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Deliberate birth spacing before the fertility transition in Europe: evidence from nineteenth-century Belgium*

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Deliberate birth spacing before the fertility transition in Europe: evidence from nineteenth-century Belgium

Abstract

Many scholars have argued that deliberate birth spacing might have played a role before and during the modern fertility transition. It has proved to be hard, however, to demonstrate convincingly that birth intervals were partly determined by deliberate fertility control efforts. Still, there remain good reasons to expect that birth spacing has played an important role. This paper suggests an approach that may reveal whether married couples were deliberately spacing or not. The method is applied to three cohorts living in a Belgian town in the nineteenth century. The findings indicate that, already before the fertility transition, working class couples were controlling their fertility by deliberate spacing.

Keywords

fertility control; natural fertility; birth spacing; birth intervals; family planning, traditional methods; demographic transition; dependency burden; household consumption; Europe; historical demography

Deliberate birth spacing before the fertility transition in Europe: evidence from nineteenth century Belgium

One of the most influential but also problematic concepts in demography is that of natural fertility, defined as fertility in the absence of deliberate birth control. Henry defined fertility control as reproductive behaviour that depends on parity and on the final number of wanted children (Henry 1953; 1979). Hence, demographers have generally identified fertility as controlled when couples stop reproducing after reaching the number of children they want, implying a notion of desired family size. In Europe, this kind of stopping behaviour emerged during the modern demographic transition. Therefore, the fertility transition is commonly seen as a change from natural to controlled fertility, equalled with a transition from parity-independent to parity-dependent fertility limitation (Coale 1986; Wilson, Oeppen & Pardoe 1988; van de Kaa 1996; Friedlander, Okun & Segal 1999).

Conceived in this way, natural fertility is not, however, necessarily high fertility because factors like low coital frequency and intensive breastfeeding may prolong birth intervals, thereby reducing the number of children irrespective of parity (Coale 1986). Clearly, these factors may influence fertility covertly and latently, but men and women might also deliberately manipulate them. Indeed, many scholars have argued that deliberate fertility control may be practiced in the form of birth spacing from the beginning of the couple's reproductive career, even if a vision of desired family size is missing (Bean, Mineau & Anderton 1990; Santow 1995; Szreter 1996; Hionidou 1998; Friedlander, Okun & Segal 1999; Fisher 2000; Van Bavel 2002).

Inferring parity-dependent stopping behaviour from quantitative data about historical populations involves already a difficult interpretative issue (Coale & Trussell 1974; Guinnane, Okun & Trussell 1994), but demonstrating intentional spacing efforts is even more complicated. In fact, Knodel (1988, pp.318-319) cites "the greater ease with which deliberate stopping can be detected compared to deliberate spacing" as the single most important reason why historical demographers have focused much more on the former than on the latter form of fertility control. Anderton and Bean (1985), Knodel (1987), Ewbank (1989), and Van Bavel (2001a) review the methodological difficulties of demonstrating deliberate spacing behaviour. In spite of the scarcity of convincing empirical evidence, there remain good historical and theoretical reasons to expect that birth spacing has played an important role as a fertility limitation strategy.

This paper first reviews these reasons and then proposes a model that may reveal whether or not married couples were deliberately spacing births. The model is implemented by means of multivariate Cox regression, applied to individual-level data on the reproductive histories of three cohorts of working class couples, living in the Belgian town of Leuven in the nineteenth century.

Household economy and birth spacing

Economic historians like David and Mroz (1989a) have argued that couples who must rely on relatively inefficient contraceptive methods are likely to practice spacing behaviour already at low parities. The argument has been reiterated by Santow (1995), who adds that it is very likely that couples tried to control their fertility by spacing before the fertility transition without any intention to reduce family size and without any belief that large families were disadvantageous. Indeed, a desire to limit family size is not the sole thinkable motivation for contraception.

Logically, there are two possibilities: parents do care about how many children they eventually have or they do not. The point is that even if final family size is not an issue, parents might want to space for other reasons, including household-economic reasons and children's health. And if final family size *is* important, spacing might still be the preferred to stopping for the additional benefits. Santow (1995, p.24) argues that, before the fertility transition, not final family size but rather these other benefits have provided the most widespread motivation for attempts to prevent that births come too close together.

For several reasons, longer spacing is beneficial to the child, the mother, and even the whole household. First, the child enjoys a longer period of close maternal attention, including a longer period of breastfeeding, and will be better established in the world before his mother turns her attention to a new infant. Longer birth intervals are not only associated with lower infant but also with lower child mortality (Palloni & Millman 1986; Miller et al. 1992; Lindstrom & Berhanu 2000). The mother herself has more time to rest and recover her strengths when birth intervals are longer. The family budget may benefit as well when the mother is not constantly either pregnant or caring for a small baby, because she has more time and strength to be active on the paid labour market or in some family business.

Particularly in the working classes a preference for spacing instead of stopping can be expected. Szreter (1996, pp.370-371) argues that in "a relatively low-income context where effective forms of contraception were lacking, infant mortality high, margins above material subsistence relatively narrow, maternal health likely to be poor and endangered by confinements, and with illness or temporary disablement of either or both spouses a frequent occurrence, 'spacing' would have been an obvious - perhaps the only obvious - way for a couple to exert some helpful control over their personal Malthusian predicament." Working class fertility control would be aimed at a target living standard rather than an ideal family size.

Following this line of thought, the rest of this paper investigates the hypothesis that nineteenth century working class couples were attempting to limit their fertility for household economic reasons. More specifically, the analysis tests whether there is evidence of intentional birth spacing motivated by the economic consequences of the family life cycle, in the sense described by Rowntree (1901 (2000), pp.135-138): most proletarian households were dancing on or falling below the poverty line during the early childhood of the first children that were born, until more and more children began to contribute to the household budget. The phase of economic hardship lasted for about ten years, depending on birth spacing and on the age at which children could start to earn money. The higher the pace of childbearing, the harder the economic stress in the household, given the level of income and costs. This may have motivated working class parents to control their fertility, not by means of stopping after reaching their ideal family size, but by means of birth spacing in order to keep the economic stress manageable. Whether or not this motivation would arise, does also depend on the natural supply of children, i.e. on the expected number of surviving children in the absence of limitation efforts (see Bulatao et al. 1983; Bongaarts & Menken 1983; Easterlin & Crimmins 1985 for a discussion of the supply-demand framework of fertility analysis).

In nineteenth century Belgium as well as in other European countries, the wage of the father was insufficient for most working class households. In general, the income generated by mothers and children was necessary, and sources of income and economies were being sought everywhere (Vanhaute 1998; Fontaine & Schlumbohm 2000). Countries, regions, cities and villages differed, however, with respect to the paid labour market participation of women and children. Mining regions provided one extreme case: in general, men's wages were relatively high while women's and children's participation in the paid labour market was low (Scholliers & Zamagni 1995). Fertility was typically high in the context of this kind of economy, engendering little motivation to prolong birth intervals. Textile regions were typically on the other side of the spectrum: many children and women were engaged in wage labour and men's wages were relatively low (Seccombe 1993). The more some local economy tended to conform to the latter type, the more local households would have been motivated to space births. The type of paid labour women were involved in also played a role: economic activity that could easily be combined with child care may have motivated women less to space births than paid labour that could not be combined with child care (Szreter 1996, pp.503-531). Whether or not a given economic activity can be combined with childcare depends on the social norms and institutions concerning childcare as well as on the characteristics of the job itself.

From a household economic perspective, then, we expect that working class birth intervals before the fertility transition depended not only on the natural supply of children but also on demand factors, implying fertility control. In order to detect control, the following analysis will not only take the determinants of the supply of children into account, i.e. natural fertility determinants like age and postpartum amenorrhea, and infant and child mortality, but also the characteristics of the family. More specifically, the following analyses will use information about the occupations of both husband and wife as well as the proportion of dependent, young children in the household.

Context and data

The hypothesis of fertility control through birth spacing will be investigated using the fertility data of three birth cohorts that lived in nineteenth-century Leuven. This provincial Belgian town was a Dutch-speaking, traditional trades and crafts centre and did not undergo a rapid and large-scale industrialization in the nineteenth century. Instead, its economy drifted with the industrializing and rapidly expanding national economy. The provincial town played a supportive role in the industrialization of Belgium, primarily through its functions as a centre of education, trades, and transport. The small-scale local industry expanded and modernized only gradually, and included mainly food industry, craft textile manufacturing, tanneries, wood, and construction. Activities in the tertiary sector included transit, wholesale and retail trade, and an important military settlement (Matthijs, Van Bavel & Van de Velde 1997; Matthijs 2001).

For women, employment opportunities in industry were scarce. According to the 1846 census, only 11 per cent of the female population between ages 15 and 65 was officially employed in industry. Lace-makers accounted for more than half of these. The others held traditionally female occupations as well: most were seamstresses, dressmakers, knitters, or laundresses (Magits 1975, pp. 164-178, appendix XI). Lace-makers were nearly always Leuven born-and-bred girls, educated and supervised in nun-schools and working at home or in small *ateliers* afterwards, together with peers and daughters (Uytterhoeven 1995; Van Bavel 2001b). Hence, lace making could be combined relatively easily with the care of infants and young children. For the women's families of origin, it not only meant some small contribution to the budget, it was also at least compatible with older sisters working with and taking care of younger sisters outside the crowded house (cf. Caldwell 1981, p.12).

The marital fertility data presented in the next section were collected from the Belgian population registers and from civil registration records (birth, death, and marriage certificates) (see Gutmann & van de Walle 1978; Leboute & Obotela 1988) for three birth cohorts that lived in Leuven at any point in time between 1846 and 1910, men as well as women, natives as well as immigrants (see Figure 1). The first generation, born in 1830, was included because it completed its fertile life course before any signs of marital fertility decline were visible on the aggregate level. The second cohort, born in 1850, entered its fertile life phase at a time when marital fertility was starting to decline in Leuven. The third generation, born in 1864, was living its adult years in full marital fertility transition. This paper only uses the marital fertility data from the working class sub-sample because we expect that spacing has played a more important role there than in the bourgeois and white collar middle classes. The sub-sample of the latter social groups is too small to allow a replication of the analysis presented below. Van Bavel (2002) gives more details about the sampling strategy and procedures.

(insert here figure 1)

Methods

The following analysis employs multivariate Cox regression in order to model the hazard rate of an effective conception, i.e. a conception leading to a birth, and, hence, the expected length of interbirth intervals. However, if fertility is natural, the unconditional hazard rate is determined by two groups of couples in the risk set: couples who are (still) fecund and couples who are (already) sterile. If some are controlling their fertility by means of stopping behaviour, this will contribute to the hazard-depressing effect of sterility. For the present analysis, therefore, the unconditional hazard rate is heavily biased by sterility (or extreme subfecundity) and possibly also by stopping behaviour, if present. These two factors introduce a bias in the unconditional hazard because we are interested in the length of birth intervals of fecund couples only, and in the determinants of this length, including intentional spacing behaviour. We want to model the *speed* of subsequent reproduction here, not the probability of subsequent fertility. The latter is done in Van Bavel (2002). In this paper, the question asked is: given that another birth has occurred, what are the covariates of the length of the past birth interval?

Hence, the present article uses closed intervals only, including only couples with at least two children and starting from progression after the first legitimate birth. The dependent variable in the following regressions is the conditional, continuous hazard rate of an effective conception, given that conception took place within five years. The latter condition was enforced in order to exclude sterile and extremely sub-fecund couples (see Larsen & Menken 1989). The date of conception is calculated from the date that closes the interbirth interval by subtracting 40 weeks. Time until conception and not time until birth has been modelled because the process that determines the outcome of pregnancy is different from the one that determines the timing of pregnancy (David & Mroz 1989a). For example: the effect of death during infancy of the previous child on the conditional hazard of conception is different from the effect on the gestation length, if any. At issue here is the former process.

There are two possibilities: either we model parity progression piecemeal (parity by parity), or we model all progressions together, including the previous fertility history in the list of covariates. Like Alter (1988), David & Mroz (1989a; 1989b), or Kertzer & Hogan (1989) we have chosen the latter approach because a number of person-specific unobservables, called heterogeneity, are correlated across parities. In contemporary societies serially correlated unobservables probably play a negligible role, but in a pre-industrial population like the one analysed here, they are important in accounting for life cycle fertility (Heckman & Walker 1992).

The regression models include two types of covariates, which are called supply and demand factors here, respectively (cf. David & Mroz 1989a; 1989b). Table 1 gives information about the distribution of all covariates that have been used. A number of covariates are included in order to control for differences between couples in the natural supply of children. The following supply-factors are known to influence the length of birth intervals, even in the absence of any fertility control.

- Women's ages at the beginning of the birth intervals are included in the form of the conventional five-year age categories. Age is known to be a major determinant of fecundity (Wilson, Oeppen & Pardoe 1988).

- Marriage duration is highly associated with fertility, even in the absence of parity-dependent fertility control (Van Bavel 2003). It is included in the regressions as the exact number of year the marriage has lasted at the beginning of the birth interval.
- Crude legitimate parity is defined as the number of children already born within the current marriage at the beginning of the interval. It represents natural fecundity differences between couples: couples with on average short birth intervals and, hence, more births at a given age and marriage duration, can be expected to have shorter birth intervals in the future as well. Differences between couples reflect differential fecundability and breastfeeding habits (Knodel 1988; Wood 1994). The number of children born to a marriage is only known for couples that had always been under observation in the Leuven population registers since the start of the marriage. Therefore, couples that entered Leuven after marriage, and for whom the date of marriage is unknown, have to be excluded from the regression. This selectivity introduces an unknown bias in the estimates.
- The survival status of the previous child has been shown to be a very important determinant of the next interval when the previously born infant is breastfed. Death of the infant interrupts breastfeeding, which shortens postpartum amenorrhea (Preston 1978; Santow 1987; David & Mroz 1989b; Wood 1994). Infant mortality is included in the regression equations as a time-varying dummy variable: from the moment the previously born infant dies, it is set to one.
- Even in the absence of fertility control, final interbirth intervals tend to be much longer than non-final intervals (Anderton & Bean 1985; Knodel 1987; 1988). Therefore, and in order to make sure that we don't mix up attempts to stop with true spacing behaviour, a dummy variable differentiates final from non-final intervals. Although it does not alter the results substantially, excluding all final intervals from the analysis is a bad idea, because then it is implicitly assumed that prolonged final intervals are *always* the result of failed

stopping attempts. However, spacing leads to longer final intervals as well. By including the final interval dummy, we guarantee that the effects of the other covariates are not limited to the final interval.

(insert here table 1)

The second set of variables represents influences on the demand side of marital fertility. The covariates of theoretical and substantial interest in this article are occupation of the husband, occupation of the wife, net parity, and, most importantly, the proportion of dependent children in the household.

- Occupations were recorded in the population registers at the time of registration, not at the beginning of each birth interval (Leboutte & Obotela 1988). It can be assumed that the occupations practiced often changed during the couples' reproductive career and it should therefore be recognized that the recorded occupations do not allow making fine-tuned distinctions in terms of the economic activity that men were actually involved in. To each birth interval, we assigned the father's occupation that was recorded at a date as close as possible to the beginning of the interval. Table 1 gives the distribution over the categories that have been used. Peeters (1996) gives more details about the underlying occupational coding scheme, and Van Bavel (2002; with Peeters & Matthijs 1998) explains how the occupational classification has been derived.
- It is well known that census takers and register makers often did not record married women's economic activities, and this tendency became stronger during the nineteenth century (Matthijs 2001, pp.68-80). Over the three generations analysed here, the proportion of married women for whom no occupation is recorded increases as well, from about 50 per cent in the first generation to about 70 per cent in the last one (see Table 1).

In addition, pregnancy and the post-natal period supposedly forced many women to stop with paid work, temporarily or permanently. The population registers do not provide this information but, still, I argue that the occupations that *were* recorded are useful for the present analysis. I assume that the probability that a civil servant recorded an occupation is higher for women that were involved in paid labour regularly than for women that were only occasionally and exceptionally active on the labour market. In other words: I do suppose that there is some association between recorded occupation and real activity on the labour market, but I do not assume that there is a one-to-one correspondence. The weaker the association, the more difficult it will be statistically to detect real effects of women's labour. Therefore, the estimates presented below can be considered to be conservative ones (Van Bavel 2002).

- Net parity is calculated as the number of children alive at the start of the interval, including children born out of wedlock (in contrast to the crude parity measure, which includes legitimate births only). If birth spacing would be aimed at a final family size, we would expect a negative effect of this variable on the conditional hazard of effective conception. Hence, we are looking here at parity-dependent spacing from the perspective of reproduction, distinguishing net parity from crude parity: the former is the number of children still alive at the beginning of the current interval, while the latter includes all children already born, alive as well as deceased. Therefore, net parity equals crude parity minus the number of deceased children, plus the number of children born before the current marriage, still alive and present in the household. If net parity has a statistically significant effect on age-specific fertility, even after controlling for crude parity (or, equivalently, the number of deceased children), this would strongly suggest that the speed of parity progression was being controlled with a desired offspring in mind.

The inclusion of crude parity is essential for the analysis in order to control for two opposing mechanisms behind the bivariate association between the number of children already born and the speed of subsequent reproduction. On the one hand, we expect a positive association between crude parity and fertility because parity, at a given age and marriage duration, is positively associated with fecundability. The higher the fecundability, the shorter the interbirth intervals, and the higher the crude parity attained. On the other hand, every birth entails some risk of secondary sterility or subfertility, implying zero or lower subsequent fertility (Van Bavel 2003).

Net parity equals crude parity minus the number of deceased children. Therefore, the effect of net parity on the conditional hazard rate, after controlling for crude parity, is exactly the opposite of the effect of the number of children lost. To some extent, then, we are capturing the effect of infant mortality on fertility, which is known to be positive, even in the absence of fertility control (Preston 1978). This would blur or even invalidate the analysis because net parity is included in order to detect parity-dependent fertility control while in fact it is capturing an infant mortality effect as well. Therefore, it is essential that we also control for the latter effect (Van Bavel 2003). As explained in the discussion of the natural supply covariates, this will be done by including a time-varying dummy variable for the survival or dead of the previous child.

- The proportion of dependent children alive is calculated at the start of each interbirth interval from the dates of birth and death of the previously born children. Infants obviously formed an economic burden. From the age of seven years, children were allowed to attend one of the Leuven primary schools. At this age, many working class children were already involved to some extent in paid labour, but it is not entirely clear from what age onwards their contribution to the household budget outweighed their burden. Probably, this age increased towards the end of the nineteenth century (Van Bavel

2002). Given the lack of empirical information, I use the age of nine years as a hypothetic and average dividing line between being a burden and a contributor to the household budget in the working classes. The proportion of dependent children is the proportion of all children living at the start of the birth interval that are under the age of nine years. Rowntree (1901 (2000)) already noted that there is a strong association between marriage duration and the proportion of dependent children. This highlights the importance of including marriage duration in the regression: if we do not control for marriage duration, we run the risk of concluding spuriously that there is a negative causal relationship between the proportion of dependent children and the length of birth intervals. Indeed, there is a negative bivariate association between interval length and dependent children. For the three generations, the Pearson correlation coefficients are –0.24, -0.20 en -0.26 respectively (all statistically significant at a level of alpha = 0.001). This results from the fact that the proportion of dependent children is generally the lowest at high marriage durations (see Figure 2), when interbirth intervals are generally longer.

(insert here figure 2)

All this again results in conservative estimates for the causal effect of dependent children on birth spacing. Indeed, in the absence of deliberate birth spacing, we would expect a negative association between the burden of children and the length of birth intervals. At a given marriage duration and a level of infant and child mortality, the couple with the shortest birth intervals will have the highest proportion of dependent children. This makes it very difficult, statistically, to detect a causal mechanism that works in the opposite direction, namely deliberate birth spacing (Van Bavel 2002). To conclude: if we are able to find a negative effect of the proportion of dependent children on the pace of childbearing (i.e. the conditional hazard rate), it would most probably be due to deliberate spacing behaviour.

Findings

Table 2 contains the maximum likelihood estimates of the effect parameters in the Cox regression of the hazard of effective conception, modelled separately for each generation. They are presented in an exponentiated form because this is more convenient for substantial interpretation: in their exponentiated form, they can be interpreted as hazard ratios (Allison 1984). A hazard ratio equal to *r* implies that the hazard rate increases with a factor *r* as the corresponding covariate increases with one unit. Hence, $r = 1$ means that there is no effect. In addition, Table 2 gives the estimated standard errors of the regression coefficients and the probability of the corresponding chi-squared statistic, testing the null-hypothesis that the regression coefficient is zero (and, hence, the hazard ratio $r = 1$). Statistically significant effects are highlighted by bold type.

(insert here table 2)

The results suggest that the two oldest generations were deliberately spacing births as a function of household economic needs. More specifically, not the number of children alive but the proportion of dependent offspring significantly influenced the pace of childbearing: holding the other covariates constant, the higher the proportion of young children, the longer the time until the next conception. In the 1830 generation, it would take about 36 per cent longer until the next child would come when all living children were under the age of nine years old compared to when there were no dependent children ($p<0.07$). In the 1850 generation, the effect was about 42 per cent ($p<0.01$), always holding the other covariates constant. These effects are all the more remarkable because in the absence of spacing behaviour, the sign would be opposite.

Although the estimated effect of the proportion of young children still runs in the same direction, it is not statistically significant anymore in the 1864 generation. The most probable reason is that the third generation was already heavily controlling its fertility by means of parity-dependent stopping behaviour (see Van Bavel 2003). Furthermore, a general cautionary remark is in place, because the number of cases in all three cohorts are relatively small. It remains to be seen whether these findings can be replicated with other and larger datasets.

Whatever the dataset, the negative effect of the proportion of dependent children on the pace of childbearing can be found only after controlling for a number of covariates that represent the natural supply of children. Death of the last child more or less doubled the hazard rate of conception, and an additional year of marriage was associated with a decrease in the hazard of six to eleven per cent, depending on the generation. The effects of crude legitimate parity imply in each generation that, as expected, at a fixed marriage duration, the more children a couple had already had, the quicker the wife got pregnant again.

Final interbirth intervals lasted significantly longer in all three generations, but especially in the two younger ones, suggesting that some couples were trying to stop. In the 1864 generation, there is an indication that spacing came to depend on ideal family size: the 5 per cent negative effect of net parity on the hazard rate was statistically significant at the 0.10 level in the youngest generation. There was no such effect in the older cohorts.

The negative effect of the proportion of dependent children on the pace of childbearing in the older generations suggests deliberate spacing behaviour and, hence, fertility control motivated by the household economy rather than by ideal family size. The effects of husband's and wife's occupation are compatible with the same hypothesis, although the parameters are sometimes hard to interpret because of the small number of cases in some occupational categories. In the 1830 generation, birth spacing still depended significantly on the recorded occupations of husband and wife but this differential pattern faded in the younger generations. As expected, the effect of the occupational activity of men was in the opposite direction of the effect of women's occupations. In a nutshell, the findings for the 1830 generation indicate that men who were practicing a relatively stable and generally well-paid occupation, *ceteris paribus* were also spacing their children to a lesser extent than men with unsteady and badly paid jobs. Birth intervals for artisans, clerks and servants, for instance, were significantly shorter than the ones for unskilled labourers, who formed the reference category. The hazard ratios were 1.33, 1.27, and 1.42, respectively.

Women's occupations were operating in the opposite direction. The speed of parity progression for shopkeepers or women with a recorded occupation in trades or handicrafts was about 30 per cent lower than for women who recorded no occupation. Assuming that a lot of occupational activity remained unrecorded for married women, the effect might have been even bigger in reality. As expected, the effect of lace making was somewhat smaller. The finding is compatible with the hypothesis that lace making could be relatively easily combined with childcare. Although it was very badly paid, lace-work was interesting for poor working class women because they could practice it together with peers and children, contributing some money to the household budget while supervising and possibly nursing young, dependent children.

The effects of the other covariates included are important but they are not the core issue of the present paper. With respect to the ages of the wives, it is interesting to see that its effect on the hazard rate disappears in the younger generations after controlling for the other covariates. More specifically, experiments indicated that two covariates are responsible for this finding:

marriage duration and the dummy that indicates whether or not the present interval in the final one. This is concordant with the finding that the younger generations were increasingly controlling their fertility by means of stopping behaviour. Women of the younger cohorts were truncating their fertile careers sooner and sooner, depending on their marriage duration and the number of children already born and alive. This process is further analysed by Van Bavel (2002).

The positive effect of crude parity, statistically significant in all three generations, is a result of differences in breast-feeding and fecundability. Not surprisingly, the death of the previous infant, which interrupted breastfeeding, doubled the hazard rate of a next conception. Indeed, analyses not shown here clearly indicate that many women were breastfeeding their infants in Leuven (Van Bavel 2002).

Conclusion

Many authors have argued that deliberate birth spacing may have been an important method for controlling marital fertility before or during the fertility transition. However, it has been difficult to show empirically that differences in birth intervals were the result of deliberate behaviour. Often, alternative explanations in terms of natural fertility differences could not be excluded empirically.

This paper used population register data from three generations living in the Belgian town of Leuven between 1846 and 1910. The wealth and detail of the data were used to construct, on the one hand, a set of covariates that represent the influences of natural fertility on birth intervals and, on the other hand, a number of variables that represent the hypothetic, household economic motivation to space births.

The findings indicate that birth spacing in Leuven cannot be explained completely by the natural supply of children. They suggest that, already before the fertility transition, working class men, women, or couples living in Leuven were controlling their fertility by deliberately postponing the next pregnancy. This control was probably not aimed at a desired family size. This goal would have been very unrealistic anyway: infant and child mortality was high and contraceptive methods inefficient. Still, many working class households were permanently struggling to stay above the poverty line. One possible strategy to limit the economic pressure was to try to restrict the proportion of dependent children in the household. This could be achieved by slowing down the pace of childbearing, without stopping altogether. Indeed, in the two oldest generations the rate of conception was a function of the proportion of dependent children, given that at least one more birth followed. Replication of the model presented here using other samples will have to tell whether or not this behaviour can be found in other populations as well.

The results on the effect of the recorded occupations of both husband and wife on birth intervals concord with a household economic explanation as well. In the youngest generation, the pace of childbearing depended on the number of children already born and still alive, hinting at fertility control with a final family size in mind. Analyses not presented here show that this was indeed the first generation that clearly started to stop as a function of net parity (Van Bavel 2002; 2003).

Earlier research has found indications of spacing behaviour before or during the fertility transition (see the overview by Friedlander, Okun & Segal 1999), most convincingly in the United States (Bean, Mineau, and Anderton 1990). The results reported here demonstrate that spacing in one Belgian population was probably a deliberate reaction to family economic circumstances. I expect that the same kind of effects can be found, before the fertility transition, among the working classes of other towns and cities in Europe as well as in North America. If this would be true, the fertility transition can no longer be conceived of as a change from natural to controlled marital fertility. Rather, it should be conceived of, then, as a transition from marital fertility control by deliberate birth spacing to marital fertility control that included stopping behaviour as well.

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Table 1. Percentage distributions, means and standard deviations of the covariates, and median length of time until next effective conception, by parity and generation. Leuven working classes, 1846-1910

COVARIATES	1830 generation		1850 generation		1864 generation	
Woman's age						
<25 years	13.07 %		19.70 %		21.48 %	
25-29	26.02		29.81		34.16	
30-34	31.86		28.23		27.11	
35-39	22.87		18.11		14.10	
40 en +	6.18		3.92		3.15	
Marriage duration (mean, years)	5.74	(4.67)*	6.21	(5.05)	5.56	(4.64)
Final interbirth intervals / all closed intervals	22.99 %		21.51 %		26.57 %	
Crude legitimate parity (mean)	3.35	(2.22)	3.71	(2.53)	3.22	(2.19)
Previous child dies before conception of the next	21.24 %		17.96 %		18.00 %	
Husband's occupation						
Labourer	16.69 %		12.00 %		11.82 %	
Artisans & Shopkeepers	15.99		22.72		25.49	
Non-factory workers	46.09		46.42		35.47	
Clerks & non-domestic servants	4.78		3.32		5.86	
Self-employed with minimal capital	6.30		4.00		5.42	
Domestic servants	2.92		0.53		0.33	
Factory workers	7.23		11.02		15.62	
Wife's occupation						
No occupation registered	50.52 %		68.08 %		70.60 %	
Shopkeepers & artisans	4.32		6.42		3.36	
Non-factory workers	5.95		5.51		6.94	
Clerks & non-domestic servants	4.32		2.11		3.15	
Self-employed with minimal capital	0.23		0.83		3.04	
(Former) domestic servants	13.54		6.34		4.45	
Lace-workers	19.60		6.42		0.00	
Factory workers	0.70		0.68		2.60	
Labourers	0.82		3.62		5.86	
Proportion of dependent children in the household (<9 years old) (mean)	0.90	(0.19)	0.87	(0.22)	0.90	(0.18)
Net parity (mean)	3.00	(1.79)	3.43	(2.03)	3.24	(1.81)
TIME UNTIL NEXT EFFECTIVE CONCEPTION IN MONTHS	*Median*	*N*	*Median*	*N*	*Median*	*N*
Parity 1	14.6	210	13.3	292	14.8	244
2	17.1	171	16.1	249	17.8	194
3	17.0	135	16.5	200	17.8	142
4	16.5	109	16.3	160	16.1	114
5	17.7	89	16.4	129	15.7	86
6	18.4	61	16.7	100	17.5	56
7	16.2	36	16.4	73	16.0	36
8	16.7	19	18.3	50	16.8	27
>8	16.8	27	15.8	72	16.3	23
Overall	16.5	857	15.7	1325	16.4	922
Number of interbirth intervals	857		1325		922	

*Standard deviations are between brackets

Source: Population registers and civil registration records (Van Bavel 2002)

Table 2. Cox-regression of the hazard of effective conception in closed interbirth intervals, by generation. Leuven working classes, 1846-1910

	1830 generation			1850 generation			1864 generation		
	e^coeff.	se coëff.	p	e^coeff.	se coëff.	p	e^coeff.	se coëff.	p
Woman's age									
<25 years (ref.)	1.00	/	/	1.00	/	/	1.00	/	/
25-29	0.92	0.122	0.477	0.96	0.084	0.646	**0.81**	0.095	0.030
30-34	0.90	0.129	0.413	1.05	0.094	0.622	1.08	0.109	0.497
35-39	0.84	0.146	0.244	1.08	0.119	0.503	0.83	0.145	0.189
40 en +	**0.56**	0.215	0.007	1.03	0.187	0.895	0.93	0.238	0.761
Marriage duration in years	**0.94**	0.024	0.007	**0.89**	0.017	<.0001	**0.94**	0.021	0.003
Final interbirth interval	**0.74**	0.094	0.001	**0.53**	0.078	<.0001	**0.61**	0.081	<.0001
Crude legitimate parity	**1.10**	0.051	0.056	**1.17**	0.031	<.0001	**1.11**	0.040	0.006
Dead of infant before conception of the next child (time-varying)	**2.08**	0.103	<.0001	**2.17**	0.084	<.0001	**1.86**	0.104	<.0001
Husband's occupation									
Labourer (ref.)	1.00	/	/	1.00	/	/	1.00	/	/
Artisans & Shopkeepers	**1.33**	0.131	0.029	0.85	0.105	0.131	1.09	0.118	0.459
Non-factory workers	**1.27**	0.102	0.018	0.95	0.093	0.584	1.06	0.113	0.589
Non-domestic servants, clerks	**1.42**	0.184	0.056	1.28	0.174	0.152	0.92	0.173	0.629
Self-employed, minimal capital	1.08	0.164	0.625	1.06	0.163	0.726	0.92	0.177	0.654
Domestic servants	1.16	0.222	0.498	0.60	0.395	0.202	0.79	0.591	0.696
Factory workers	1.03	0.156	0.837	0.91	0.120	0.405	1.09	0.131	0.523
Wife's occupation									
No occupation registered (ref.)	1.00	/	/	1.00	/	/	1.00	/	/
Shopkeepers & artisans	**0.71**	0.180	0.056	1.03	0.117	0.796	0.88	0.188	0.513
Non-factory workers	**0.70**	0.157	0.022	0.84	0.124	0.147	1.11	0.135	0.432
Non-domestic servants	0.78	0.180	0.173	0.97	0.194	0.857	0.85	0.194	0.384
Self-employed, minimal capital	0.44	0.713	0.251	1.01	0.307	0.982	**1.60**	0.206	0.023
Domestic servants	1.01	0.110	0.967	0.99	0.117	0.937	**0.70**	0.168	0.032
Lace-workers	**0.84**	0.095	0.060	0.91	0.116	0.412	/	/	/
Factory workers	1.04	0.414	0.917	1.15	0.341	0.676	**1.91**	0.219	0.003
Labourers	0.63	0.383	0.224	0.88	0.156	0.419	0.93	0.144	0.612
Proportion of dependent children in the household (<9 years old)	**0.64**	0.243	0.063	**0.58**	0.209	0.009	0.89	0.267	0.664
Net parity	1.02	0.034	0.492	0.98	0.024	0.484	**0.95**	0.034	0.099
Number of person years:	1287.88			1882.00			1387.47		
Number of intervals:	857	df	p	1325	df	p	922	df	p
Likelihood ratio Chi²	112.68	24	<.0001	238.43	24	<.0001	136.31	23	<.0001

Source: Population registers and civil registration records (Van Bavel 2002)

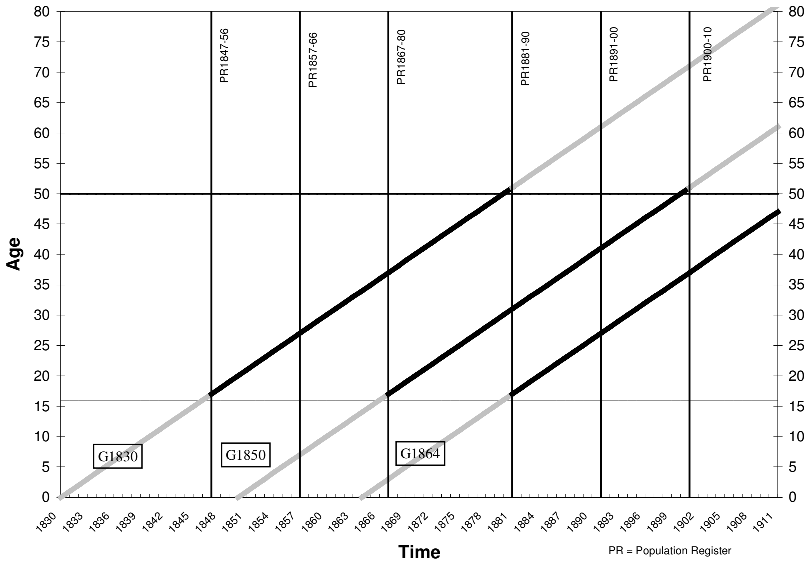

Figure 1. Lexis diagram of the three Leuven sample generations

Source: Population registers and civil registration records (Van Bavel 2002)

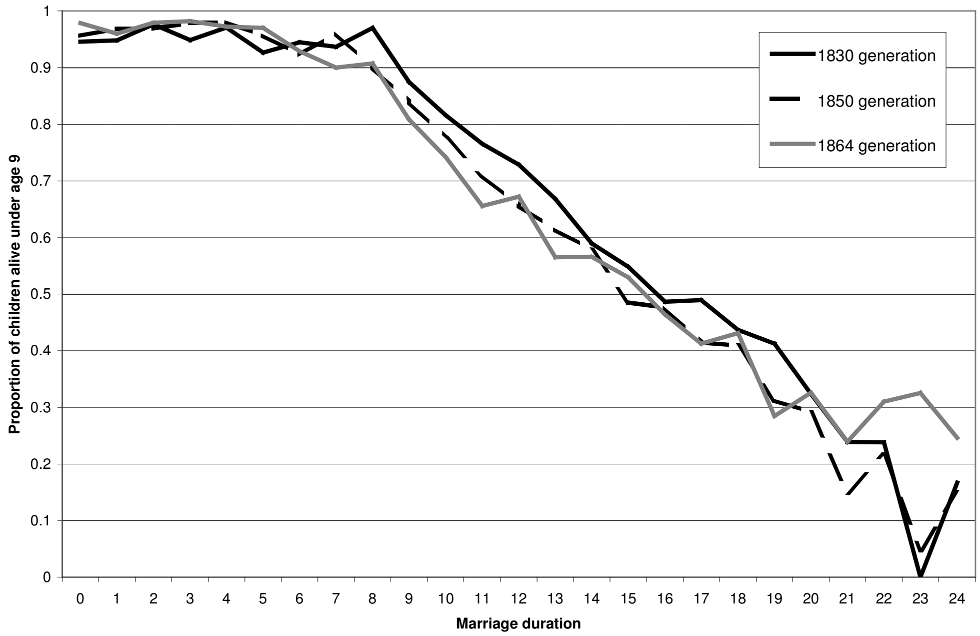

Figure 2. Relation between the proportion of dependent children and marriage duration for the three sample generations

Source: Population registers and civil registration records (Van Bavel 2002)