Seasonality of Births in the Netherlands: Changing Patterns Due to Conscious Planning?

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Abstract

Explaining seasonal patterns of births continues to be a challenge to demographers. Different patterns have been found across and within countries. Little research on seasonality has been done for the Netherlands. We examine seasonal fluctuations in fertility in the second half of the 20th century in the Netherlands. A decomposition into parity and marital status is conducted, in order to shed some light on the observed patterns. Since the 1970s, when the majority of women started to use modern contraceptives, the seasonal pattern of births has changed. This raises the question whether volitional human control is a key determinant in explaining seasonality. The data comes from the Dutch population register, and covers the period 1952-2001. The Dutch pattern takes a middle position between northern and southern Europe, with a peak in births in August and September. First births and marital births determine the general seasonal pattern of births. Higher order births follow a less pronounced seasonal pattern.

Introduction

Seasonality of human births is found in different populations all around the world. Relative to other temporal demographic trends, seasonal patterns are relatively large (Lam and Miron 1991). Different patterns have been found in different countries, within geographical regions, and within subgroups of populations.

Seasonality of births in the Netherlands has been addressed in a small number of international comparative studies, for instance Cowgill (1966), Calot and Blayo (1982), Prioux (1988), and Lam and Miron (1994, 1996). The first objective of this paper is to describe patterns of the monthly number of births in the Netherlands (1952-2001) and to identify possible similarities and discrepancies with the American and European pattern of reproductive seasonality, that have been distinguished in the literature on seasonality of births (e.g. Seiver 1985, Doblhammer-Reiter et al. 1999). The causes and mechanisms behind seasonal patterns of human births are still not fully understood. Based on the literature on explanations of birth seasonality and the limited availability of data, we investigate whether seasonal patterns of births exist for all parities, and for non-marital births, and if so, to what extent they might shed light on the overall seasonality patterns in the Netherlands.

The seasonal variation of births has been studied for many countries and periods, and many different patterns and explanations have been described. As Doblhammer-Reiter et al. (1999) have nicely described, research into seasonality of births may be divided into three categories. The first category is research directed towards identifying the environmental, social and biological *correlates* of seasonality of birth patterns. Other researchers have attempted to identify the *causes of shifts in patterns* of human births seasonality over time. Third, another group of researchers have tried to analyse the underlying *causes of peaks and valleys* in patterns of seasonality of births. In this paper we review the literature on correlates of reproductive seasonality, and attempt to decompose seasonality of births into a parity component and a legitimacy component, thereby trying to disentangle the dynamics of seasonality of births.

The structure of the paper is the following. The paper starts with a short review on the different patterns that have been identified in the literature, and different explanations that have been offered to explain human birth seasonality. Next, the data and research method are described. In the section on findings we present the Dutch seasonal pattern of births in the last 50 years, and compare patterns for overall seasonality to seasonality for different parities and for non-marital births.

Background of the paper

This section starts with a short overview of the general patterns that have been distinguished concerning seasonality of births. It then continues with a review of research on the explanations of seasonality patterns, and concludes with the links between overall seasonality of births and seasonality of births of different parity and legitimacy.

Patterns of human birth seasonality

Seasonal patterns of birth occur relatively stable over time, and within defined geographical regions. However, between geographic regions many different patterns have been found. One of the most important findings in this respect is the identification of the American and European pattern of monthly births. A 'trough' in April, followed by an increase in the number of births in the period after April until the fall, are features of the American pattern. The European pattern of seasonal births is characterized by a peak early in the year (usually the spring), with a decreasing number of births for the rest of the year, but with an exception in September, when there is a peak in births again (e.g. Seiver 1985, Doblhammer-Reiter et al. 1999). According to Lam and Miron (1994) and De Beer (1997) the Netherlands currently takes a middle position in Europe. In Northern Europe the peak of births is in spring (March-April), while births in the Netherlands are (recently) more concentrated in late summer (August-September). In Southern Europe the peak of births occurs either in summer or late summer; the seasonal pattern is less pronounced than the Dutch pattern.

Explanations for human births seasonality

A large variety of hypotheses have been postulated to account for seasonal variations in fertility. Explanations for patterns, peaks and troughs in the monthly distribution of births can be categorized into different classes. A possible typology is one that distinguishes between environmental, cultural and other factors. Environmental, or biological, explanations include theories that link seasonality of births and temperature (Lam and Miron 1996), rainfall (Bailey et al. 1992), cloud cover (Cummings 2002), and hormone level (Seiver 1985). Cultural factors that may influence seasonality of births are marriage seasonality (Avdeev et al. 2001), religious holidays (Rosenberg 1966), seasonal labour migration, and tax laws. Other explanations include for instance registration effects (Anderson and Silver 1988), socio-economic status (Cowgill 1966) and air conditioning (Seiver 1985).

Some researchers have combined external (e.g. photoperiod) and internal causes (e.g. ovarian function linked to nutrition) to explain reproductive seasonality (Bailey et al. 1992). Trovato and Odynak (1993) proposed a theoretical model, demonstrating that most exogenous factors (e.g. seasonal patterns of marriage or Christian holidays) affect birth seasonality through a series of proximate fertility variables like breastfeeding and contraception. An Indian study concluded that a baseline biological seasonality exists, which may be influenced by external factors such as contraceptive use, socio-cultural factors (e.g. caste differences) and climatic factors (Anand et al. 2000). In this paper it was postulated that high summer temperatures reduce conception chances directly (in a physiological way by affecting ovulation, spermatogenesis or foetal loss), or indirectly (in a behavioural way by decreasing frequency of sexual intercourse). A conflicting notion is that male testosterone levels

are higher in the summer, which may lead to increased, rather than decreased, sexual activity (Reinberg et al. 1978). Also, frequency of sexual intercourse may actually reduce during winter (when conception should take place, preceding childbirth in summer), because of the lack of privacy in houses of extended families (Anand et al. 2000). Werschler and Halli (1992) note that the effect of temperature on human birth seasonality is most pronounced in areas where the seasonal variation is extreme. Compared to the results by Anand et al. (2000), Cassel (2001) drew a similar conclusion. The results of the analysis of Swedish data on live births during the period 1900-1999, suggested the existence of a basic biological rhythm, to be modified by the occurrence of festivals. In the 1990s in Sweden, a different pattern was observed than the decades before, with most children born during the summer. Cassel (2001) interpreted this as an increase in the capability of couples to plan when having children, enabled by the use of contraceptives. Lam et al. (1994) made the endeavour of building a model of birth seasonality, including behavioural and biological components of fecundability. According to the authors, some variables influencing fecundability may vary seasonally, such as the length of the menstrual cycle and the probability of foetal loss. Simulations of the model suggest that extreme temperature may cause seasonal fluctuations in the components of fecundability, thereby affecting the number of births nine months later.

Doblhammer-Reiter et al. (1999) argue that a few basic, fundamental causes of seasonality patterns in human reproductive behaviour exist, along with a multiplicity of additional correlates causing small changes in the size and shifts of the peaks and troughs in the number of live births. The September peak, to be observed in both the European and the American pattern, would be caused by the 'holiday theory', found in many Christian cultures, but also in for example Israel and India, meaning an increase in conceptions around Christmas and New Year. The same authors speculate about the causes behind the spring peak. They associate the wish of women or couples to have a child in the spring with rebirth, 'as the physical world is reborn every spring' (Doblhammer-Reiter et al. 1999: 19). These women also might prevent hot weather in the last months of pregnancy. This last type of explanation may be classified into the relatively unexplored category of human volitional control: seasonality of births as a result of purposeful planning by women or couples. In present-day societies, where couples have access to and more importantly, use contraceptives on a large scale, it seems likely that people are able to plan their fertility (Prioux 1988; Werschler and Halli 1992).

However, research into the causality between timing of births and decision-making processes are scarce. The possibility that seasonality of births is a result of conscious planning is a relatively unexplored domain (Doblhammer-Reiter et al. 1999). Werschler and Halli (1992) argued that the periods December-January and July-August are considered the least favourite for Canadian women to give birth, related to extreme weather conditions. Furthermore, many Canadian women in a survey by Werschler (1990, cited in Werschler and Halli 1992) indicated that they tried to avoid planning childbirths during the holiday season in December, because then they would be able to fully participate in the holiday festivities. US college students prefer the spring for having births, according to Rodgers and Udry (1988). Another study by Basso et al. (1995) concluded that European women prefer the summer as a starting point for having children, suggesting the spring as the period for childbirth. CBS (2000) suggested that Dutch women probably act likewise, but do not succeed in

planning the birth of children in the spring, since the peak is in the summer. The preference for spring, but the actual occurrence in summer, was associated with the delay in conception, from the moment of stopping to use contraceptives (CBS 2000). Similarly, Rodgers and Udry (1988) found that the spring trough in the American pattern of birth could be ascribed to the preference of women to avoid births during the winter, but actually contributing to the trough because of the waiting time to conception. Rodgers and Udry (1988) call the phenomenon that the peak of births occurs in unpopular months, and the trough in actual births occurs in popular months, the 'Season-of-Birth paradox'. They explain the paradox by the 'Misinformed Reproducer Hypothesis', meaning that couples do not take the waiting time to conception into account when they start to think about having children.

From the above we may conclude that no single theory has proven to form a complete explanation of seasonal variations in births. Often, environmental or social phenomena have been associated with seasonal patterns of birth, but mostly it was concluded that these factors could not be the single causes for seasonality of births; they were just a contributing factor.

On the basis of the former review of literature we postulate the following. In North-Western Europe no solid evidence exists that environmental factors cause the observed seasonal patterns. We assume that in modern societies it is likely that births are a result of the conscious planning of pregnancies. We expect that seasonality patterns keep on existing because couples prefer spring or summer for childbirth and they can plan their births accordingly because they can control their fertility.

Seasonality of births for different parities and marital status

Some of the research undertaken on human birth seasonality focused on the association between the pattern of the monthly number of births and the patterns of births of different parities and legitimacy. When linked to parity-specific fertility, some of the seasonality may be explained. In the study by Prioux (1988) it was found that children of parity two are more planned than children of a higher birth order. The seasonal peaks of births become less pronounced with increasing rank of birth, i.e. seasonality of births is less obvious for higher order births (Prioux 1988)

Also, by dividing births into marital and non-marital births, some more patterns can be explained. Cowgill (1966) found that illegitimacy of births increases the amplitude of seasonality, i.e. non-marital births follow a more pronounced seasonal pattern than marital births. In the study by Prioux (1988), it was found that non-marital births are nowadays, compared to some decades ago, less conceived in the summer. Prioux (1988) explains this by linking it to the extent to which people can control fertility, that is, non-marital births are less the result of 'coincidental' conceptions. She says that summer was the season popular by 'illegimate loves' (Prioux 1988: 599).

This paper studies seasonality of births in the Netherlands in the period 1952-2001. In this period, major changes have taken place in the level of controlling fertility: Until the 1970s the use of contraceptives was low, resulting in more unexpected and mistimed childbirths, including non-marital births. After the 1970s, the use of contraceptives increased and the timing of pregnancies is more often the result of conscious decisions. We expect a convergence of non-marital births and all births

because of the changed character of non-marital births and the increased ability to plan childbirth

Since for the Netherlands no sophisticated analyses have been done before, the first logical step seems be to identify possible patterns in seasonality of births. Based on the literature on explanations of birth seasonality and the limited availability of data, we investigate whether seasonal patterns of births exist for all parities, and for both marital and non-marital births, and if so, to what extent they might shed a light on seasonality patterns in recent years in the Netherlands.

Data and method

Trends in seasonal patterns of births should preferably be investigated using long time series of vital statistics data. This paper uses vital statistics data published by Statistics Netherlands (CBS). The data are obtained from the Dutch population register (GBA, the Municipal Registration System), which are published in the electronical database StatLine (CBS 2004) and the monthly publication 'Maandstatistiek van de Bevolking'. Since data on seasonality of births in the Netherlands in StatLine are only available for the years 1995 to 2001, data from 'Maandstatistiek van de Bevolking' were taken for the years 1952-1994. The data are categorized into different (biological) parities, namely all, parity 1 (1952-1969), parity 1, 2, 3, and 4 and higher (1970-2001). Furthermore the data were sorted in marital and non-marital births for the whole period under study.

As is common in research on human birth seasonality, we calculated moving averages. A moving average is a form of average that has been adjusted to allow for seasonal or cyclical components of a time series. It is a smoothing technique used to make long-term trends of a time series clearer. Following Seiver (1985), the trend contamination of pure seasonality is reduced by converting each month's births to a centered twelve-month moving average of births, and normalizing the number to 100 percent:

$$Ma_j = \frac{B_j}{\sum_{i=j-6}^{i=j+5} B_i} * 1200$$

Where Maj is the moving average of births in percent, for month j, and Bj is the number of births in month j.

Then, the moving averages are corrected for both the number of days per month and for leap years. Finally, to smooth results, for every month 5-year averages were calculated. The end result is a reproductive seasonality index. The values of this index vary around 100. If the index is 100, the number of births occurring in that month is exactly what one would expect according to the number of births in the year surrounding the month, and the number of days in that month and year. If the value of the index is over or under 100, the number of births is more, respectively less, than one would expect.

The available dataset covers the period 1952-2001. To avoid complex graphs, we have selected several periods to show seasonal birth patterns. For instance, to display changes in patterns since the 1950s we chose the periods 1960-64, 1970-74, 1980-84 and 1990-94. Data on parity 2, 3 and 4 and higher was only available since the year 1970. Therefore we chose two time periods to compare trends in seasonality for different parities: 1975-79 and 1995-99.

Findings

In this section we start with a historical overview of birth seasonality in the Netherlands. This description is based on the limited literature that exists on the subject. Next, possible similarities or discrepancies with the American and European pattern of seasonality of births are described. Seasonality of birth patterns for different periods since the 1950s are examined, with a focus on shifts in patterns, patterns for different parities, and patterns for non-marital births.

Seasonality of births since the 19th century

Little is known about historical patterns of seasonality of births in the Netherlands. Historical monthly birth data are not available through StatLine (see Data). In recent years, only 3 short articles on historical trends in seasonality of births were published by CBS (De Beer 1989, 1997; CBS 2003). According to Prioux (1988) and CBS (2003), several shifts in seasonal patterns of births have occurred in the Netherlands during the 20th century. The first shift in patterns was observed during the 19th century. Around the year 1850, June and July were the months in which the fewest number of births took place (De Beer 1989). Ever since, the number of births in the summer has increased. In the beginning of the 20th century, most births occurred during the first quarter of the year, with a sharp decrease after March, and a local peak in September. Around the 1950s the peak in the beginning of the year had dampened, although most births still occurred in the first months of the year. The decrease in summer had disappeared, but the decrease at the end of the year still persisted (CBS 2003).

A prototype European pattern?

When we compare the above with the European and American pattern, we may conclude that at the beginning of the 20th century the Dutch pattern resembled more or less the European pattern, with a peak of births in the beginning of the year, a decreasing number of births in the remaining months, and a local peak in September. Around the 1950s, seasonality seems to have declined. The peak in the beginning of the year is less pronounced, the September peak has disappeared, and the end of the year seems to have to compensate for the peak in the beginning of the year. Lam and Miron (1994, 1996) present data for the Netherlands for the period 1941-84 and 1951-84 respectively. They argue that the Dutch pattern is similar to that of England and West Germany, with seasonal amplitudes of about 15 percent. In the time period 1941-84 the Dutch pattern of birth seems to follow the European pattern quite closely, with a global peak in the spring, a local peak in September, and an October to December trough. In the period 2000-2002, the pattern has completely changed again, according to CBS (2003). Currently, most children are born in August and September. According to De Beer (1997) the Netherlands (together with Belgium) currently takes a middle position in Europe as far as seasonality of births is concerned. Compared to northern Europe, where the peak of births is in the spring, Dutch births are more concentrated in late summer. In southern Europe most children are born either in summer or late summer. Similarly, Lam and Miron (1994) conclude that the Netherlands take a position in between northern en southern Europe. In their analysis, Sweden and Finland represent northern Europe, where the pattern is relatively outspoken, with high spring peaks. For France, Italy and Spain a different pattern is observed, with a still present, but less marked, European pattern of seasonality of births.

Shifts in seasonality patterns

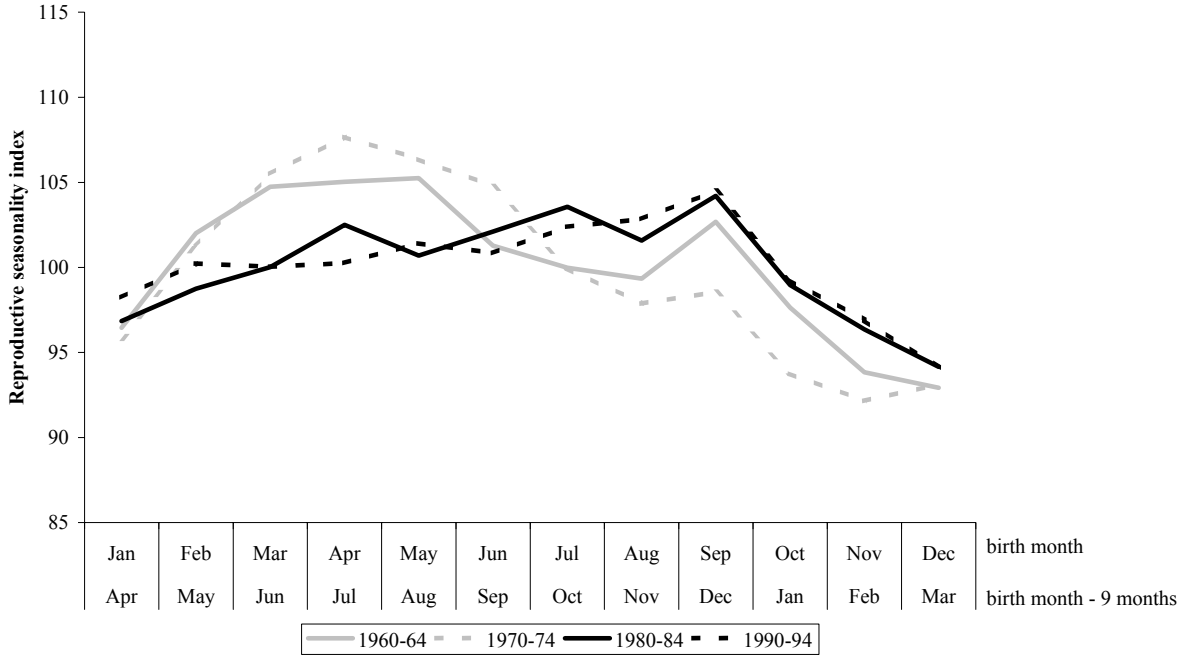

Figure 1. Seasonality of births in the Netherlands, 1960-1994

Figure 1 shows the seasonality of births in the Netherlands for the periods 1960-64, 1970-74, 1980-84 and 1990-94. A shift has occurred in the seasonal pattern of births in the Netherlands. Seasonality of births in the 1950s, 1960s and 1970s is characterized by a peak in spring, followed by a trough, and a local peak in September. The period October-January is characterized by a relatively low number of births. This pattern reflects a peak in conceptions in summer, and a peak in conceptions around the Christmas holidays. The annual pattern of births in the 1980s and 1990s shows a peak of births in summer and late summer, with a clear peak in September. Again, the period October-January is characterized by a relatively low number of births. The pattern reflects a concentration of conceptions around November-December.

Seasonality is more pronounced for first births

The pattern of first births (accounting for almost 50 percent of all births) indicates a pronounced seasonal pattern for both 1960-64 and 1990-94 (figure 2). In particular the September peak is higher for first births. This could mean that couples have a preference for summer for especially first births – it could indicate that first births are more planned than higher parity births that could be more 'accidental'. These preferences might result in a more pronounced seasonal pattern of first births.

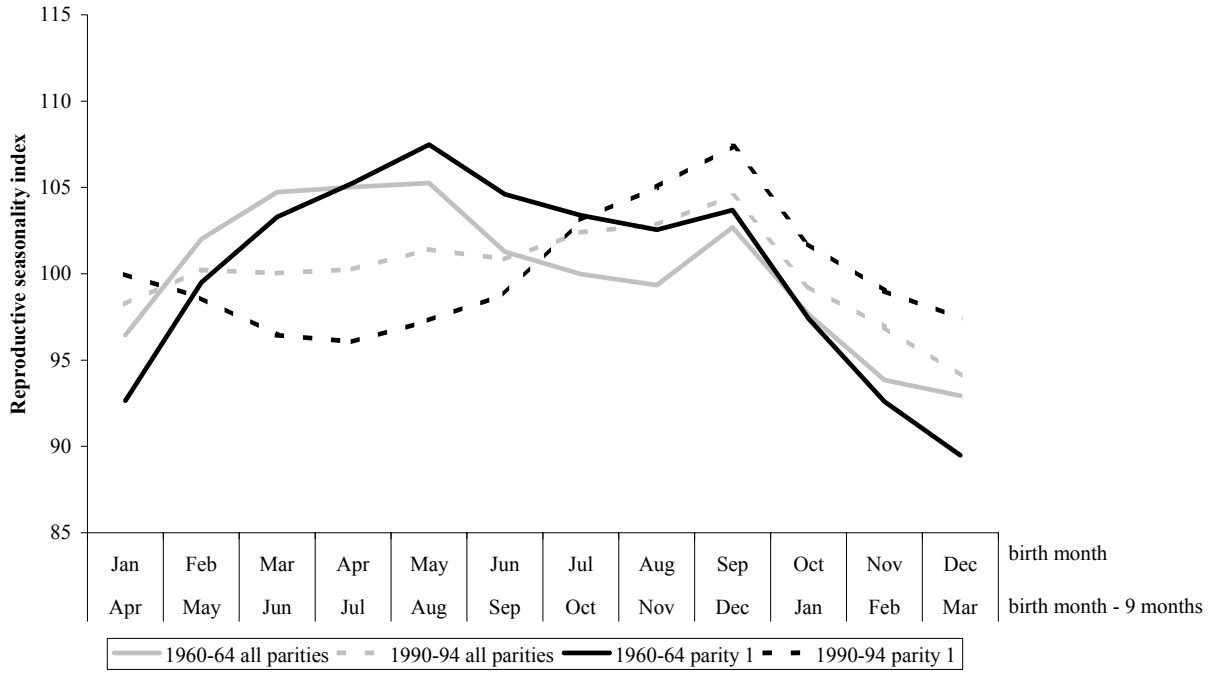

Figure 2. Seasonality of births, all parities and parity 1, 1960-1964 and 1990-1994

Figure 3 and 4 show the seasonality of births for different parities for the periods 1975-79 and 1995-99. Seasonality of births is changing over the years: in the later period we observe a less obvious seasonal pattern for all parities than in the former period. The differences between seasonal patterns of births of different parities seem to disappear: the seasonal pattern seems to converge.

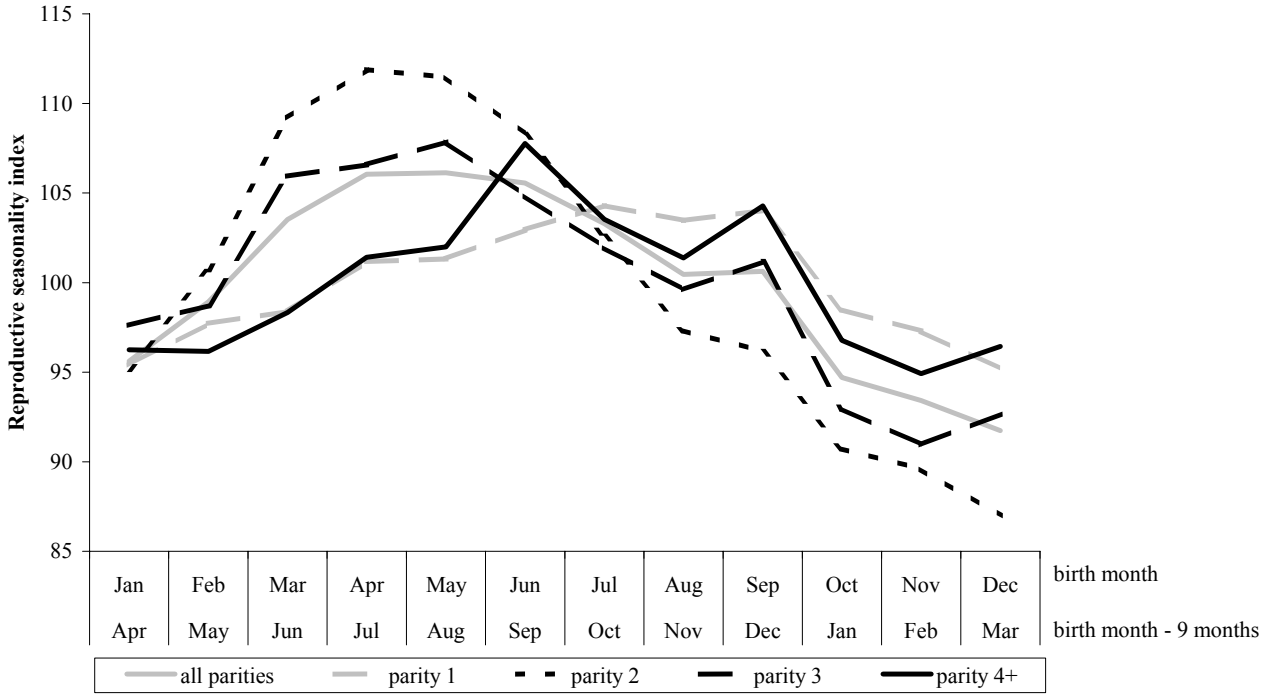

Figure 3. Seasonality of births, 1975-1979, comparison between parities

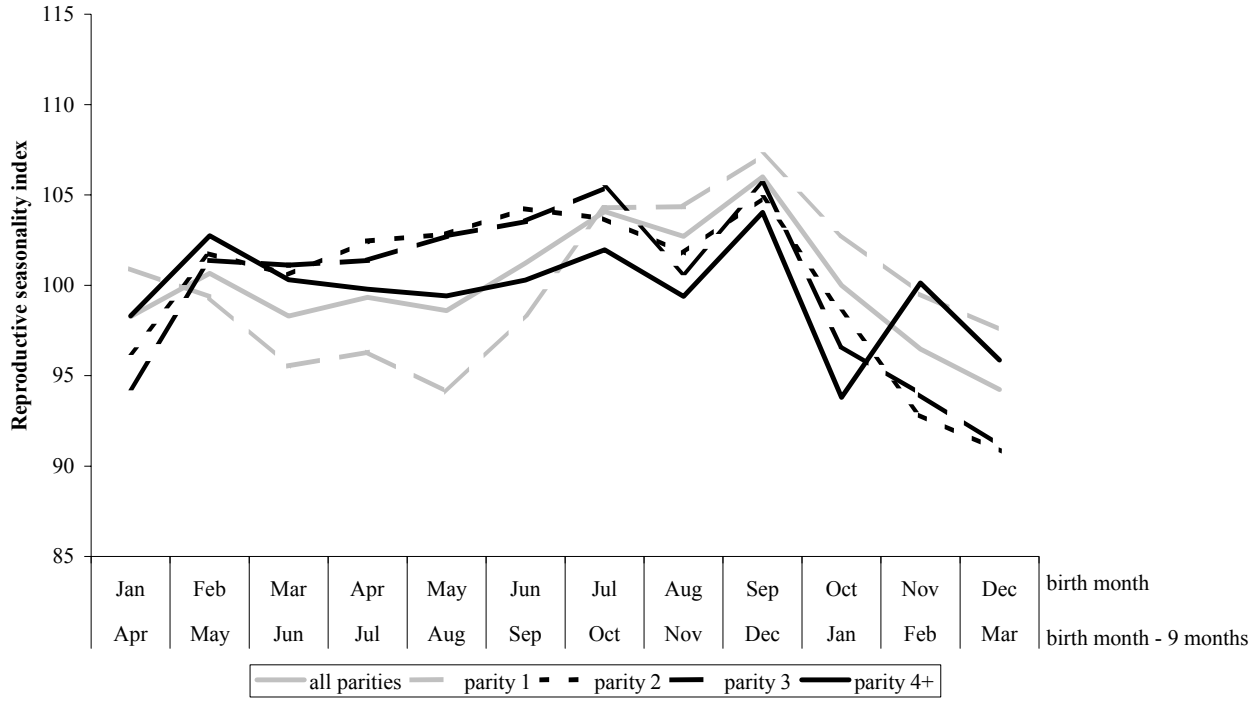

Figure 4. Seasonality of births, 1995-1999, comparison between parities

The seasonal pattern of births of parity 1 is most pronounced in both periods. First births account for almost 50 percent of all births, and determine the pattern for all parities. As we found before, the September peak is higher for first births, and the trough in the spring is deeper. Most first births are conceived in the period of August to October. This could be a reflection of the wish for summer births, assuming that seasonality of births is a planned phenomenon.

The patterns of births of parity two and three are quite different from the pattern of first births: births occur more than average from February to August for both parities and both periods, and occur much less than average in the last months of the year. Births of birth order four and higher follow a less obvious seasonal pattern. This might indicate that higher order births are less planned than first births, resulting in a more obvious seasonal pattern.

A remarkable observation is that in 1975-79 the seasonal pattern for parity 2 is very pronounced. Furthermore, in both periods, the September peak is persistent. This could be a combination of the wish for a summer birth and the Christmas holiday effect.

Non-marital births: convergence to all births

The share of non-marital births in the total number of births has undergone an enormous change in recent decades. In the 1950s only one percent of all births was born out of wedlock; in the 1960s and 1970s this slightly increased to two percent. The onset of the greater increase was in the 1980s, when the percentage increased to about eight percent. The greatest increase was attained in 1990, when 11 percent was non-marital. In recent years, a steep increase was observed, with a rise from 15 percent in 1995 to 27 percent in 2001 (CBS 2004).

Figure 5 shows the seasonal patterns of all births and non-marital births. The seasonal pattern of non-marital births clearly deviates from the pattern for all births: non-marital births have a stronger seasonality than all births. Most non-marital births were born in the spring in the 1960s, with a lower number of these births in the rest of the year. This indicates that during the 1960s (and the 1970s), non-marital births were mainly conceived during spring and summer. Starting from the 1980s and continuing in the 1990s, births more and more took place in late summer (July-October), just as marital births. Nowadays, more and more non-marital births are planned births by cohabiting couples, and therefore have a different character than the non-marital births of the sixties and seventies, that were mostly accidental births. As a result, the seasonal pattern of non-marital births is increasingly coinciding with the seasonal pattern of all births.

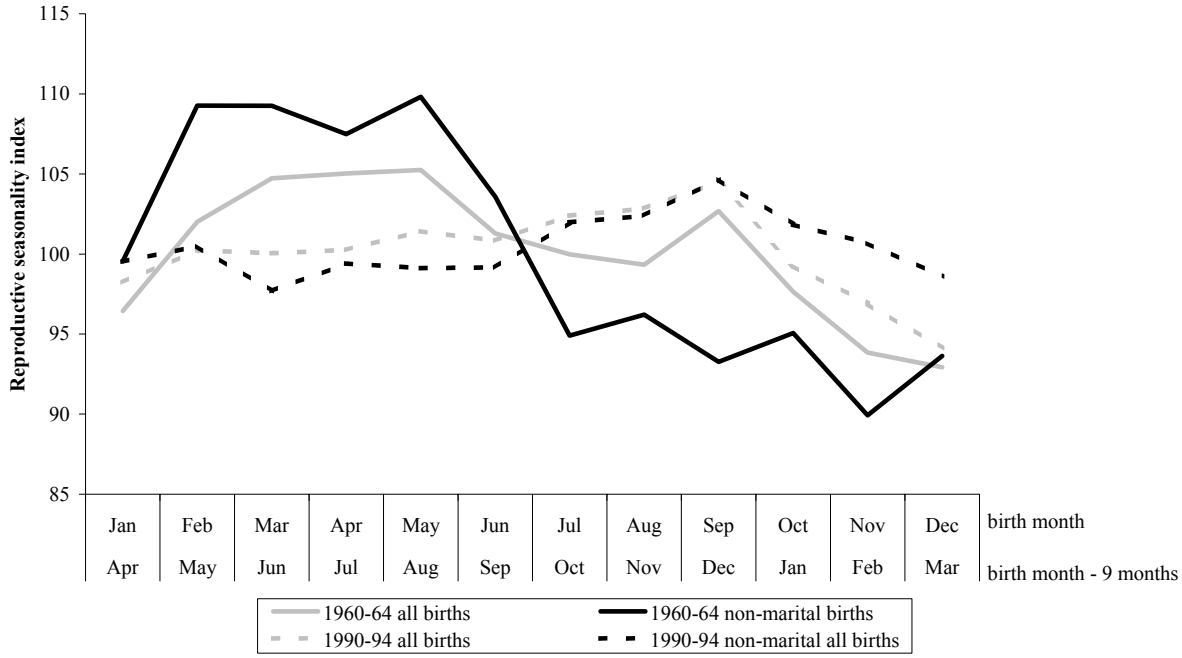

Figure 5. All and non-marital births, all parities

Conclusion and discussion

Overall seasonality pattern

The Dutch pattern of seasonality of births has changed from a pattern with a peak in spring in the 1950s, 1960s and 1970s, to a pattern with a peak in summer and late summer in the 1980s and 1990s. Both patterns are characterized by a relatively low number of births in the winter months and a local September peak.

At the beginning of the 20th century, the seasonal pattern resembled the European pattern, with a peak in the beginning of the year, a decreasing number of births in the rest of the year, and a local September peak. As the century advanced, the peak shifted more and more to later periods in the year. First, in the 1950s and 1960s, a spring preference occurred, changing into a summer preference from the 1980s and 90s onwards. Currently, the pattern is characterised by a peak in August and September, and lower numbers of births for all remaining months. With this pattern, the Netherlands takes a middle position in between northern and southern Europe.

Parity

A seasonal pattern of births is the result of the sum of births of different parities, which have different seasonal patterns of births. For the Netherlands, seasonality of births seems to be mainly determined by the pattern for first births. First births, currently comprising almost 50 percent of all births, follow a distinct seasonal pattern, and seem to occur more in summer. Births of higher orders have a less obvious seasonal pattern. Furthermore, the seasonal pattern of different parities seems to converge.

Non-marital births

The pattern for non-marital births used to be quite different from the pattern of marital births: non-marital births were mostly born in spring, an indication of a peak of conceptions in summer. This correlates with the findings by Cowgill (1966) who found that non-marital births follow a more pronounced seasonal pattern than marital births. Some decades ago, most of non-marital births were ‘accidental’ or the result of extramarital affairs, but nowadays many births occur outside marriage (27 percent in 2001). Therefore, non-marital births are more planned than before, and follow a clear-cut seasonal pattern. The seasonality pattern of non-marital births now approaches the pattern for all births

Planning and preference

On the basis of the literature and the data found, we argue that during the last 50 years in the Netherlands, seasonality of births has been obvious. We observe in all the years from 1952 to 2001 that the September peak is persistent. This peak in births may be the result of the so-called ‘holiday theory’ combined with a preference for spring or summer births. Also because there is no solid evidence that environmental factors are a major contributor to seasonal patterns of births in the Netherlands, we argue that it is very likely that births are a result of the conscious planning of pregnancies. A big question in this research is whether an obvious seasonal pattern of births as a result of purposeful planning is a result of a preference of certain periods of the year for childbirth. This question cannot be answered in this paper. If it is the case that childbirths are a result of planning on the basis of preferences, then Dutch couples have shifted their preferences from spring to summer. Several studies found that many

women or couples do not take the waiting time to conception into account, and this may also be the case for Dutch women: they prefer spring or summer, but the child is then born in August or September. This could be an example of the 'Season-of-Birth paradox', postulated by Rodgers and Udry (1988): the peak of births does not occur in the month or season preferred, because of couples not taking into account the waiting time to conception.

Births of higher orders have a less obvious seasonal pattern. This may indicate that these births are less planned than first births. It could mean that higher order births are more accidental than first births. This is more or less in line with Prioux's (1988) findings, who argued that births of parity two are more planned than children of a higher birth order, although we cannot prove it. What we do find is that the seasonal peaks of births become less pronounced with increasing rank of birth.

To explain the causal mechanisms behind seasonal patterns of birth, more (micro) data on explanatory variables is needed. A qualitative survey on the decision-making processes preceding childbirth could shed some light on the causal mechanisms operating behind seasonal patterns. Do women or couples have preferences for certain seasons or months for childbirth, and if they do, do they plan their childbirth accordingly? Further research should focus on decision-making processes of couples concerning childbirth. A prospective study in which couples or women are followed through time, disentangling their possible preferences and their ways to accomplish these preferences, including the 'results' (are children really born in the preferred period?) could help in the search for the explanation of seasonality of births.

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