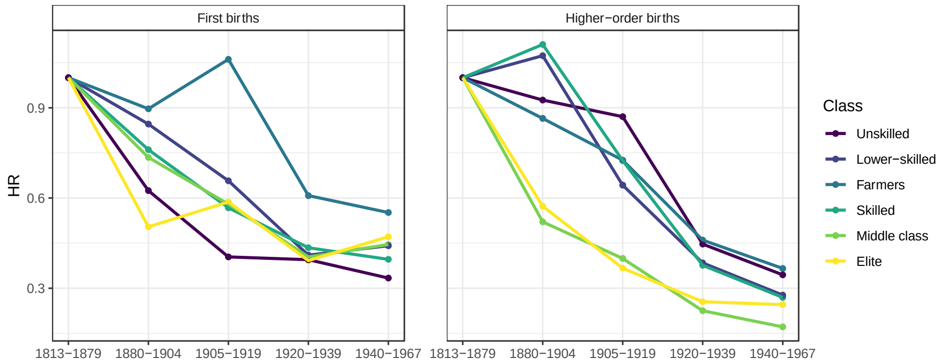
Source: SEDD.

Figure A-2: Cure model coefficients for spacing and stopping from parity-specific models. The coefficients are the same as in Figure 5B (full estimates in Appendix Table A-3)



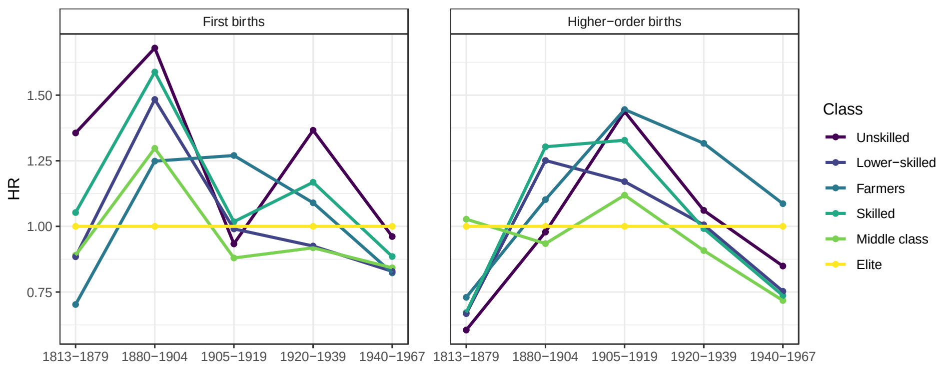
Source: SEDD.
Note: The axIs lengths of the ellipses represent 95% confidence intervals.

Figure A-3: Net effects (hazard ratios, HR) of period by class



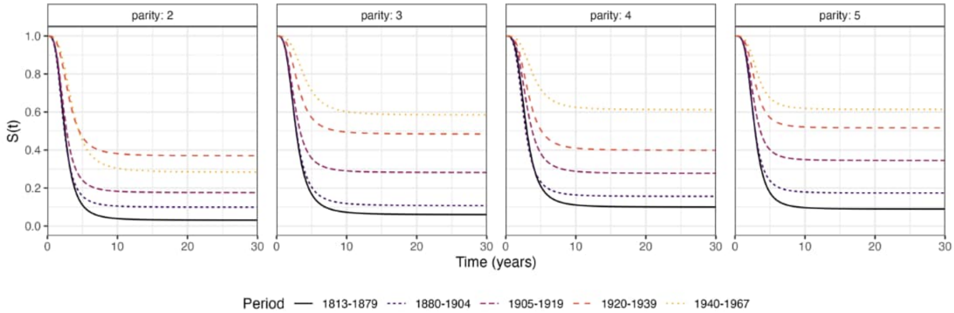
Note: Hazard ratios for each class have been divided by their level in the first period. Results come from two Cox models, one fitted on first births and one including all birth intervals after the first parity. Full estimates in Appendix Table A-5.
Source: SEDD.

Figure A-4: Net effects (Hazard ratios, HR) of class by period



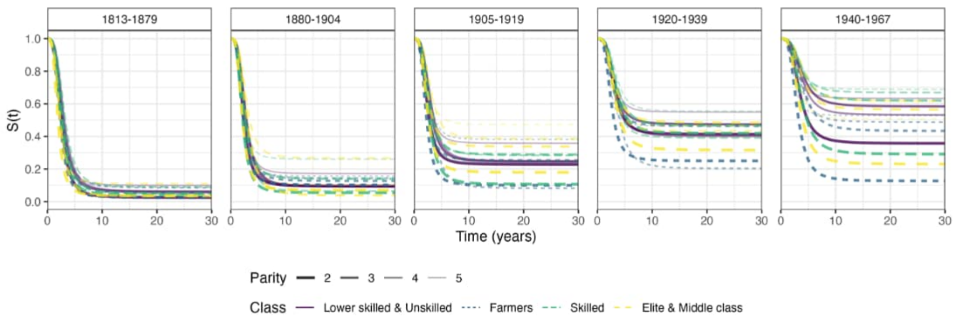
Note: Hazard ratios for each class have been divided by their value for the highest class, “Elite”. Results come from two Cox models, one fitted on first births and one including all birth intervals after the first parity. Full estimates in Appendix Table A-5.
Source: SEDD.

Figure A-5: Estimated survival curves from parity-specific models for every level of period, all other covariates left at their reference value (Table A-1)



Source: SEDD.

Figure A-6: Estimated survival curves from parity–specific models for any combination of class and period, all other covariates left at their reference value (Table A-3)



Source: SEDD.