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JEANNE CILLIERS, MARTINE MARIOTTI

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Centre for Economic Demography
Lund University School of Economics and Management
P.O. Box 7083
SE-220 07 Lund, Sweden

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Stop! Go! What can we learn about family planning from birth timing in settler South Africa, 1800-1910?*

Jeanne Cilliers † Martine Mariotti ‡

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Abstract

We revisit the discussion on family limitation through stopping and spacing behavior both prior to and during the fertility transition. Using the birth histories of 13 519 settler women in nineteenth century South Africa we find no evidence of parity specific spacing prior to the transition. In addition we find no differences in spacing behavior based on differences in time invariant economic and social characteristics. On commencement of the fertility transition, we see increasing parity dependent spacing as well as variation in spacing based on differences in economic and social characteristics. We see little change in stopping behavior over time. The transition appears to be driven by delayed marriage and wider birth intervals.

Keywords - South Africa, fertility limitation, cure models, parity dependent spacing

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†Centre for Economic Demography and Department of Economic History, Lund University School of Economics and Management. jeanne.cilliers.7367@ekh.lu.se

‡Research School of Economics, Australian National University. martine.mariotti@anu.edu.au

Introduction

There is a robust debate in the historical demography literature over whether the first fertility transition was characterized by an increase in stopping behavior or an increase in spacing or postponement of subsequent births (Knodel, 1987; Anderton and Bean, 1985). The dominance of one over the other has important implications for understanding the causes of the fertility transition. If the transition was dominated by stopping it suggests an innovation in birth control that was absent before the transition as the main mechanism through which the transition was implemented. If however, spacing dominated the transition, it suggests increased use of known behaviors to adjust family size given some change in preferences (Carlsson, 1966).

The debate has evolved in response to developments in computing power, econometric techniques and data collection. Despite this evolution there is still no consensus on the dominance of one or the other or whether they might have occurred together. Furthermore, the shift by economic historians to examine pre-transitional spacing has left a void in the analysis of transitional spacing. Pre-transitional evidence of spacing is implicitly being used to suggest that the transition must then have been driven by changed spacing behavior. However, there is limited evidence in the way of transition era spacing.[1]

Our country wide data set of complete birth histories of white South African women from 1800 - 1910 allows us to enter the fray. Settler South Africa was in many respects similar to other settler communities on the periphery. South Africa during the nineteenth century was largely rural, land abundant and labor scarce, much like the frontiers in the United States and Canada, and like much of Australia and New Zealand. Like Canada, South Africa's settler population consisted of two main language groups, in this case Afrikaans and English. The fertility transition among the settlers in South Africa began in the late 1870s to women born in the 1850s, a timing which compares favourably to other settler fertility transitions as well as several European transitions (Cilliers and Mariotti, 2018). South Africa is therefore well-suited to an examination of differential family limitation behavior over time, by social status, rural-urban setting, and by cultural factors.

We stratify our sample into four birth cohorts and use event history analysis techniques to determine the effects of social, economic and physiological characteristics on the age of marriage and first birth, spacing, and stopping. We use cox proportional hazard models to determine the age at marriage and first birth. Since all women in our data set had at least one child the data are well suited to such models. Cox models may not, however, be appropriate for the analysis of the timing of second and higher order births. For this analysis

[1] See Reher et al. (2017) for a summary.

we rely on mixed population models, known as cure models in the biomedical literature. Cure models are increasingly popular in demographic analysis because they take into account that some women may never go on to experience an event, something the cox model does not allow for. Furthermore, unlike cox proportional hazards models, cure models allow for right censored data which is a feature of the family reconstitution data that has often been used for historical fertility studies. It is also a feature of our data in cases where we do not observe a woman's death date.

We find steady marriage and first birth ages in the pre-transition population over time. We find that a woman's physiology is the prime determinant of the space between her consecutive children as well as when she has her final child. That is, age and fecundity matter most. Social and economic characteristics do matter for age at marriage/first birth but they do not play a role in spacing or stopping prior to the transition. Crucially, we do not find evidence of parity dependent spacing prior to the fertility transition. Quite the contrary, women at high parities have the shortest intervals, we interpret this to be evidence of fecundity rather than demand for children.

These findings change during the transition. While age at marriage continues to be affected by social and economic conditions, we see an increase in this age during the transition, an increase large enough to account for a reduction of at least one child. We see an increase in birth interval lengths during the transition, as economic and social factors begin to play a role. We see little change in stopping rates during the transition, the effect of demand side conditions on stopping behavior remains muted. We do see an increase in parity dependent spacing during the transition.

We conclude that although there does not seem to be active control over spacing prior to the transition, the transition itself was characterized predominantly by changes in spacing behavior. This finding suggests that couples did know how to limit family size, but simply weren't doing so prior to the transition.

Literature on parity-specific control

Whether the fertility transition was driven by either stopping or spacing is a crucial issue in the debate on the causes of the fertility transition. The argument being that an increase in stopping is suggestive of an innovation in techniques that prevent pregnancy, in an environment where there has been an unmet need for pregnancy prevention. In contrast an increase in spacing is indicative of a change in preferences toward small families and thus an increase in the application of methods that would already be known, such as abstention and withdrawal (Carlsson, 1966; Okun, 1994). Naturally, the transition could be a result of changes to both stopping and spacing and stopping could also result from a change in preferences.

The discussion of birth stopping and spacing prior to and during the demographic transition has evolved tremendously in the 60 or so years that demographers have been studying it. Methodological innovations, improvements in computing power and the ability to access ever better data have allowed demographers and also economic historians to revisit this issue and the debate remains far from resolved.

The earliest investigations concluded that there was little attempt to limit fertility prior to the transition and that any deviations of the pre-transition fertility rates between groups had more to do with things such as cultural practices and seasonal migration (Henry, 1961; Knodel and van de Walle, 1979). It followed that the fertility transition must have been driven largely by an increase in stopping rates once couples had achieved a desired family size. The Coale and Trusell m index (Coale and Trussell, 1974) was instrumental in reaching this conclusion. However the index had been constructed specifically to detect parity dependent stopping rather than spacing, an immediate limitation (Knodel, 1987; Okun, 1994). Okun (1994) and Guinnane et al. (1994) note that the Coale and Trussell index cannot accurately identify a small proportion of fertility controllers in a population. Family limitation through spacing may well have been taking place but was not being detected. David et al. (1988) subsequently developed the Cohort Parity Analysis technique specifically to be able to identify spacing behavior, yet Okun (1994) notes that it too is unreliable in certain cases.

Data advances, in particular the use of family genealogies, allow a more precise look at the length of time between consecutive births both prior to and during the fertility transition. Anderton and Bean (1985) show graphically that other than in small subsections of the population, birth intervals prior to the transition were short. During the transition there is a shift of a large portion of the population toward longer birth intervals. Anderton and Bean argue that given that a womans reproductive period is finite, a lengthening of all birth intervals will result in fewer children and that thus the fertility transition is, at least in part, characterized by increased spacing.

The debate then incorporated a quest to find evidence of demand side differences in birth spacing prior to the onset of the fertility transition. The goal was to prove that couples controlled conception in response to existing family size and to time invariant socio-economic conditions as well as to fluctuations in such conditions (van Bavel, 2004; Bengtsson and Dribe, 2006; van Bavel and Kok, 2010; Dribe and Scalone, 2010; Cinnirella et al., 2017). This shift is important because if evidence can be found of spacing in response to these factors, particularly the time invariant factors, then we have clear evidence that couples already knew how to achieve their desired family size and that they were doing so prior to the transition. The conclusion would then be that the transition itself is a result of changing family size preferences in response to a change in external conditions in the late nineteenth century.

van Bavel (2004), van Bavel and Kok (2010), and Cinnirella et al. (2017) have taken up the challenge of detecting spacing in response to time invariant factors.[2] Exploiting the use of event history models, in particular, cox proportional hazards models, and using family reconstitution data, these papers all find evidence of parity dependent control, that is longer birth intervals at higher parities, after controlling for age, prior to the transition. What is more, they find differences in birth interval lengths based on occupation, region of residence, religion, language and other variables that are unlikely to change much over the adult lifetime. The conclusion here must be that couples were able to practice family limitation prior to the transition.

In a recent dramatic twist in the debate, Clark and Cummins (2019) argue that the parity dependent control in Cinnirella et al. (2017) is an artefact of the estimation method and that there is actually no parity dependent control in pre-transition England.[3] Further support for their argument is in Clark et al. (2019) which argues that the unexpected arrival of twins led to an increase in the total number of children by almost one, saying that couples did not respond to the additional unexpected birth.

Furthermore, Yamaguchi and Ferguson (1995); Li and Choe (1997); Alter et al. (2007), and Gray et al. (2010) argue that cox proportional hazards models are inappropriate for this type of event history analysis because the technique assumes all women will at some stage experience a subsequent birth when in reality some stop having children. The suggestion is that the data may not satisfy the proportionality assumption needed to get unbiased estimates in the cox model.

A debate that began about whether the transition was driven by stopping or spacing and which has not yet ended in consensus has shifted to an investigation of whether couples practiced conscious spacing prior to the transition. This second debate has culminated in substantial disagreement on the appropriate use of methodology given limitations to family reconstitution data. It is at this stage in the debate that our paper enters the fray. With data spanning 100 years and armed with event history models that look simultaneously at stopping and spacing we investigate fertility outcomes both prior to and during the transition.

[2]See Bengtsson and Dribe (2006) and Dribe and Scalone (2010) for a discussion on postponement of births in response to short run economic fluctuations.

[3]Cinnirella et al. (2019) provides a rejoinder to the Clark and Cummins (2019) argument.

Data, context, and descriptive statistics

Data

We are fortunate to benefit from the rich colonial administrative records available South African archives that historians and genealogists have, over the last century, worked tirelessly to combine into *South African Families* (SAF), a genealogical registry of all settler families living in the eighteenth-, nineteenth- and early twentieth century.[4] It is one of very few in the world that is known to document a full population of immigrants and their families over several generations and its vast scope over nearly three centuries is well suited to the study of demographic responses over the long-run.[5]

Individuals in SAF are reported patrilineally, with children appearing exclusively in their father's lineage. Children are as such, not directly linked to their mothers.[6] Every male to immigrate to South Africa begins a new lineage in the data. These family trees contain as much as was known about each family member and will typically include birth, baptism, marriage and death dates and locations as well as region of origin for progenitors. Spouse's name (maiden name where applicable) and vital information are also listed. Ideally all entries would be complete for all life history events but this is not always the case.[7]

We restrict the sample to women with complete birth histories and limit the analysis to marital childbearing since children born out of wedlock were rarely recorded in any of the source documents used by the genealogists who compiled the family lineages.[8] A womans reproductive life is taken to be between the ages of 15 and 49. Women with inter-birth intervals greater than 8 years were excluded because it is important to distinguish between deliberate controllers and those who experienced imperfect stopping. As a result, some women will exit observation before they reach the end of their reproductive life.

[4]The registers were compiled from the baptism and marriage records of the Dutch Reformed Church, marriage documents obtained from various courts and magistrates offices and a number of notable genealogical publications and individual family histories. Gouws (1987) provides a more detailed description of the origins of these data. Cilliers and Fourie (2012) and Cilliers and Mariotti (2018) give a full account of transcription of SAF into a database fit for use in demographic analysis.

[5]Although the data contain all known families, they do not always contain all members of these families.

[6]For example, if settler A1 (male) has two children, A1B1 (male) and A1B2 (female), both of whom then marry and have a number children of their own, only the children of A1B1 will appear in settler A1's lineage (as these children share their paternal grandfather's surname), while the children of A1B2 will appear in her husband's lineage. We describe how we construct a dataset of mothers from these patrilineages in Cilliers and Mariotti (2018).

[7]Cilliers and Mariotti (2018) provide an extensive discussion of the implications of missing data on SAF sample representativeness when studying fertility behaviour in this population.

[8]This includes women who either never married or married a man who is not in the SAF data because his lineage has not been traced. The analysis does not include women who have no children recorded under their husbands in the analysis since is unclear whether these women truly had no children or whether their children simply weren't recorded.

We follow 13 519 women born between 1800 and 1910, who gave birth to a total of 92 264 children during their reproductive years. A caveat is that between 32 and 45 % of our sample are missing death information.[9] We do include these women in the analysis as our estimation technique requires both large numbers of observations and is able to deal with right censoring in the data.[10] We include births for there is no corresponding death date, since we do not know whether the child died in infancy or not. In that sense, our measure of net parity is subject to measurement error.

Context

We break the sample into four birth cohorts to coincide with the timing of the fertility transition and also to coincide with the timing of changes in settlement patters and economic developments. Our first cohort was born between 1800 and 1825, this cohort completed its reproductive years prior to the start of the fertility transition. These women were almost all born in the Cape Colony and resided either in Cape Town, which we denote Old Urban, or in what was then, and still largely is, a rural region that extended north and east from Cape Town exceeding to some extent the boundary of the Cape Colony to the north, we call this region Old Rural. The southwestern portion of this area was agriculturally wealthy with good rainfall and soil quality. Further in land the region was more arid and lent itself well to stock farming. If pre-transitional spacing in response to long run economic conditions was taking place, we expect to see larger birth intervals in urban areas. The wealth, space and high labor demand in the rural areas should lead to shorter intervals.

Our second cohort, born 1825 - 1849, reached reproductive age prior to the start of the fertility transition although some of the younger women would have still been having children during the transition. This cohort corresponds to the cohort that began what is known as the Great Trek, the movement of Afrikaans speakers out of the Cape Colony into the interior, eastern and north eastern parts of South Africa. We call these regions New Rural, they span essentially all of modern South Africa that excludes Old Rural and the urban areas. That is, New Rural contains the two independent Boer Republics, the British colony of Natal and the far northern districts of what came to be the Cape Colony under the British.

Portions of New Rural were subject to territorial conflict with the Nguni peoples that were simultaneously migrating southwards. The impact on fertility rates is hard to predict, on the one hand the conflict may have increased the desire for sons particularly in the period before the British government sent soldiers to the conflict zones, on the other it may have

[9] Appendix table A.1 compares the proportions and means of women with and without death dates.

[10] We stop our analysis in 1910 since the sample drops off around 1912. GISA hope to update those records in the future.

reduced access to open lands thereby increasing pressure on the settled land. Relative to Old Rural, it is hard to predict the direction of difference on birth spacing if indeed such an effect existed.

With the Great Trek we begin to see the establishment of small urban pockets along the east coast as well as in the interior, we label these urban areas New Urban. Initially these were small but began to grow with the development of the mining industry in the interior in the last quarter of the nineteenth century.

Our third cohort, born 1850 - 1874 was the cohort that began the fertility transition. This cohort began its fertile period at much the same time as the discovery of diamonds in the arid north west and the slow advent of industrialization. When thinking about the effect of mining on fertility, it is useful to note that diamond mining in Kimberley in the north west relied to a large extent on European migrant labor as well as unskilled African labor (Davenport, 2013). It is arguable that the mining industry itself had a negligible effect on the economic, social and reproductive lives of the majority of the settlers at that time.

Our final cohort was born between 1875 and 1910. This is the cohort for which we see the largest fertility decline. The major economic development during this cohort's childhood was the advent of gold mining on the Witwatersrand. Once again, mining was dominated early on by skilled labor from Europe as well as unskilled African labor with little initial exposure for the early settlers. The settlers themselves began only a slow urbanization late in the nineteenth century, with the pace increasing as a result of the Second Boer War and the subsequent growth of the mining industry around Johannesburg in the early twentieth century (Giliomee, 2003, p. 323).

Descriptive statistics

We turn now to look at mother's and birth interval characteristics over our sample period in Table 1. Panel A reports means for children ever born, age at marriage and first birth and birth interval lengths. The average number of children ever born is 6.81 for the first cohort, increases to 7.20 for the second before it begins to decrease for the third culminating in 4.10 children for the last cohort. Figure 1 shows this result in more detail by looking at the distribution of women in a cohort over children ever born. The first three cohorts exhibit largely the same distribution over children ever born with most women having anywhere between one and nine children. There is arguably a slight change for the third cohort with slightly higher shares of women with seven or fewer children and a faster drop off in share as the number of children increases. The big change is in the final cohort where we see a large increase in the proportion of women with smaller families, we see much more concentration around low numbers of children whereas the earlier cohorts were fairly uniformly distributed between one and nine children.

Average age at marriage is increasing throughout the period with an increase in age of almost one year between the second and third cohorts and an increase in age of two years between the third and fourth cohorts. We see a similar increase in age at conception of first child throughout the period. Notably, the gap between marriage and conception of first child is larger than a year, barely changing over the period with only a slight increase for the final cohort. Finally, looking at average birth interval lengths by cohort we see a slight increase between the second and third cohorts but, again, the real increase is between the third and fourth cohorts. This increase in average interval length points to an increase in the amount of time between consecutive births for the final cohort.

We explore the increase in birth interval length in greater detail in figure 2 which is a plot of birth interval lengths by mother's birth cohort over parities. Figure 2 does not take into account the number of children ever born and hence at higher parities is dominated by an increasingly small proportion of women with large numbers of children, women we may deem to be highly fecund relative to the average. At lower parities the figure shows longer birth intervals for later cohorts, the birth interval lengths converge at higher parities as we might expect if the remaining women are not attempting to decrease family size. Figure 2 is suggestive of spacing driving the transition, although it cannot show stopping.

Figure 3 explores interval length in yet further detail, looking at both mother's birth cohort as well as children ever born. The figure plots birth interval lengths for the first and last cohorts by whether the total number of children ever born was three, five or eight to capture average family sizes before the transition and at the end of the analysis period. Unsurprisingly, we find that smaller numbers of children are correlated with larger birth intervals regardless of the mother's birth cohort. We also find an increase in birth interval length by cohort even when holding the number of children ever born constant. That is, the birth interval lengths of families with five children, for example, are shorter for the 1800 cohort than for the 1875 cohort. Finally, we see very little change in the interval lengths at low parities for women with eight children between the two cohorts, an increase in interval length for the younger cohort only kicks in after the fifth child.

Panel B reports shares for demographic, economic and cultural characteristics. The first row shows the share of women for whom we have death dates. The share is lowest for the earliest cohort, 55%, this share increases to 66% for the second cohort and remains constant for the rest of the study. We next show the age distribution of mothers within a mother's birth cohort for each birth interval, where age is her age at the conception of that child. The number of observations here is the number of birth intervals as shown in the final row of the table. Just under 30 % of all the birth intervals occur for mothers aged below 24 and below with this number decreasing to 20% as we move from earliest cohort to latest cohort. We see increases in the percentage of birth intervals going to mother's aged 25-29, 30-34 and 35-39 while we see a decrease in the percentage of birth intervals going to mothers aged 40 and over. This figure is already suggestive of changes in the timing of births across intervals. The decrease in share at the youngest age suggests both a later start to childbearing as well as an increase in birth intervals once child bearing has started. The decrease in the final age group, although small, suggests slightly earlier stopping for the youngest cohort where stopping may be driven by either conscious effort or hitting the infertility behavior due to extended birth intervals. The proportion of final birth intervals increases from 16 % for the 1800-1824 cohort to 28.23 % for the 1875-1910 cohort. The increase is however predominantly between the third and fourth cohorts.

As can be seen for each economic and cultural characteristic in the table there is a somewhat high percentage of unknowns. Since there is most likely some selection bias correlated with the unknowns we include them in the subsequent analysis. Let us begin with *region*. The first birth cohort was predominantly located in the Cape Colony, particularly in the rural areas which makes sense as this was a largely rural colony. As the settlers began to migrate the percentage in the Cape Colony drops and the percentage of unknowns increases.[11] We continue to see increases in the percentage of the sample from outside of the Cape Colony and in particular an increase in the proportion of the sample in the New Rural area.

Husband's occupation is a particularly poorly recorded variable. The registration documents seldom required the husband to fill out his occupation and hence the occupation information available in the sample is most likely subject to some bias. However, Cilliers and Fourie (2018) show that the occupational distribution in SAF closely resembles that in the Cape Colony censuses of the late nineteenth century.

As to be expected given the late arrival of British migrants, the dominant home language of the early cohorts is Afrikaans. This dominance abates somewhat over the century due to increasing immigration from Britain, particularly after the discovery of diamonds in the late 1860s. The sample is dominated by women born locally but consists also of a large proportion of unknowns and is most likely skewed towards the local born.

While the table and the figures show substantial changes in child numbers, the distribution of children ever born and interval lengths over time, they are unable to separate spacing behavior from stopping behavior and are unable to pick up intentional family limitation prior

[11] It is quite likely that as the settlers migrated the quality of the records deteriorated, the implications of this for the purposes of analysis are discussed at length in Cilliers and Mariotti (2018).

to the transition. For this we turn to the empirical analysis.

Empirical Methodology

We break our empirical strategy into two parts to correspond with the phases during which family size may be controlled: we first look at the time until marriage and first birth, we then look at both whether subsequent births commence and if so, how soon after the previous birth.

Time until marriage and first birth

We use a Cox proportional hazards model (Cox, 1972; Alter, 1988; Wooldridge, 2001) to model the length of time until marriage and until the first birth. The method is appropriate since all the women in our data marry and have at least one child. The estimation equation is as follows:

$$ln\frac{h_i(t)}{1-h_i(t)} = \beta X_{i,t}$$

where $\frac{h_i(t)}{1-h_i(t)}$ is the odds ratio of the natural log transformation of the hazard rate, h_t. We provide exponentiated coefficients in the results section. A $\beta > 1$ implies that an increase in the individual specific explanatory variable, X_i, is associated with an increase in the hazard rate, that is a woman is likely to be younger at either marriage or first birth. Conversely a $\beta < 1$ indicates that an increase in the explanatory variable is associated with a decrease in the hazard rate, a woman is likely be older at either marriage or first birth. We stratify by birth cohort in quarter-centuries to account for heterogeneity between different birth cohorts. The unit of observation is the woman.

The X_i's include region controls to account for different labor needs based on differences in the arability of the land and availability of alternate sources of labor. We include the husband's occupation home language, whether it is English or Afrikaans and whether the mother was born in South Africa or abroad.

Simultaneous determination of stopping and spacing

While a typical survival model such as a cox proportional hazards model suffices to evaluate the time until marriage or time until first birth in our data because all the women in our sample experience the event, such a model is inadequate when evaluating time till subsequent births because not all women have additional births. A standard survival model amalgamates the speed of progression to the next event with the proportion progressing because it assumes that everyone in the data is at some point subject to the event (Schmidt and Witte, 1989). In fertility analysis this simply is not the case, some women will drop out of the time to subsequent birth analysis because they stop having children. Furthermore, factors affecting the speed to the progression of a subsequent child may differ from the factors affecting whether or not a woman does progress to a subsequent child. One final concern is censoring in the data whereby some individuals are classified as not experiencing the event because they have not experienced it under the period of observation. This misclassification may lead to bias in a cox model (Li and Choe, 1997).

Methodologically, recent use of split population models, also known as cure models in the biomedical literature have been used to evaluate stopping and transition rates in demography (Yamaguchi and Ferguson, 1995; Li and Choe, 1997; Alter et al., 2007; Gray et al., 2010; Bremhorst et al., 2016). The advantage of these models over other event history models is that they allow for women to leave the duration estimation if they have stopped having children. One consequence for our data is that we can include women with unknown death dates who may have died during their fertile period and who may have had more children had they not died.[12]

The intuition is that we want to estimate the proportion of the population surviving till some time, t, that is, not having a subsequent birth by some time, t. This proportion is a mixture of two different groups of women, the women who never have another child, termed stoppers, with proportion denoted p, as well as those who have not yet had another child but will eventually, sometimes termed movers.

Mathematically we can write this as:

$$S(y) = p + (1 - p)S_m(t, x)$$

where p is the proportion of stoppers estimated from the following logistic regression

$$L_{i,t} = ln\frac{p_{i,t}}{1 - p_{i,t}} = \beta X_{i,t} + \varepsilon_{i,t}$$

where $ln\frac{p_{i,t}}{1-p_{i,t}}$ is the log transformation of the probability that no subsequent child is born after the observed birth.

$S_m(t, x)$, termed the survivor function in medical analysis, also sometimes referred to as a duration model in the fertility literature, is the probability that women who do have another

[12]The implementation of the cure model is sensitive to the number of observations, we are unable to run the model when we omit women with missing death dates.

birth have not had one by time t and is estimated as follows:

$$S_m(t,x) = 1 - \Phi\left(\frac{ln(t) - \beta X_{i,t}}{\sigma}\right)$$

where $\Phi()$ is the standard normal cumulative distribution function, $ln(t)$ is the log of time till next birth, $X_{i,t}$ are the explanatory variables, and σ is a scale parameter. Following Yamaguchi and Ferguson (1995) we use an accelerated failure-time regresion for the spacers/movers rather than a proportional hazards model.

In the stopping component of the model, a positive coefficient indicates a higher likelihood of the observed interval being the final, whereas in the spacing model a negative coefficient indicates a lengthening of the birth interval. We first stratify by birth cohort to account for heterogeneity between birth cohorts, we then stratify by parity progression to control for heterogeneity across parity progressions. We are unable to stratify across cohort and parity simultaneously due to the computational intensity of the cure models. The unit of observation is the length of time between consecutive births.

We include both supply of and demand for children in the explanatory variables. On the supply side we control for fecundity by accounting for the age at conception of the current birth since age is highly associated with fecundity. We would ideally also like to include crude parity, that is all previous births whether the infant survived or not. This measure would allow us more accurately to control for a couple's natural fecundity, the ease with which they conceive a child, and to distinguish this impact from net fertility, the number of surviving children which may affect the demand for an additional child. Our data do not however allow this. We include net parity and are agnostic about whether this variable is a demand or supply side variable. As a demand side variable it may affect both the probability of another child as well as the birth interval if parents make a conscious choice about whether to have another child based on the number they already have. As a supply variable it is another indicator of a woman's fecundity where we expect that a higher parity means she is both more likely to have another child as well as to have her children closer together. The demand side variables are as for the cox models above.

Results

Hazard of first birth

Table 2 provides the regression results from a cox proportional hazards model of the risk of marriage. Each column represents a birth cohort as specified above, the coefficients are the hazard rate and, as such, a coefficient greater than one indicates an increased hazard, whereas a coefficient less than one indicates a decreased hazard. Beginning with column one, women born between 1800 and 1824, we find women from Old Urban have a lower hazard rate, meaning they are older when they marry than women from rural areas, as we might expect given what we know from the literature on age at marriage (De Moor and Van Zanden, 2010).

We also find Afrikaans women likely to be younger than English speaking women when they marry. This result persists into the second cohort, which for the most part is also a pre-transition cohort. Columns three and four are for the transition cohorts and here we begin to see different hazard rates across the demand side variables. Women with white collar husbands have a lower hazard rate relative to farmers' wives. The geographic differences persist and we now find women from New Urban have a lower hazard of marriage than those from Old Rural, while women from New Rural have a higher hazard of marriage. Throughout, Afrikaans speaking women have a higher hazard of marriage than English speaking women.

To see whether differences in marriage ages persist into differences in the age of first birth, we turn to Table 3 which provides the regression results from a cox proportional hazards model of the risk of first birth. The women in this regression all have at least one child, hence they have all experienced the event and the cox model is once again appropriate for this analysis. Beginning with column one in order to see the steady state prior to the transition, we find very little effect of demand conditions on the hazard of a woman's first birth. There is only the small possibility of a lower hazard rate for women in the old urban areas relative to women in the old rural areas indicating women in urban areas are slightly older than women in rural areas when they have their first child. As we shift to column two we see a decreased hazard rate for women in the old urban areas relative to old rural areas. This may well indicate a conscious intention to limit family size given space constraints as suggested in Easterlin (1971). We also see a higher hazard rate for Afrikaans speaking women relative to English, as before.

We begin to see changes in the timing of first births for women born in the final two cohorts. Women with white collar husbands have a lower hazard relative to farmers' wives while wives of unskilled workers have a higher hazard of first birth. We continue to see the lower hazard for urban women, now in both the Old Urban as well as New Urban areas. The women in the New Rural areas have a higher hazard of a first birth relative to women in the Old Rural areas, again supporting the argument in Easterlin (1971). Finally in both of the younger cohorts, the cohorts we term transition cohorts, Afrikaans women are younger when they have their first child. Although this finding is consistent with that in Beach and Hanlon (2019) with respect to language differences during the transition, our data are not fine enough to pick up whether this is indeed the effect of the Bradlaugh-Besant trial claimed by Beach and Hanlon. Overall, the first birth results are similar to the marriage results.[13]

Simultaneous determination of stopping and spacing

Table 4 provides the results of the cure regression. The table is in two parts, the first part shows the coefficients, the log odds, for the fraction of women who stop having children, called the cure fraction. The second part shows the coefficients for the women who continue to have children. In the first part, coefficients larger than one indicate an increased log odds of *not* having another child given the current birth interval, a negative coefficient therefore indicates a lower log odds of not having another birth given the current birth interval. In the second part, the spacing component, a positive coefficient suggests an increased hazard of having another birth, which we think of as resulting in shorter birth intervals. A negative coefficient suggests a decreased hazard of having another birth, or in other words, a lengthening of the birth interval (Li and Choe, 1997).

We begin with column one of table 4, looking at the women born between 1800 and 1824 who stop. The control variables are the woman's age at the conception of the birth that is the observed birth interval, the number of previous births where the children are still alive, net parity (in categories)[14], the husband's occupation, the region of residence, whether the mother was born in South Africa and whether the home language is Afrikaans.[15]

The log odds increase as we move down the age categories. That is as we expect given a woman's physiological ability to conceive as she ages, the older a woman is at the conception of a birth, the more likely that is to be her final birth. The reference category here is women aged 20 - 24. The log odds of stopping for a woman aged 25 - 29 are 1.6 times higher than for a woman aged 20 - 24. This increases over age so that the log odds of stopping for a woman aged over 40 are 5.4 times higher than for a woman aged 20 - 24. This number translates into a probability of stopping of 99.5 %, the implication is that women observed having a birth in their 40s are essentially on their last birth.

We construct three categories for parity, the base category of one to three children prior to the current birth, four to six, and seven or more. The log odds of stopping are lower for women with four to six children and even lower for those with seven or more children. This result is noteworthy in that it suggests that women who already have high numbers of children are less likely to stop than women with fewer children. In other words, there does

[13]It appears that first birth is driven to a large extent by when the couple marry. A regression testing the time to first birth from the date of marriage finds no significance other than the age of marriage.

[14]We cannot include individual parity levels in table 4 due to the size of the data set.

[15]We include the unknowns in the regression but do not show them in the results.

not appear to be parity dependent stopping, at least prior to the fertility transition.

Continuing down column one, we find no deterministic effect of the demand side variables, no coefficients are significant and the signs on the coefficients are not what one might expect from theory.

We now compare the coefficients across the columns. Our prior is that if there is an increase in the incidence of stopping at earlier ages we should see an increase in the coefficients on age as we progress across the cohorts. We do not see any substantial change in the coefficients on age, the log odds of stopping at each age group remain around the same size as those for the 1800 - 1824 cohort. The only change is the log odds of stopping for the 1875 - 1910 cohort of women aged 25 - 29 at the time of conception, these women do not have an increased log odds of stopping relative to younger women.

There is no change to parity dependent stopping, the coefficients remain large, negative and significant suggesting that even during the transition there is no parity dependent stopping. The demand side again offers limited additional information.

Looking now at the second part of the table, the hazard of having another birth, we begin again with column one. The coefficients on age for the women born 1800 - 1824 are negative and increasing in size over the age categories. The implication is that older women have longer birth intervals, as we expect given the physiological nature of women's fertility. We find that women who had already had four to six or seven or more births experienced a shorter birth interval on their next birth relative to a woman who had between one and three children prior to the current interval. This too is expected, in order to have many children a woman must have shorter birth intervals.

This result is important in that it suggests that net parity is rather a supply side determinant of birth interval length than a demand side determinant. It rather suggests something about a woman's fecundity than her preference for another child, although it may do both. In which case it suggests that women with many children prefer to have more. We however believe it has more to do with a woman's ability to have many children. We will revisit this issue further on.

We find limited impact of demand side variables on birth intervals for the first cohort. Being from Old Urban increases the odds of a subsequent birth, being born locally decreases the odds and being Afrikaans speaking decreases the odds.

We now look at how the birth interval lengths change by cohorts. Birth interval lengths continue to increase by age, however the effect at each age increases as we move from the first cohort to the last. This result suggests an increase in birth interval lengths as we move from first to last cohorts, assuming no significant decreases in the intervals for the youngest group of mothers.

We see an increase in the hazard of another birth for women with four to six and seven or more children in the final cohort. This is expected since given the reduction in average family sizes, those women in the last cohorts having large numbers of children will be having the shortest intervals out of all the women in the sample. Furthermore, given an increase in interval length for women with few children, the impact would be relatively shorter intervals for those women with large families even if they weren't positively selected. The coefficients on the two net parity variables are approximately double the size of the coefficients of the previous cohort, reinforcing the finding that women with many children have shorter intervals more than anything else. This regression is unable to pick up any parity dependent stopping or spacing behavior.

The coefficients on the demand side are for the most part imprecisely measured however we do have some traction for the region variables where it appears that during the transition, birth intervals were longer for families in the New Urban and New Rural regions than in the Old Rural region. This somewhat follows expectations since, as noted above, Old Rural consisted in part of very fertile areas with very suitable rainfall and limited territorial conflict by the time of the fertility transition.

We finally turn to look very specifically at parity dependent control. Table 5 presents results from a cure model of second and higher order births stratified by parity. In contrast to table 4, we do not break the results down by cohort, rather we look at the coefficients for stopping and spacing for each of the four cohorts as we move across parities. Column one reports the coefficients for stopping and spacing as we move from a first child to a second, column two for the second to third child and so on. Looking at the stopping coefficients on the cohort categories we see very little in the way of a monotonic progression as we move across the parities. The lowest two progressions are associated with an increased odds of stopping relative to the first cohort, this gives way for the next few parities, while becoming positive again for parity seven or more. None of these coefficients are ever significant.

Looking at parity specific spacing over the cohorts we find shorter birth intervals for the second and third cohorts as they move from one to two children but nothing subsequently. The implication here is that we see no parity dependent spacing prior to the onset of the fertility transition. We do see increasing birth interval lengths for the final cohort as we progress across parities with the suggestion that once the transition is well and truly underway, women are beginning to postpone the next birth. There is however no monotonic progression in coefficient sizes across the parity progression.

Discussion

Family size may be controlled in one or more of three ways: individuals and couples have control over when they start procreating, once they have started they may have control over the pace of procreation, and ultimately they may control the point at which they stop procreating. We argue that over the 100 years in which we observe settler women in South Africa each of these three methods has played some role and that the extent of that role changed over time, particularly due to the advancement of the fertility transition in the last 30 years of the nineteenth century.

Changes to the age of marriage necessarily affect the final number of children born in wedlock due to the effect of marriage length on exposure time. Prior to the onset of the fertility transition, we do find variation in the relationship between region and marriage as well as home language and marriage. These effects remain during the transition. During the transition we additionally begin to see variation in the marriage ages of women based on their husband's occupation with white collar wives marrying later.

These findings extend to the age at first birth with the implication that in the South African data, it was marriage that determined the start of childbearing. Indeed, the descriptive statistics show firstly that the gap between marriage and first birth was on average longer than a pregnancy and that this gap remained fairly constant over a substantial period of time.

Once childbearing had commenced prior to the onset of the transition, the pace of subsequent births was determined by age at conception of the previous birth with older mothers likely to have longer birth intervals; the number of prior births with women with more children likely to have shorter birth intervals; and with Afrikaans speaking, locally born women likely to have longer intervals (although they start earlier). There are therefore both physiological and cultural contributors to birth pacing. Note the cultural factors need not reflect a conscious choice to affect birth outcomes. Rather, a consequence of cultural factors responding to a current birth may be the length of the subsequent the birth interval, for example the length of time a woman breast feeds may impact her ability to conceive another child. The only characteristics whose intensity increased during the transition are age at conception and how many dependent children the household already had. Furthermore, relative to women with 1 - 3 prior births, those with higher parities saw their hazard of another birth increase during the transition, driven most likely by those few highly fecund women still having large numbers of children. We therefore find no evidence of intentional control over pre-transitional spacing.

Finally, with regards to stopping behavior, the primary determinants before and during the transition are age and the number of previous births and these do not appear to change during the transition. Economic, social and cultural factors play a limited role in determining the stopping rate. The implication of these findings is that changes to the final numbers of children ever born are driven predominantly by later starting following later marriage and an increase in the birth interval length.

Ours is a novel finding in the literature because until now there has been very little investigation of spacing during the transition (Reher et al., 2017) and the literature on spacing has been dominated by investigations into whether women/couples could to any extent control birth interval lengths prior to the transition.

Speaking to the literature on parity specific control, an explicit examination of such control shows no change in stopping rates as parity increases neither for pre-transition nor for transition cohorts (apart from the 1875-1910 birth cohort at parities seven or greater) and no parity dependent spacing for the pre-transition cohorts indicating no parity specific control prior to the transition. In stark contrast, we find increases in birth intervals until parity four for women born 1875-1910. Recall, these women have three and a half children on average, so it is no surprise that we lose significance at higher parities.

Conclusion

This paper examines the fertility experience of settler women in nineteenth century South Africa. Our period, 1800 - 1910, starts with women born and having their own children prior to the fertility transition and culminates with women born themselves during the transition. We look at three factors known to affect total numbers of children born, the age at marriage and age at first birth, the length of time between consecutive births, and the likelihood of stopping after a certain number of children have been born. Our data which comprises women's complete birth histories is well-suited to event history analysis techniques. We use cox proportional hazards models for marriage and first birth since every woman in our sample experienced those events at some point. For the timing of subsequent births analysis we use mixed population models to allow for both ongoing procreation as well as the cessation of child bearing.

We find a fairly steady age at marriage and age at first birth for women born prior to the transition. In addition, it appears that supply side factors, that is a woman's own physiology and fecundity, are the main determinants of both birth interval length and when a woman stopped having children. We do not find evidence of the importance of variation in time invariant demand conditions nor of explicit parity dependent control for either spacing or stopping.

Once the transition had begun we see an increase in age at marriage and age at first birth, without much increase in the gap between marriage and first birth. We also see an increase in both explicit parity dependent control as well as variation in the impact of long run demand side conditions on the length of birth intervals. We do not see much change in stopping behavior.

Our findings contrast both with the early literature that assumed the transition was driven by stopping behavior and with the literature that finds parity dependent control prior to the transition. We conclude that South Africa's settler population did not make conscious decisions regarding birth spacing prior to the transition but did rely on spacing during the transition to limit family size. Given the resurgence of the debate on parity specific spacing prior to the transition (Clark and Cummins, 2019; Clark et al., 2019; Cinnirella et al., 2019) and the lack of research on spacing during the transition for European and other settler societies, we believe these results suggest a revisit to these issues is necessary.

Conflict of interest

The authors declare that they have no conflict of interest.

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Table 1 Descriptive statistics

	1800-1824	1825-1849	1850-1874	1875-1910
	(1)	(2)	(3)	(4)
A. *Means by mother's birth cohort*				
Children ever born	6.81	7.20	6.37	4.10
	(3.80)	(3.75)	(3.51)	(2.60)
Age at marriage	19.76	20.01	20.99	22.99
	(3.86)	(3.90)	(4.14)	(4.30)
Age at first conception	20.91	21.10	22.04	24.31
	(4.50)	(4.49)	(4.62)	(4.93)
Birth interval	2.44	2.43	2.57	3.12
	(1.25)	(1.26)	(1.44)	(1.82)
B. *Sample share by mother's birth cohort*				
Mother's age				
$\leq$ 24	29.82	27.46	25.43	20.32
25-29	25.51	25.12	26.14	28.98
30-34	21.14	22.09	23.42	25.97
35-39	15.49	16.67	16.91	17.36
$\geq$ 40	8.04	8.66	8.10	7.37
Mother's death dates non-missing	55.00	66.00	68.00	67.00
Final births	16.02	15.23	17.83	28.23
Region				
Old Urban	5.26	3.57	2.05	3.95
Old Rural	76.42	58.70	43.6	25.60
New Urban	0.30	2.44	3.19	6.96
New Rural	3.43	13.70	26.67	33.50
Unknown	14.60	21.60	24.50	29.99
Husband's occupation				
White collar	5.21	6.55	8.40	11.72
Farmer	18.00	21.00	20.81	17.47
Skilled/semiskilled	1.94	3.40	2.98	3.42
Unskilled	2.28	3.82	2.60	0.89
Unknown	72.44	65.08	65.21	66.50
Mother's home language				
English	12.66	19.41	20.62	21.03
Afrikaans	81.33	74.12	72.40	67.53
Unknown	6.01	6.47	6.98	11.44
Mother's birth place				
Born abroad	0.79	1.39	1.36	2.31
Born locally	47.57	52.52	49.58	49.97
Unknown	52.00	46.00	49.05	47.71
Mothers	2052	2422	3288	5757
Birth intervals	13904	19968	26299	32315

Notes: Standard deviation in parentheses.

Table 2 Cox regression of the hazard of marriage

	1800-1824 (1)	1825-1849 (2)	1850-1874 (3)	1875-1910 (4)
White collar	1.127	0.850	0.798**	0.791***
	(1.08)	(-1.81)	(-3.12)	(-4.69)
Skilled/semiskilled	0.876	0.819	0.764*	1.044
	(-0.81)	(-1.70)	(-2.49)	(0.56)
Unskilled	1.025	0.975	1.197	1.210
	(0.16)	(-0.23)	(1.59)	(1.36)
Old Urban	0.729**	0.689***	0.765*	0.732***
	(-3.09)	(-3.40)	(-2.15)	(-4.36)
New Urban	0.956	1.209	0.925	0.945
	(-0.11)	(1.39)	(-0.77)	(-0.98)
New Rural	0.697**	1.078	1.251***	1.210***
	(-2.81)	(1.20)	(5.15)	(5.47)
Afrikaans	1.199**	1.232***	1.286***	1.229***
	(2.63)	(4.02)	(5.71)	(6.24)
Born locally	0.895	2.081***	1.325	1.336**
	(-0.41)	(4.02)	(1.84)	(3.25)
Observations	1994	2434	3324	5822

Notes: Exponentiated coefficients. “Farmers”, “Old rural”, “English” and “Born abroad”are reference categories. “Unknown” categories estimated but not reported. t statistics in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3 Cox regression of the hazard of first birth

	1800-1824 (1)	1825-1849 (2)	1850-1874 (3)	1875-1910 (4)
White collar	1.106	0.921	0.816**	0.799***
	(0.93)	(-0.93)	(-2.84)	(-4.46)
Skilled/semiskilled	0.963	0.769*	0.770*	1.050
	(-0.24)	(-2.24)	(-2.42)	(0.63)
Unskilled	1.114	0.963	1.357**	1.477**
	(0.72)	(-0.34)	(2.78)	(2.79)
Old Urban	0.765**	0.671***	0.745*	0.706***
	(-2.66)	(-3.63)	(-2.34)	(-4.85)
New Urban	0.659	1.173	0.906	0.863**
	(-1.01)	(1.22)	(-0.98)	(-2.58)
New Rural	0.643***	1.105	1.163***	1.176***
	(-3.52)	(1.64)	(3.54)	(4.65)
Afrikaans	1.128	1.205***	1.221***	1.166***
	(1.78)	(3.62)	(4.59)	(4.65)
Born locally	0.784	1.759**	1.310	1.282**
	(-0.93)	(3.20)	(1.76)	(2.77)
Observations	2178	2550	3405	5821

Notes: Exponentiated coefficients. "Farmers", "Old rural", "English" and "Born abroad"are reference categories. "Unknown" categories estimated but not reported. t statistics in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4 Cure model of second and higher-order births, stratified by mothers birth cohort

	1800-1825	1825-1849	1850-1874	1875-1910
A. *Stopping*	(1)	(2)	(3)	(4)
Age 25-29	1.600***	2.205***	1.518***	-13.90
	(3.43)	(6.13)	(4.40)	(-0.01)
Age 30-34	3.413***	3.466***	3.432***	2.730***
	(7.79)	(9.76)	(11.02)	(6.56)
Age 35-39	4.776***	4.573***	4.373***	4.253***
	(10.83)	(12.79)	(13.89)	(10.42)
Age $\geq$ 40	5.375***	6.031***	5.520***	5.150***
	(11.17)	(16.39)	(16.86)	(12.34)
4-6 births	-1.458***	-1.819***	-1.475***	-1.187***
	(-6.89)	(-10.99)	(-11.36)	(-9.88)
7+ births	-4.523***	-4.215***	-3.771***	-4.172***
	(-10.27)	(-17.02)	(-15.88)	(-5.78)
White collar	-0.0789	-0.804	-0.230	-0.469
	(-0.13)	(-1.92)	(-0.84)	(-1.96)
Skilled/semiskilled	0.0636	-0.247	-0.491	-0.274
	(0.06)	(-0.55)	(-1.05)	(-0.72)
Unskilled	0.630	-0.115	-0.0590	-1.872
	(0.90)	(-0.26)	(-0.13)	(-0.65)
Old Urban	-0.372	-0.340	-0.239	-0.393
	(-0.85)	(-0.76)	(-0.41)	(-1.03)
New Urban	-13.02	0.449	0.647	0.0913
	(-0.01)	(0.99)	(1.79)	(0.32)
New Rural	-0.700	0.161	0.742***	0.200
	(-1.39)	(0.70)	(4.41)	(1.27)
Afrikaans	0.360	0.241	0.439**	0.254
	(1.02)	(1.20)	(2.66)	(1.66)
Born locally	12.52	2.545	0.944	-0.182
	(0.02)	(1.28)	(1.13)	(-0.44)
Constant	-19.19	-8.483***	-7.625***	-5.886***
	(-0.03)	(-4.18)	(-8.31)	(-9.61)

Table 4 (continued)

B. *Spacing*	1800-1825 (1)	1825-1849 (2)	1850-1874 (3)	1875-1910 (4)
Age 25-29	-0.147***	-0.173***	-0.198***	-0.287***
	(-13.19)	(-19.07)	(-23.55)	(-33.78)
Age 30-34	-0.264***	-0.296***	-0.346***	-0.511***
	(-19.74)	(-27.98)	(-36.20)	(-52.90)
Age 35-39	-0.375***	-0.400***	-0.496***	-0.697***
	(-24.05)	(-32.79)	(-44.30)	(-60.37)
Age $\geq$ 40	-0.587***	-0.575***	-0.715***	-0.893***
	(-31.05)	(-39.09)	(-49.73)	(-54.82)
4-6 births	0.0529***	0.0456***	0.0528***	0.163***
	(5.05)	(5.38)	(6.96)	(22.47)
7+ births	0.215***	0.212***	0.263***	0.448***
	(15.60)	(19.52)	(26.91)	(41.53)
White collar	0.00693	0.0330*	0.0146	-0.00611
	(0.38)	(2.50)	(1.17)	(-0.47)
Skilled/semiskilled	0.0286	0.0454*	0.0512**	-0.00252
	(1.09)	(2.55)	(2.68)	(-0.13)
Unskilled	-0.0394	-0.0541**	-0.0297	0.0603
	(-1.50)	(-3.16)	(-1.60)	(1.95)
Old Urban	0.121***	0.0755***	0.0879***	0.0178
	(7.04)	(4.26)	(3.74)	(0.81)
New Urban	0.0748	-0.00801	0.000344	-0.0769***
	(1.18)	(-0.40)	(0.02)	(-4.83)
New Rural	0.0328	0.0111	-0.0299***	-0.0794***
	(1.60)	(1.27)	(-4.02)	(-9.32)
Afrikaans	-0.0275*	-0.0419***	-0.0236**	-0.0261***
	(-2.39)	(-5.51)	(-3.18)	(-3.36)
Born locally	-0.136***	-0.0131	-0.0448	-0.0212
	(-3.70)	(-0.40)	(-1.40)	(-0.70)
Constant	-0.506***	-0.592***	-0.552***	-0.587***
	(-13.55)	(-17.65)	(-16.61)	(-18.13)
Observations	13886	19828	26235	32315

Notes: “Farmers”, “Old rural”, “English” and “Born abroad”are reference categories. “Unknown” categories estimated but not reported. t statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5 Cure model of second and higher-order births, stratified by parity

	1-2	2-3	3-4	4-5	5-6	6-7	≥ 7
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. *Stopping*							
Age 25-29	1.563***	15.10	1.668	-0.0450	-0.0140	-0.00829	-0.134
	(6.70)	(0.04)	(0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)
Age 30-34	3.142***	17.61	18.67	17.26	13.67	0.494	0.459
	(14.64)	(0.05)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)
Age 35-39	4.083***	18.70	20.33	19.30	17.82	16.50	15.72
	(18.51)	(0.05)	(0.02)	(0.01)	(0.01)	(0.00)	(0.00)
Age $\geq$ 40	4.480***	19.63	21.10	20.43	19.45	19.13	18.10
	(17.94)	(0.06)	(0.02)	(0.01)	(0.01)	(0.00)	(0.00)
1825-1849	0.402	0.241	-0.578	-0.185	0.0544	-0.156	0.364
	(1.59)	(0.66)	(-1.57)	(-0.50)	(0.11)	(-0.25)	(0.76)
1850-1874	0.0169	0.411	-0.236	-0.0414	-0.346	-0.0168	0.861
	(0.07)	(1.27)	(-0.80)	(-0.13)	(-0.72)	(-0.03)	(1.93)
1875-1910	-0.0728	0.539	-0.230	0.0824	-0.0229	0.206	1.280**
	(-0.32)	(1.76)	(-0.84)	(0.26)	(-0.05)	(0.41)	(2.88)
White collar	-0.446	-0.350	-0.224	-0.201	-0.478	0.732	0.186
	(-1.84)	(-1.50)	(-0.73)	(-0.55)	(-0.88)	(1.24)	(0.43)
Skilled/semiskilled	-0.104	-0.273	0.0245	-0.663	-0.543	-14.36	-1.500
	(-0.29)	(-0.68)	(0.06)	(-1.07)	(-0.66)	(-0.01)	(-0.62)
Unskilled	-0.194	-0.124	-0.355	-0.666	0.0664	0.00245	0.355
	(-0.32)	(-0.20)	(-0.42)	(-0.61)	(0.07)	(0.00)	(0.57)

Table 5 (continued)

	1-2	2-3	3-4	4-5	5-6	6-7	≥ 7
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Old Urban	-0.0311	0.0321	-1.032	-1.282	-16.54	-0.743	-0.702
	(-0.10)	(0.10)	(-1.42)	(-1.31)	(-0.01)	(-0.45)	(-0.51)
New Urban	-0.0445	0.321	0.266	0.0833	0.879	-16.05	-1.476
	(-0.14)	(1.06)	(0.69)	(0.19)	(1.54)	(-0.01)	(-0.59)
New Rural	0.354*	0.295	0.251	0.183	0.168	0.0374	0.303
	(2.16)	(1.81)	(1.26)	(0.84)	(0.51)	(0.09)	(1.14)
Afrikaans	0.227	0.494**	0.350	0.0280	-0.0817	0.533	0.471
	(1.65)	(3.04)	(1.69)	(0.14)	(-0.25)	(1.11)	(1.54)
Born locally	0.764	0.132	-0.102	-0.150	0.140	-0.979	0.0501
	(1.28)	(0.27)	(-0.20)	(-0.25)	(0.13)	(-0.75)	(0.04)
Constant	-6.691***	-21.41	-22.33	-21.64	-21.10	-21.36	-23.08
	(-9.89)	(-0.06)	(-0.02)	(-0.01)	(-0.01)	(-0.00)	(-0.00)
B. *Spacing*							
Age 25-29	-0.248***	-0.239***	-0.193***	-0.230***	-0.188***	-0.137	-0.217**
	(-26.71)	(-26.94)	(-19.03)	(-15.49)	(-6.49)	(-1.86)	(-3.22)
Age 30-34	-0.412***	-0.435***	-0.391***	-0.433***	-0.382***	-0.345***	-0.366***
	(-31.16)	(-36.59)	(-31.57)	(-27.28)	(-13.19)	(-4.70)	(-5.46)
Age 35-39	-0.452***	-0.562***	-0.549***	-0.635***	-0.591***	-0.556***	-0.501***
	(-21.06)	(-32.36)	(-33.01)	(-33.19)	(-19.52)	(-7.53)	(-7.48)
Age ≥ 40	-0.498***	-0.574***	-0.717***	-0.773***	-0.799***	-0.775***	-0.707***
	(-12.64)	(-17.17)	(-23.93)	(-27.08)	(-22.35)	(-10.23)	(-10.52)
1825-1849	0.0457**	0.00939	0.00456	0.00441	0.00541	-0.0141	0.00827
	(3.19)	(0.68)	(0.32)	(0.30)	(0.35)	(-0.86)	(0.98)

Table 5 (continued)

	1-2	2-3	3-4	4-5	5-6	6-7	≥ 7
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1850-1874	0.0660***	0.0174	0.00580	0.00615	-0.000805	0.00233	-0.00641
	(4.87)	(1.32)	(0.42)	(0.43)	(-0.05)	(0.14)	(-0.75)
1875-1910	-0.0614***	-0.0916***	-0.0747***	-0.0568***	-0.0186	-0.00501	-0.0541***
	(-4.65)	(-7.03)	(-5.37)	(-3.81)	(-1.17)	(-0.29)	(-5.64)
White collar	-0.0111	0.0125	0.0259	0.0102	0.0304	0.0230	0.00600
	(-0.70)	(0.77)	(1.42)	(0.50)	(1.38)	(0.94)	(0.46)
Skilled/semiskilled	0.0256	0.0380	0.0336	0.0361	0.0256	0.0139	0.0242
	(1.05)	(1.55)	(1.26)	(1.26)	(0.82)	(0.39)	(1.29)
Unskilled	-0.0400	-0.0108	0.0227	-0.0385	-0.0462	-0.0427	-0.0412*
	(-1.36)	(-0.38)	(0.77)	(-1.24)	(-1.45)	(-1.21)	(-2.21)
Old Urban	0.107***	0.0998***	0.0669*	0.0411	0.0987**	0.0882*	0.0697***
	(4.57)	(4.15)	(2.54)	(1.42)	(3.14)	(2.49)	(3.70)
New Urban	-0.0308	-0.0189	-0.0221	0.0153	-0.0722*	-0.0775*	-0.0510*
	(-1.45)	(-0.82)	(-0.85)	(0.52)	(-2.21)	(-2.13)	(-2.50)
New Rural	-0.0403***	-0.0337**	-0.0394***	-0.0313*	-0.0145	-0.0151	-0.0133
	(-3.72)	(-3.11)	(-3.37)	(-2.47)	(-1.06)	(-0.99)	(-1.62)
Afrikaans	-0.0376***	-0.0271**	-0.0354**	-0.0179	-0.0306*	-0.0389**	-0.0332***
	(-3.85)	(-2.73)	(-3.27)	(-1.52)	(-2.39)	(-2.74)	(-4.35)
Born locally	-0.00817	-0.117**	-0.0267	-0.0645	-0.0142	-0.0743	-0.128***
	(-0.24)	(-3.22)	(-0.65)	(-1.35)	(-0.26)	(-1.20)	(-3.68)
Constant	-0.583***	-0.484***	-0.542***	-0.422***	-0.452***	-0.350***	-0.183*
	(-15.94)	(-12.43)	(-12.30)	(-8.22)	(-7.33)	(-3.69)	(-2.45)
Observations	19216	16284	13369	10868	8729	6975	23798

Notes: "Farmers", "Old rural", "English" and "Born abroad"are reference categories. "Unknown" categories estimated but not reported. t statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Fig. 1 Distribution of women with children ever born, by cohort

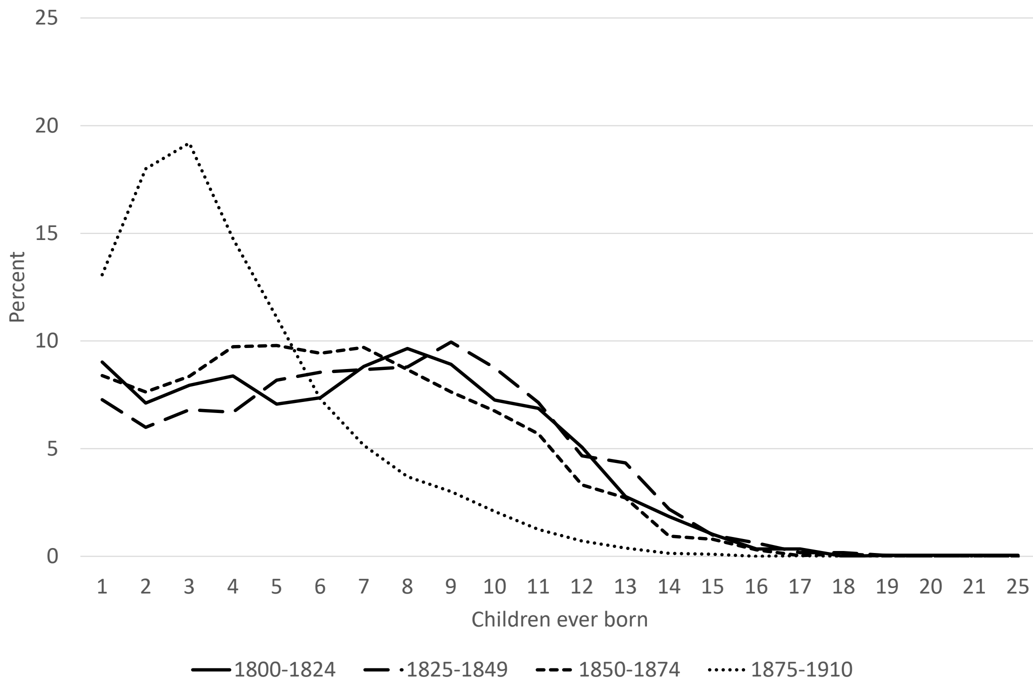


Fig. 2 Birth interval length over parity, by cohort

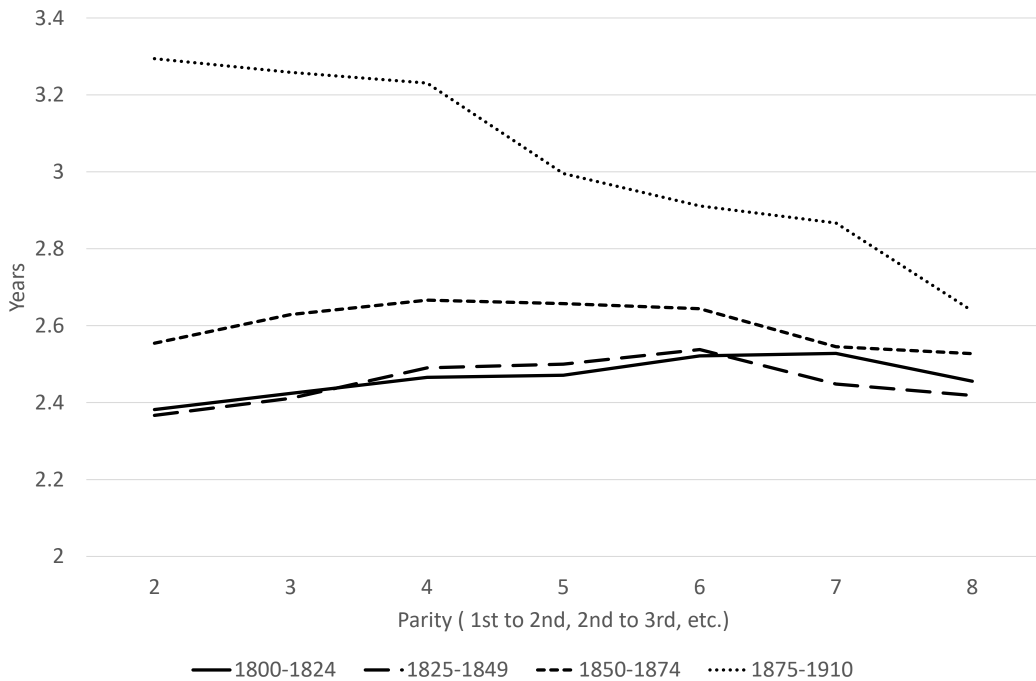
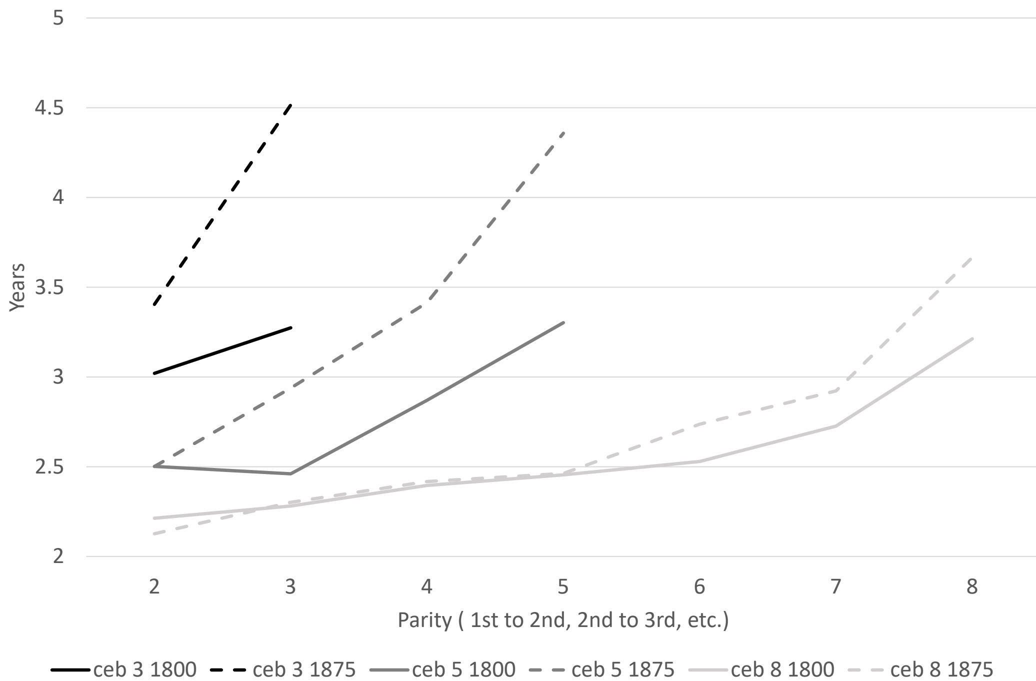


Fig. 3 Birth interval length over parity, by children ever born and cohort



For Online Publication: Additional Results Appendix

Table A1 z-values for test of difference in means by whether mother's death date exists or not

	1800-1824 (1)	1825-1849 (2)	1850-1874 (3)	1875-1910 (4)
Region				
Old Urban	2.130*	1.080	2.483*	2.380*
Old Rural	-4.046*	-3.298*	-1.715	5.787*
New Urban	-1.077	-0.151	3.498*	-0.028
New Rural	1.722	2.488*	0.109	3.658*
Unknown	2.796*	1.444	-0.374	-10.267*
Husband's occupation				
White collar	2.871*	5.400*	4.268*	1.064
Farmer	6.771*	5.258*	6.918*	6.388*
Skilled/semiskilled	-0.164	2.226*	3.113*	1.630
Unskilled	1.404	2.639*	-1.195	1.065
Unknown	-7.678*	-9.211*	-9.090*	-6.703*
Mother's home language				
English	3.172*	4.119*	5.155*	-1.182
Afrikaans	-2.389*	-3.889*	-5.801*	4.601*
Unknown	-0.522	0.303	1.992*	-5.267*
Mother born abroad or locally				
Born abroad	2.135*	2.657*	1.041	-0.427
Born locally	8.745*	5.416*	3.258*	8.161*
Unknown	-9.118*	-6.047*	-3.494*	-8.041*
Children ever born	3.112*	5.421*	2.834*	7.674*
Age at marriage	-0.090	0.067	0.014	0.381
Age at 1st conception	2.067*	0.410	5.724*	-1.270
Mother's age				
$\leq$25	1.208	2.173*	1.121	2.231*
25-29	-0.240	0.197	0.042	1.278
30-34	0.510	0.111	1.517	-0.302
35-39	1.216	0.504	2.158*	-0.304
$\geq$40	0.092	-0.799	0.830	-0.612
Proportion final births	0.236	-1.193	0.299	-0.152
Ave. interval length	-6.846*	-6.575*	-3.977*	-6.761*

Notes: z-values, negative sign indicates proportion/mean is lower for those with death dates. * denotes significance at 5 percent level. Cohorts represent mother's birth year.