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Birth spacing as a family strategy: evidence from 19th century Leuven, Belgium

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Abstract

This article investigates the hypothesis that 19th-century working class families in Leuven, Belgium, were controlling their fertility by means of birth spacing for household economic reasons. Detailed life-course data were collected in order to construct, on one hand, a set of covariates that represent the influences of natural fertility on birth intervals and, on the other, a number of family variables that represent the hypothetical, household economic motivation to space births. The findings strongly suggest that birth intervals were not merely a function of natural fertility differences and that family strategic spacing behavior also played a role.

1. Introduction

Before the development of social security regulations, many 19th-century working class families were hovering around or falling below the poverty line in Europe. Basically, families who lived by the work of their hands were at risk, and the reasons for their economic insecurity were manifold: economic cycles and seasonal fluctuations, warfare and taxation by the elites, but also natural factors, both catastrophes and normal weather fluctuations affecting harvest yields. Equally important were the uncertainties inherent in family life and demographic reproduction: disease, old age, widowhood, or having many young children (Fontaine & Schlumbohm, 2000).

In social history generally and in family history particularly, a line of research has emerged that investigates how working class families coped with economic and demographic risks and

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uncertainties before the advent of the welfare state (Camps-Cura, 1996; Hareven, 1987; Knotter, 1994; Levine, 1989; Tilly, 1979; Vanhaute, 1997; Wrigley, 1978). In this context, the concept of family or household strategy has been introduced and developed to summarize the range of actions that men and women, couples, households, or families undertook to cope with or overcome the challenges of life, including social structural conditions. Over the course of about two decades, the concept has been developed in response to many critiques (Emigh, 2001; Fontaine & Schlumbohm, 2000; Hareven, 1987; Tilly, 1979). Most importantly, scholars using the concept now recognize that (1) a so-called strategy may be, and indeed most often is, the result of a sequence of implicit decisions; and (2) this sequence is the complex result of the interactions and negotiations between household members, each with their own social positions, role expectations, and resources (Emigh, 2001; Fontaine & Schlumbohm, 2000, pp. 6–9).

Next to inheritance, labor, and other economic strategies, an important type of family strategy concerns demographic reproduction. The role of demographic strategies has been a major topic in the literature concerning the economics of the family household, and primary attention has been given to the age at marriage and fertility (Rudolph, 1992).

This article investigates the hypothesis that before the fertility transition, working class families were controlling their fertility by means of birth spacing for household economic reasons. The hypothesis has been formulated before, but it has been difficult to find hard evidence to support it. Indeed, it is not at all easy to demonstrate that differences between birth intervals were partly the result of deliberate spacing behavior and not merely the result of natural fertility differences (Knodel, 1987). This study uses data that allow us to control for natural fertility differences and to assess at the same time the role of family variables, employing multivariate Cox regression techniques. The results strongly suggest that differences between birth intervals were not only the result of differential natural fertility but birth control, motivated by the household economy, also played a role.

2. Working class family life cycles, economic stress, and birth spacing

Already at the beginning of the 20th century, Rowntree (1901 [2000], pp. 136–137) noted that working class families can be expected to face economic problems mainly during two phases of the family life cycle: during the early family formation years, when young children are still an economic burden to the household, and during the empty-nest phase, when all the children have left home. Chayanov (1966) formulated similar ideas about the relationship between demographic reproduction, the ratio of consumers and producers, and economic stress in the household. However, just as with Chayanov's account of the Russian peasant family, Rowntree's version of the life cycle of the urban proletarian family formed a highly stylized version of reality (Fauve-Chamoux, 1993): clearly, real family life cannot be divided into neat phases of establishment, extension, aging, and contraction (Hareven, 1977, 1978; Spanier, Sauer, & Barzelere, 1979; Trost, 1977). Rowntree's concept of primary and secondary poverty has been under attack as well (Gazeley & Newel, 2000; Veit-Wilson, 1986). But no research has contradicted what is essential in the hypothesis on the relationship between demographic reproduction and the household economy: that the proletarian household will be under economic stress when a large fraction of the children are young and dependent (also see Alter, 1988, pp. 167–173). The degree of stress depends not only upon the proportion of dependent children but obviously on the pooled level of income and on life style and consumer culture as well.

2.1. The family budget and birth spacing

It is implausible that 19th-century working class men and/or women were motivated to control their fertility because they had an ideal final family size in mind. Rather, we suppose that they were motivated to control their fertility to keep the pace of childbearing economically bearable. Economic historians such as David and Mroz (1989) have argued that couples who must rely on relatively inefficient contraceptive methods are likely to practice spacing behavior already at low parities. The argument has been reiterated by Santow (1995), who added that couples likely 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 only possible motivation for contraception. A far more widespread motivation, Santow (1995, p. 24) argued, is a desire to ensure that births do not come too close together.

Szreter (1996, pp. 370–371) argued 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." Hence, working class fertility control would be aimed at a target living standard rather than an ideal family size.

For several reasons, longer spacing is beneficial to the child, the mother, and the 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 or her mother turns her attention to a new infant. Longer birth intervals are not only associated with lower infant mortality but also lower child mortality (Lindstrom & Berhanu 2000; Miller, Trussell, Pebley, & Vaughan, 1992; Palloni & Millman, 1986). The mother herself has more time to rest and recover her strength 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 labor market or in some family business.

In short, before the fertility transition, we suspect parity-independent spacing behavior in the working classes rather than parity-dependent stopping behavior. Whether or not the motivation to space births would arise depended on the natural supply of children as well—on natural fertility and on infant and child mortality (Bongaarts & Menken, 1983; Bulatao et al., 1983; Easterlin & Crimmins, 1985). In case of subfecundity, for example, the motivation to postpone a (long-awaited) next birth would not arise.

To the extent that any motivation to control fertility has household economic grounds, a crucially important variable is the family budget. In the European working classes, the earnings of the fathers have hardly ever been sufficient to survive. The contributions of women and children have mostly been necessary and often outweighed the husband's earnings (Camps-Cura, 1998; Fontaine & Schlumbohm, 2000; Vanhaute, 1998). In the 19th century, one possible strategy for enlarging the family budget was wage-work by both women and children in the local industry.

Szreter (1996, pp. 310–366) has argued that differences in the timing of the fertility transition in Great Britain reflected to a large extent differential waged labor market participation by women and children. "Probably the single factor most consistently and thoroughly related to the range of fertility variation found in 1911 was the way in which local labor markets were age and gender structured," he concluded (p. 531). There was a significant negative correlation between the wages of adult men and wage-work in the local labor market by women and children. Mining towns were typically at one end of the spectrum, with high male wages, low labor market participation by women and children, and generally a high fertility level. Textile cities were at the other end with low wages, high participation by women and children, and low fertility. Most regions were situated between these two extremes (Seccombe, 1993).

The more women worked on the paid labor market, the lower the level of marital fertility generally. These low levels of working class fertility, Szreter argued, were probably not reached through stopping but rather through spacing. This would have been a consequence of the economic role played by children: in regions where many women were engaged in wage-work, child labor was generally widespread as well. Hence, from some age onward, children were contributing to the family budget, a necessity because women's as well as men's wages were typically low in these regions. In this context, birth spacing would have been a reasonable strategy for balancing the family budget (Szreter, 1996, pp. 503–525). In addition, spacing facilitated childcare by older siblings.

Where most women were working at home in Britain, or where they were engaged in wage-work only occasionally, marital fertility remained generally high. A typical example are lace workers: they generally worked at home or in a small *atelier*, together with peers, making labor-intensive products for a trader. Wages were extremely low. An advantage was that this paid activity could continue even when small, dependent children were present. Of all British textile workers, lace makers had the highest marital fertility in 1911. The situation of milliners was very different, although they worked at home and in small *ateliers* as well. The biggest difference was that they were generally working for their own account or were even employers in their own right. "These were businesswomen in an entirely different market position and probably enjoying a situation of relative economic equality vis-à-vis their husbands. For them, too rapid childbearing would disrupt their relatively lucrative economic activities" (Szreter, 1996, p. 507). In other words, the opportunity cost of an additional child was much higher for milliners than for lace workers.

The household economic part of Szreter's analysis can be generalized in a schematic way for testing in other contexts as follows (see Fig. 1). The relative cost of an additional birth is an important determinant of the motivation to postpone it. This cost weighs less when the

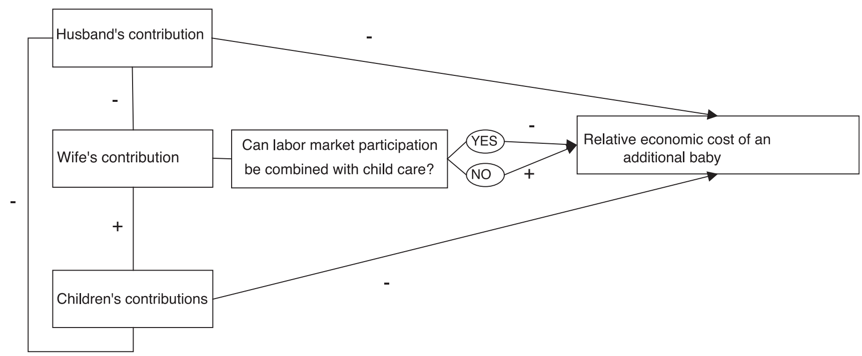

Fig. 1. Relationships between the family members' contributions to the household budget and the relative economic burden of an additional baby.

family budget is relatively high. Only the wages contributed by the husband and children, however, have a simple, direct effect on the cost: the higher their earnings, irrespective of the wife's contribution, the less economic stress caused by a new baby. With respect to the wife's earnings, there are more complex interaction effects: for mothers who did not have to give up their paid work for child care, a new baby caused less opportunity costs than for mothers who had to stop wage-work. The extent to which pregnancy and childbirth causes a loss of income as a consequence of the loss of paid work, depends on social norms and on institutional child care provisions, but also on the characteristics of the job: repetitive work at home, often executed together with children (in general, badly paid, for example, lace-work) can be combined more easily with infant care than work that demands full attention and organizational skill (generally better paid or self-employed, for example, millinery).

To sum up, the following analyses will investigate the hypothesis that birth intervals were partly determined by two household economic factors: the proportion of dependent children and the family budget. With respect to the budgetary factor, a critical distinction will be made between the effect of the father's and the mother's contributions.

3. Setting: work and income in Leuven

We will test the hypothesis that working class families were spacing births for household economic reasons in the context of the Belgian town of Leuven, situated in the Dutch-speaking part of the country but close to the language border. Leuven did not undergo a rapid and large-scale industrialization in the 19th 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 center of education, trade, and transport. The small-scale local industries expanded and modernized only gradually, and included mainly food processing, craft textile producing, tanning, woodworking, and construction. Leuven became an important educational center, offering primary and secondary education to the province, and higher education to the whole country. Activities in the tertiary sector included transit, wholesale and retail trade, and an important military settlement (Van Bavel, 2001b).

3.1. Women's wage-work

According to the 1846 census, 30% of the adult female labor force worked as servants, and 25% were registered without an occupation. Seventeen percent worked in industry, almost always in clothing and textiles, and about 9% in trade (Van Bavel, 2002). Servants were predominantly unmarried women. For many, it was a phase in their life course before marriage when they could save some money (Buyst, 1996). They were therefore much sought after as future brides. After marriage, service generally stopped but still, they had learned about bourgeois manners, consumption levels and patterns, and their norms and values concerning the bearing and rearing of children (McBride, 1974, 1976). This may have influenced their behavior (cf. Szreter, 1996, pp. 311–316). In the following analysis, we will therefore keep track of their status as former domestic servants, even if they were recorded "without occupation" after marriage.

Married women were predominantly registered "without occupation." Certainly, this does not imply that they were not economically productive, or not active on the labor market (Vanhaute, 1997, 1998). Supposedly, all of their other roles besides being wives and mothers were viewed as being of secondary importance by themselves, their husbands, and/or the census taker. Wage-work, even if it were important for the family budget, was probably not the primary role ascribed to these women. Although they may actually have been doing lace-work at home, we expect their fertility to be lower than for women who recorded an official occupation.

According to the industrial census of 1846, most women working in industry were lace makers. For working class, married women, lace making was the most important form of wage-work. Of all women older than age 16 who were recorded as working in an industry, 65% were lace makers and 24% milliners or laundresses, leaving 11% recorded as performing other industrial jobs (see the upper panel of Table 1). Lace makers were mostly working in collective *ateliers*, while milliners and laundresses were generally self-employed, occasionally employing an assistant. The lace-making *ateliers* employed many young children. In 1846, the age distribution of female lace workers under age 17 was as follows: 26% under age 9, 30% between 9 and 12, and 44% between 13 and 17. Few young girls were working as milliners or laundresses: none under age 9, 11% under 13, and 89% between 13 and 17 (Van Bavel, 2002, pp. 231–237).

Milliners and laundresses gained higher daily wages, on average, than lace makers (see lower panel of Table 1). None of the lace makers above age 16 earned more than one franc per day, while 29% made less than half a franc. In contrast, none of the milliners and laundresses earned less than half a franc, while 26% made more than a full franc. In short, the opportunity cost of an additional child was probably higher for the latter than for the former occupational category: milliners and laundresses were doing a job that could not easily be combined with child care and generally earned more than lace makers. The latter, however, could combine their work with child raising. In addition, even at a young age, girls could begin making lace.

Table 1
Female employment in industry: women older than 16 years in Leuven, 1846[a]

	Number of workers		Number of ateliers	Workers per atelier	
	N	%		Excluding children	Including children
Lace makers	303	65.0	32	9.5	37.8
Milliners and laundresses	111	23.8	75	1.5	2.5
Others	52	11.2	499	0.1	
	466	100.0	606		
	% distribution of daily wages (in Belgian francs)				
	< 0.5 fr	0.5–1 fr	1–1.5 fr	1.5–2 fr	
Lace makers	28.7	71.3	0.0	0.0	100%
Milliners and laundresses	0.0	73.9	26.1	0.0	100%
Others	7.7	40.4	44.2	7.7	100%

Source: Industrial census of 1846.
[a] Cottage industry not included.

3.2. Men's wage-work

In 1846, about one-third of the adult male labor force worked in industry, while 18% worked in various sectors. The latter group consisted mainly of day laborers. About one-quarter of the industrial workers were employed in breweries and malthouses. Major employers in Leuven were concentrated in a number of relatively large-scale plants by Leuven standards. There were also a sizable factory producing wallpaper and a large contractor undertaking public works. Besides that, industrial activity was scattered over many small-scale, traditional businesses, usually headed by an artisan who employed a couple of laborers or apprentices (Van Bavel, 2002, pp. 237–242). Day laborers without a fixed job or industrial employer were undoubtedly suffering the most from low wages and economic insecurity. Hence, we expect that this group was more chronically and constantly motivated to postpone the next birth than other occupational groups.

4. Data and methods

Although inferring parity-dependent stopping behavior from quantitative data about historical populations already involves a difficult interpretative issue (Coale & Trussell, 1974; Guinnane, Okun, & Trussell, 1994), demonstrating intentional spacing is even more complicated. In fact, Knodel (1988, pp. 318–319) has cited "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), Ewbank (1989), Knodel (1987), and Van Bavel (2001a) have reviewed the methodological difficulties of demonstrating deliberate spacing behavior.

The main reason why the detection of controlled spacing is hard is that birth spacing varies substantially between populations in the absence of fertility control as well. Important proximate determinants of the length of birth intervals are postpartum amenorrhea, influenced by breastfeeding practices and infant mortality, and fecundability (Bongaarts & Potter, 1983). Even without deliberate manipulation, these determinants vary between individuals, couples, and populations for social as well as physical reasons. This variability needs to be controlled for in order to detect controlled birth spacing. To do this, detailed data are necessary and were collected for the present study.

4.1. Data

Fertility data of three birth cohorts that lived in 19th-century Leuven will be used to investigate the hypothesis of birth spacing for household economic reasons. Detailed marital fertility data were collected from the population registers and civil registration (birth, death, and marriage certificates) (see Gutmann & van de Walle, 1978; Leboutte & Obotela, 1988) for three birth cohorts who lived in Leuven at any point in time between 1846 and 1910, men as well as women, natives as well as immigrants (see Fig. 2). The

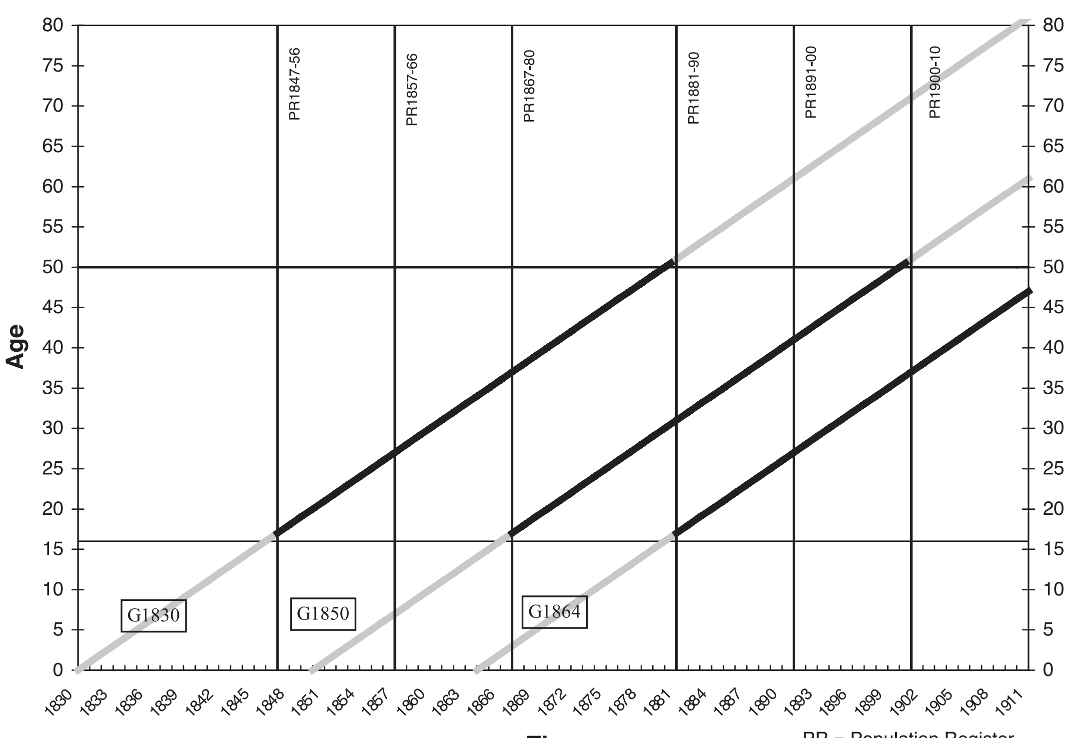

Fig. 2. Design of the sample.

first generation (G1830), 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 (G1850), born in 1850, entered its fertile life phase at a time when marital fertility was starting to decline in Leuven. The third generation (G1864), born in 1864, lived its adult years in full marital fertility transition. This article only uses fertility data from a working class subsample because we expect that spacing played a more important role there than in the bourgeois and white-collar middle classes. The subsample of the latter social groups is too small to allow a replication of the analysis presented below. Van Bavel (2002) provides more details about the sampling strategy and procedures.

4.2. A hazard model for closed birth intervals

The following analyses employs multivariate Cox regression to model the length of interbirth intervals. Since only closed intervals were used, the analysis includes couples with at least two children. More specifically, the dependent variable in the regressions to be presented is the 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 subfecund couples as well as couples who were trying to stop (see Larsen & Menken, 1989; Van Bavel, 2002, pp. 278–280). The date of conception is calculated from the date that closes the interbirth interval by subtracting 40 weeks. Time until conception, not time until birth, has been modeled because the process that determines the outcome of pregnancy is different from the one that determines the timing of pregnancy. At issue here is the latter process.

A number of covariates have been included to control for differences in the natural supply of children, including unintended variability in the length of birth intervals. Table 2 gives information about the distribution of the following covariates:

(a) Age of the wife represents an important biological determinant of fecundability (Wilson, Oeppen, & Pardoe, 1988). This variable is included in the form of the well-known 5-year categories, measured at the beginning of each birth interval.
(b) Marriage duration is highly associated with fecundability, even in the absence of fertility control (Van Bavel, 2003). It is included in the regressions as the exact number of years the marriage has lasted at the beginning of the birth interval.
(c) 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, relatively many 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 were always under observation in the Leuven population registers from the start of their marriage. Therefore, couples who entered Leuven after marriage and for whom the date of marriage was

Table 2
Percentage distributions, means, and standard deviations of the covariates

	G1830	G1850	G1864
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+	6.18%	3.92%	3.15%
Marriage duration (mean, years)	5.74 (4.67)[a]	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			
Laborer	16.69%	12.00%	11.82%
Artisans and shopkeepers	15.99%	22.72%	25.49%
Nonfactory workers	46.09%	46.42%	35.47%
Clerks and nondomestic 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%
Artisans and shopkeepers	4.32%	6.42%	3.36%
Nonfactory workers	5.95%	5.51%	6.94%
Clerks and nondomestic 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%
Laborers	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)
N = Number of interbirth intervals (number of married couples generating these intervals)	857 (214)	1325 (313)	922 (363)

Source: the Leuven Cohort Fertility Project (Van Bavel, 2002).

[a] Standard deviations are in parentheses.

unknown had to be excluded from the regression (66 marriages in G1830, 76 in G1850, and 20 in G1864). The bottom panel of Table 2 displays the remaining number of married couples included in the regression analysis.

(d) The survival status of the previous child has been shown to be an important determinant of the next interval when the previously born infant is breast fed. Death of the infant interrupts breastfeeding, which shortens postpartum amenorrhea (Preston, 1978; Santow, 1987; 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.

(e) In the absence of efficient contraception, parity-dependent attempts to stop procreation are associated with longer final intervals. But even in the absence of fertility control, final interbirth intervals tend to be much longer on average than nonfinal intervals (Anderton & Bean, 1985; Knodel, 1987, 1988). Therefore, to make sure that attempts to stop are not confused with true spacing behavior, a dummy variable differentiates final from nonfinal 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.

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. The occupations of children were usually not recorded.

(a) Occupations were recorded in the population registers at the time of registration, not at the beginning of each birth interval (Leboutte & Obotela, 1988). Yet, it can be assumed that the occupations practiced often changed during the couples' reproductive careers and it should therefore be recognized that the recorded occupations do not allow fine-tuned distinctions to be made in terms of the economic activity in which the men were actually involved. 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 2 provides the distribution over the categories that have been used. Peeters (1996) provided more details about the underlying occupational coding scheme, and Van Bavel (2002, pp. 205–215); Van Bavel, Peeters, and Matthijs (1998) explained how the occupational classification was derived.

(b) 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 19th century (Matthijs, 2001, pp. 68–80). Over the three generations analyzed here, the proportion of married women for whom no occupation is recorded increases as well, from about 50% in the first generation to about 70% in the third (see Table 2). In addition, pregnancy and the postnatal period supposedly forced many women to stop their 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 greater for women who were regularly involved in paid labor than for

Table 3
Cox regression of the hazard of effective conception in closed interbirth intervals, by generation Leuven working classes, 1846–1910

	G1830			G1850			G1864		
	$e^{coeff.}$	S.E.$^{coeff.}$	*p*	$e^{coeff.}$	S.E.$^{coeff.}$	*p*	$e^{coeff.}$	S.E.$^{coeff.}$	*p*
Woman's age									
<25 years (ref.)	1.00	–	–	1.00	–	–	1.00	–	–
25–29	0.92	0.122	.477	0.96	0.084	.646	**0.81**	0.095	.030
30–34	0.90	0.129	.413	1.05	0.094	.622	1.08	0.109	.497
35–39	0.84	0.146	.244	1.08	0.119	.503	0.83	0.145	.189
40+	**0.56**	0.215	.007	1.03	0.187	.895	0.93	0.238	.761
Marriage duration in years	**0.94**	0.024	.007	**0.89**	0.017	<.0001	**0.94**	0.021	.003
Final interbirth interval	**0.74**	0.094	.001	**0.53**	0.078	<.0001	**0.61**	0.081	<.0001
Crude legitimate parity	**1.10**	0.051	.056	**1.17**	0.031	<.0001	**1.11**	0.040	.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									
Laborer (ref.)	1.00	–	–	1.00	–	–	1.00	–	–
Artisans and Shopkeepers	**1.33**	0.131	.029	0.85	0.105	.131	1.09	0.118	.459
Nonfactory workers	**1.27**	0.102	.018	0.95	0.093	.584	1.06	0.113	.589
Nondomestic servants, clerks	**1.42**	0.184	.056	1.28	0.174	.152	0.92	0.173	.629
Self-employed, minimal capital	1.08	0.164	.625	1.06	0.163	.726	0.92	0.177	.654

Domestic servants	1.16	0.222	.498	0.60	0.395	.202	0.79	0.591	.696
Factory workers	1.03	0.156	.837	0.91	0.120	.405	1.09	0.131	.523
Wife's occupation									
No occupation registered (ref.)	1.00	–	–	1.00	–	–	1.00	–	–
Artisans and shopkeepers	**0.71**	0.180	.056	1.03	0.117	.796	0.88	0.188	.513
Nonfactory workers	**0.70**	0.157	.022	0.84	0.124	.147	1.11	0.135	.432
Nondomestic servants	0.78	0.180	.173	0.97	0.194	.857	0.85	0.194	.384
Self-employed, minimal capital	0.44	0.713	.251	1.01	0.307	.982	**1.60**	0.206	.023
Domestic servants	1.01	0.110	.967	0.99	0.117	.937	**0.70**	0.168	.032
Lace workers	**0.84**	0.095	.060	0.91	0.116	.412	–	–	–
Factory workers	1.04	0.414	.917	1.15	0.341	.676	**1.91**	0.219	.003
Laborers	0.63	0.383	.224	0.88	0.156	.419	0.93	0.144	.612
Proportion of dependent children in the household (<9 years old)	**0.64**	0.243	.063	**0.58**	0.209	.009	0.89	0.267	.664
Net parity	1.02	0.034	.492	0.98	0.024	.484	**0.95**	0.034	.099
Number of person years:	1287.88			1882.00			1387.47		
Number of intervals	857			1325			922		
Likelihood ratio χ^2	112.68	df=24	<.0001	238.43	df=24	<.0001	136.31	df=23	<.0001

Statistically significant effects (α=.10) are in boldface.

women who were only occasionally and exceptionally active on the labor market. In other words, some association between recorded occupation and real activity on the labor market is not assumed, but neither is a one-to-one correspondence. The weaker the association, the more difficult it will be statistically to detect real effects of women's labor. Therefore, the estimates presented below can be considered conservative (Van Bavel, 2002, pp. 280–282).

(c) Net parity is calculated as the number of children alive at the beginning of the interval, including children born out of wedlock (in contrast to the crude parity measure, which only includes legitimate births). 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.

(d) The proportion of dependent children alive was calculated at the start of each interbirth interval from the dates of birth and death of the previously born. Infants obviously formed an economic burden. At age 7, 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 labor, but it is not entirely clear from at what age their contribution to the household budget outweighed their burden. Probably, this age increased towards the end of the 19th century (Van Bavel, 2002, pp. 246–257). Given the lack of empirical information at the micro level, age 9 has been used as a hypothetical and average dividing line between being a burden and being 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 who are under the age of 9 years.

Rowntree (1901 [2000]) had already noted that a strong association exists 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 $-.24$, $-.20$, and $-.26$, respectively (all are statistically significant at a level of $\alpha=.001$). This results from the proportion of dependent children generally being the lowest at high marriage durations (Van Bavel, 2002, pp. 285–287), when interbirth intervals are generally longer.

This implies that the estimates for the causal effect of dependent children on birth spacing are conservative. 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 difficult statistically to detect a causal mechanism that works in the opposite direction, namely, deliberate birth spacing (Van Bavel, 2002, pp. 285–287). In conclusion, if we would find a negative effect of the proportion of dependent children on the pace of childbearing (the hazard rate), it would probably be due to deliberate spacing behavior.

5. Results

Table 3 contains the maximum likelihood estimates of the effect parameters in the Cox regression of the hazard of effective conception, modeled separately for each generation. Running a single regression of all cohorts combined with a set of dummies indicating the generation (cf. Kertzer & Hogan, 1989, pp. 170–173) would yield misleading results if the effects of the other covariates changed with time. The regression parameters 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 3 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 in boldface.

The results suggest that the two oldest generations, G1830 and G1850, 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 influenced the pace of childbearing significantly: holding the other covariates constant, the higher the proportion of young children, the longer the time until the next conception. When all living children were under the age of 9, it would take about 36% longer for the arrival of the next child in G1830 ($P < .07$) compared to when no dependent children existed. In G1850, the effect was about 42% ($P < .01$), always holding the other covariates constant. In the absence of spacing behavior, we would expect the opposite association.

To be sure, 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 6% (G1830 and G1864) to 11% (G1850). The effects of crude legitimate parity imply in each generation that at a fixed marriage duration the more children a couple 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 G1864, there is an indication that spacing came to depend on ideal family size: the 5% negative effect of net parity on the hazard rate was statistically significant at the .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 strongly suggests deliberate spacing behavior and, hence, fertility control motivated by the household economy rather than by ideal family size. In the two youngest generations, occupational differences were no longer significant. Analyses not shown here indicate that occupational groups of the second generation differed with respect to stopping behavior, which became general in G1864 (Van Bavel, 2002, pp. 303–308; 2003). In G1830, birth spacing still depended on the recorded occupations of husband and wife. The following discussion is therefore limited to the oldest generation.

Day laborers supposedly had the lowest income and were suffering the most from economic insecurity. In line with our hypothesis, parity progression was indeed slowest in this group. Clerks and nondomestic servants had their next child 42% faster on average. For artisans and shopkeepers, the difference with the day laborers was estimated at about 33%, and for nonfactory workers at 27%. There was no difference between day laborers and factory workers.

The estimated effects of women's occupations were generally in line with our expectations as well. The hazard rate of conception for shopkeepers or women with a recorded occupation in trades or handicrafts was about 30% lower than for women who recorded no occupation. Assuming that much occupational activity remained unrecorded for married women, the real effect was probably bigger. As expected, the effect of lace making was somewhat smaller. This finding is compatible with the hypothesis that lace making could be combined relatively easily with childcare. Although poorly paid, lacework was popular among poor working class women because they could practice it with peers and children, contributing some money to the household budget while supervising and possibly nursing young, dependent children. The group of married, female factory workers is too small to make inferences from the findings presented here (see Table 2). The same holds for the self-employed. Servants were in most cases only formerly employed as such, and gave up their job after marriage. This may be the reason why their birth interval cannot be distinguished from that of women recorded without occupation.

The effects of the other covariates included are important, but not the core issue of the present article. With respect to the age of the wives, it is noteworthy 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 the present interval is the final one. This agrees with the finding that the younger generations were increasingly controlling their fertility by means of stopping behavior. Women of the younger cohorts were truncating their childbearing careers increasingly earlier, depending on their marriage duration and the number of children already born and alive. Van Bavel (2003) further analyzes this process.

The positive effect of crude parity, statistically significant in all three generations, is a result of differences in breastfeeding 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 breast-fed their infants in Leuven (Van Bavel, 2002, pp. 179–193).

6. Conclusion

This article investigated the hypothesis that 19th-century working class families controlled their fertility by means of birth spacing for household economic reasons rather than with an ideal family size in mind. To do this, detailed data were collected to construct, on one hand, a set of covariates that represent the influences of natural fertility on birth intervals and, on the other, a number of variables that represent the hypothetical, household economic motivation to space births. The findings strongly suggest that birth intervals were not merely a function of natural fertility differences and that strategic spacing behavior also played a role.

First, in the two oldest generations, the proportion of dependent children alive had a significant effect on the pace of subsequent childbearing: the higher the proportion of dependent children, the longer the birth interval. This suggests that couples were trying to balance consuming and producing. To be sure, this effect can only be found after controlling for crude parity and marriage duration: without these controls, there is an association in the opposite direction between the pace of childbearing and the proportion of young children.

Second, husbands who had an unstable, badly paid job as a day laborer were generally having their children at a slower pace than husbands with a more stable job and on average a higher wage. As expected, the effect of women’s jobs ran in the opposite direction: stable work that generated higher earnings, on average, was associated with longer birth spacing. Women who could combine their wage-work relatively easily with childcare, particularly lace makers, and women who recorded no occupation were reproducing at a higher rate than the former group. The finding that the relatively well-paid milliners were spacing more than the generally poorly paid lace workers runs against the thesis that our findings are produced by women’s malnutrition.

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 began to stop as a function of net parity. Another contribution will investigate whether spacing behavior continued to play a role during the fertility transition.

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