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Reflexion

Anticipatory analysis and its alternatives in life-course research. Part 2: Two interacting processes

Jan M. Hoem

Michaela Kreyenfeld

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Demographic Research – Volume 15, Article 17
reflexion

Anticipatory analysis and its alternatives in life-course research. Part 2: Two interacting processes

Jan M. Hoem [1]

Michaela Kreyenfeld [2]

Abstract

In the present second part of these reflections, we use the connection between marriage and first birth to demonstrate further issues involved in anticipatory analysis when two individual-level processes operate in interaction. The wish to have children is probably a very important determinant of marriage. Unfortunately, longitudinal data on fertility intentions are rarely available. In order to demonstrate how childbearing intentions guide marriage behavior, one might be tempted to use anticipatory research strategies. In this paper we discuss the drawbacks involved with such an approach and display a non-anticipatory research strategy.

[1] E-mail: Hoem@demogr.mpg.de
[2] E-mail: Kreyenfeld@demogr.mpg.de

1. Introduction

As common sense would tell us, people are rational actors who plan their lives ahead of time. (For traces in the literature, see, e.g., Buchmann 1989; Willekens 1991: 14; De Bruijn 1999.) Behavior will be guided by expectations about the future. In this sense, it is the very nature of human behavior to be anticipatory. Take childbearing and marriage formation. Surely, people who form a partnership consider the possibility of marrying the partner. Correspondingly they marry because they want children or they buy a house in anticipation of family formation. Perhaps they even become happier because they anticipate a marriage or the birth of a child (Clark et al. 2000; Stutzer 2006). How one can draw such intentionality into empirical analysis of data that contain no explicit information about intentions has caused considerable concern, however, particularly since methodologists keep warning us about the dangers of anticipatory analysis. In this paper the critical question is how one can address these aspects in life course research, given that access to longitudinal data on people's intentions rarely are available.

With this in mind we discuss two approaches that aim at unraveling the interrelation between childbearing and marriage. The first approach is based on an anticipatory research strategy that we have found in the literature, but that we find problematic. A second approach that draws on standard ingredients in elementary event-history analysis avoids these problems. It contains no real novelty, but it seems little known among practitioners, and we have decided to make our reflections generally available, particularly since discussions of these issues seem to be rare. We hope that a clarification will prove as useful to others as it has been to us.

2. Marriage in anticipation of parenthood

For a description of how a future event impacts on current attitudes and behavior, the following suggestion can be found in the literature (see, e.g., Huinink 1998; Clark et al 2000; Mulder and Wagner 1998, 2001; Feijten and Mulder 2002; Stutzer 2006). It runs like this.

Suppose the analyst is dealing with two interacting processes, such as marriage formation and childbearing. Then proceed as follows: Fix an event on one of the processes (i.e., select a birth, say) and study individual behavior on the other process (marriage formation) in relation to the given event on the first (the birth). Subtract the time of occurrence of an event on the second process from the fixed time of occurrence of the first and use this difference as a waiting time for the second process, whether the difference is positive or negative. (The difference will of course be negative if the event on the fixed process occurs before the event on the other process.) In imitation of this approach we use such a

procedure here to see whether one can say that marriages often are formed in anticipation of entry into parenthood. To this end, we fix the time of first birth to a woman and let marriage be a process which we study in relation to the first birth. We then calculate the duration of marriage at first birth by subtracting the respondent's age at marriage from her age at first birth. This duration will be negative if the child is born before marriage formation.[3] We then compute and plot occurrence/exposure rates[4] of marriage by this duration and see that marriages are heaped around the arrival of the first child, as in Figure 1.

For this empirical illustration we have used data from the German Family and Fertility Survey of 1992. We have selected women aged 30 to 39 years at the date of interview and have omitted respondents with invalid fertility or marriage histories. The computation just described cannot be done for childless respondents (one has to fix the time of entry into motherhood), so we have omitted them and got a remaining sample of 886 cases and 840 first marriages. The computations produce a curve of marriage risks (occurrence/exposure rates) as in Figure 1, which shows a clear pattern. Two years before first birth, marriage risks quickly increase, they peak during the year when the child is born and fall off rapidly thereafter. This looks like a strong coupling of the two events (marriage and first childbirth). According to this type of analysis, marriages are likely to happen shortly before childbirth, the interpretation being that many marriages are triggered by the *motivation* to have a child soon. If people make scripts of their lives, couples would think in terms of a plan for a good while ahead and would let plans for future childbearing guide present marriage formation behavior.

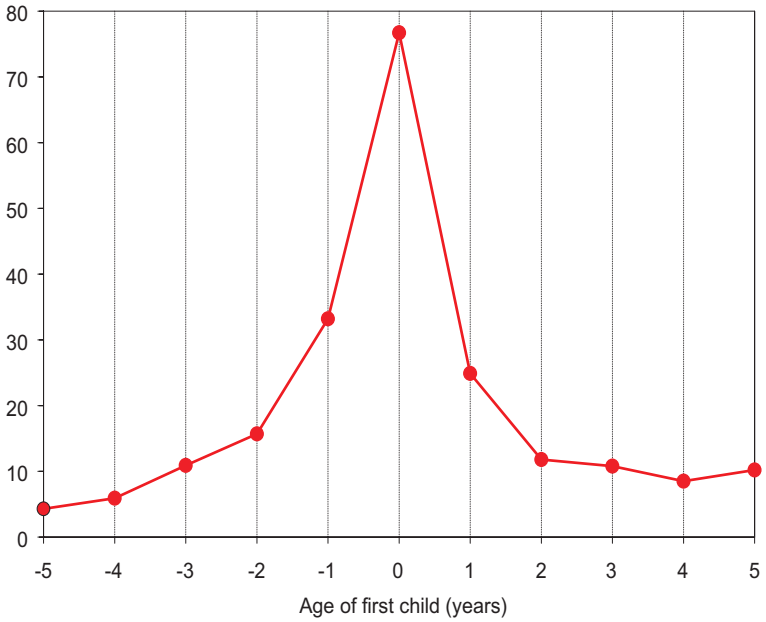
The question is whether one can legitimately interpret such a result as an indication that marriages are formed in anticipation of parenthood. Obviously, we only observe manifest fertility behavior, but one could argue that future fertility behavior must be strongly correlated with past fertility intentions. When marriage risks are higher two years before a child is born than five years before, can we then assume that childbearing intentions were lower five years before childbirth than two years before childbirth? An argument along these lines seems to support the hypothesis that childbearing intentions guide marriage behavior.

The pitfall in this argumentation is that current childbearing behavior is only loosely associated with past fertility intentions. Many births are unplanned. Conversely, some

[3] If one subtracts the age at marriage from the age at first birth, one gets negative values for respondents who married after they had their first child. Most computer programs will not estimate a survival or hazard function for negative durations. If one adds some arbitrary high number to the process time, one can perform the analysis.

[4] We use the term "occurrence/exposure rate" here as shorthand for "the number of marriages observed divided by the number of person-years recorded for the subpopulation that experienced the key event whose time we have taken as fixed". For the left-hand side in Figure 1 this is some kind of conditional occ/exp rates and not the regular occ/exp rates used in the right-hand side. Some colleagues may not like this usage, but we trust that such terminological simplification has some merit.

Figure 1: First marriage rates per 1000 women months, by age of first child.



Notes: The sample comprises West German mothers aged 30 to 39 at the time of interview. The hazards are estimated for single years of age of the child (see Table 1). The hazard rates are plotted against the start of each age interval.

Source: German Family and Fertility Survey 1992 (our own estimates).

women might have gotten married with the intention to have children but never actually gave birth. These cases are not considered in the analysis, and that would bias the outcome.

It must also generally be problematic that the analysis only comprises respondents who actually experience a first birth. In fact the first birth must even have occurred before the end of the period of observation. However, childbearing had not come to an end for "our" respondents when the data were collected, so many respondents are eliminated needlessly.

Finally, while a good analytical procedure would treat the two events (marriage and childbearing) in a reasonably symmetric manner, procedures of the kind just described introduce a basic asymmetry between them, since it requires that one take one of the two

Table 1: First-marriage rates per 1000 woman-months, by age of first child.

Age of child (in integer years)	Absolute marriage risks
-5	4.3
-4	5.9
-3	10.9
-2	15.7
-1	33.2
0	76.7
1	24.9
2	11.8
3	10.8
4	8.5
5	10.2

Notes: The sample comprises West German mothers aged 30 to 39 at the time of interview.
Source: German Family and Fertility Survey 1992 (our own estimates).

events as given. For this "fixed" process one cannot consider the censored cases (i.e., births after the time of data collection cannot enter the analysis, as we just mentioned). A better procedure should avoid these weaknesses.

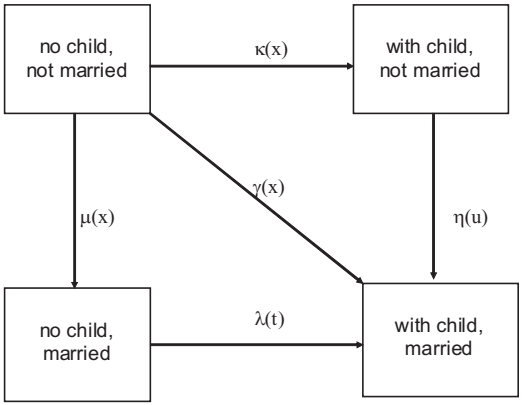
3. Separate modeling of the different transitions

Methods for studying interrelations between two life-course processes have roots going back almost a century (DuPasquier 1912/13; see also Simonsen 1936). The ideas have also become common in contemporary event-history research (see, e.g., Courgeau and Lelièvre 1992: 82ff.; Petersen 1995; Blossfeld and Rowher 2002: 134ff.). The first step in a non-anticipatory procedure is to define a status space as in Figure 2. Boxes represent life-course states and arrows indicate possible transitions; the functions written beside the arrows represent transition intensities (hazards) that here depend on age x, duration t of marriage, and duration u since first birth, as the case may be.[5]

In this picture, $\kappa(x)$ denotes the first-birth intensity of a (childless) unmarried woman at age x. Her marriage-formation intensity is $\mu(x)$, and she has an intensity $\gamma(x)$ of the simultaneous occurrence of marriage formation and a first birth. The two latter hazards represent risks that compete with the risk of having a child while unmarried. Similarly, $\lambda(t)$ denotes the first-birth intensity for a woman who has been married for t months, and $\eta(u)$ denotes the first-marriage intensity for a woman with a child born u months ago. For

[5] If we take conception to occur a standard nine months before childbearing, we can let u be duration since conception.

Figure 2: State space of transitions around marriage formation and first birth.



simplicity of argument we disregard the woman's age in the two latter intensities, and we also disregard complications like marriage disruption and mortality.

Figure 3a through Figure 3d show the estimated hazard rates. We have included the intensity $\gamma(x)$ of the simultaneous occurrence of marriage formation and a first birth in Figure 2 because of its interest in principle,[6] but it cannot be represented by a hazard rate for our data set. There are only nine respondents (out of 1.003 for whom we have a first marriage recorded) who experienced birth and marriage in the same month, and this is too few to draw a sensible curve. In practice, we take $\gamma(x)$ to be identically zero in this application.

4. Mirrored hazard rates[7]

The procedure that builds on the transition space in Figure 2 and on the intensities in Figures 3a-d and Table 2 represents the dynamics of the interactions between marriage and first birth, but it does not lead immediately to anything like the neat curve in Figure 1, which seemed so nicely to demonstrate the strong coupling of marriage and childbirth.

[6] See for instance the attention that Petersen (1995) has given the question of a simultaneous transition.

[7] In order to describe the coupling of two events, Billari (2001) introduces the term "mirrored survival curves". We adopt the "mirror" terminology for the representation of the back-to-back hazard diagrams that we will soon introduce.

Figure 3a: First-birth rates per 1000 woman-months, childless unmarried women.

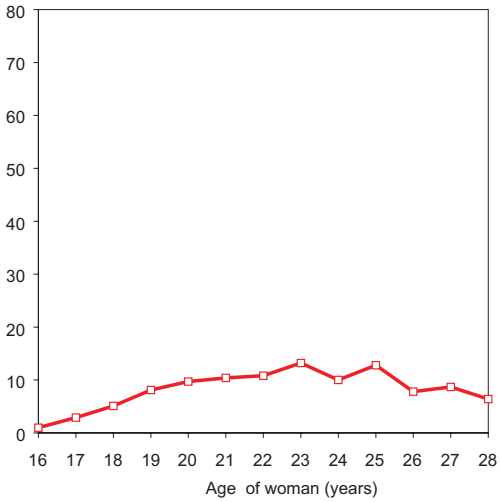


Figure 3b: First-marriage rates per 1000 woman-months, childless women, all ages combined.

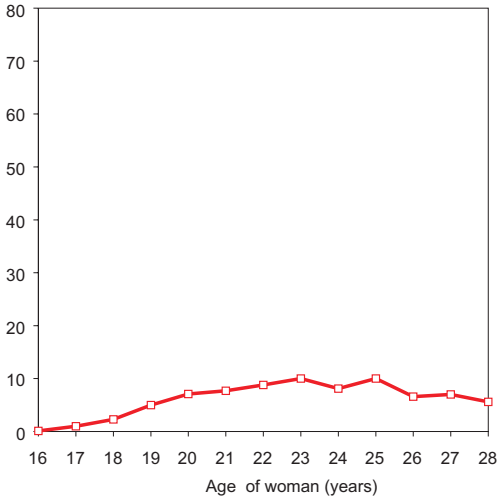


Figure 3c: First-birth rates per 1000 woman-months, childless married women, all ages combined.

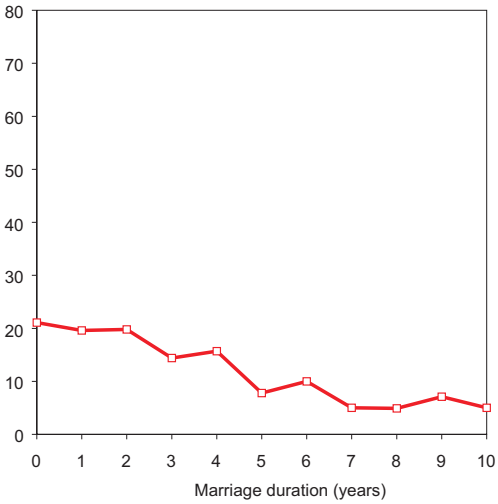
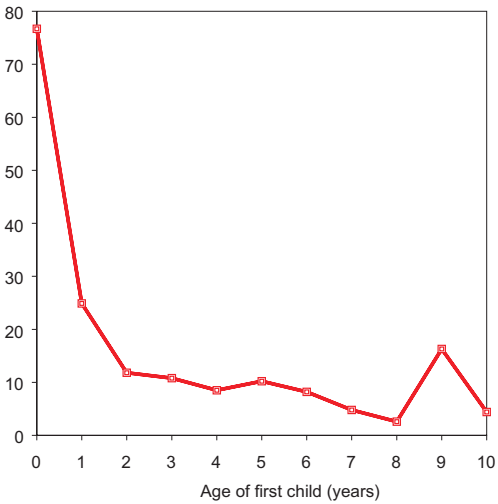


Figure 3d: First-marriage rates per 1000 woman-months, women with children, all ages.



Note: The sample comprises West German women aged 30 to 39 at the time of interview. The hazards are estimated for single years of age (see Table 2). The hazard rates are plotted against the start of each age interval.

Source: German Family and Fertility Survey 1992 (our own estimates).

Table 2: First-birth and marriage rates per 1000 woman-months.

Age of woman	Marriage risk $\mu(x)$	Birth risk $\kappa(x)$	Age of first child (u) or duration of marriage (t) in years	Marriage risk $\eta(u)$	Birth risk $\lambda(t)$
16	1.0	0.1	0	76.7	21.1
17	2.9	1.0	1	24.9	19.6
18	5.1	2.3	2	11.8	19.8
19	8.1	5.0	3	10.8	14.4
20	9.7	7.1	4	8.5	15.7
21	10.4	7.7	5	10.2	7.8
23	10.8	8.8	6	8.2	10.0
24	13.2	10.0	7	4.8	5.0
25	10.0	8.1	8	2.6	4.9
26	12.8	10.0	9	16.3	7.1
27	7.8	6.6	10	4.4	5.0

Notes: The sample comprises West German mothers aged 30 to 39 at the time of interview.
Source: German Family and Fertility Survey 1992 (our own estimates).

The following procedure moves toward a similar picture by combining two of the separate transitions.

In Figure 4, we have plotted the two functions $\lambda(t)$ and $\eta(u)$ from Figures 3c and 3d back-to-back in a diagram with the origin ('zero-point') in the middle of the abscissa, the duration t of marriage running leftwards from that origin, and the age u of the first child running rightwards. The right-hand curve in Figure 4 is the same as the right-hand branch of the curve in Figure 1. The left-hand curve is, however, different. In Figure 1, the left-hand curve represented the first marriage risks before first birth. In Figure 4, the left-hand curve represents first birth risks by marriage duration. In principle, both processes are similar. If there is an increase in marriage risks before childbirth, one would also expect that there is an increase in birth risks after marriage. However, this pattern is not supported by this figure. Contrary to Figure 1, Figure 4 does not show much of an increase of birth rates after marriage. We see problems with a representation in the manner of Figure 1 of the possibility that many marriages are formed with the intention of producing a birth. It is hard to represent intentionality in event-history analysis unless one measures intentions explicitly. At best one can account for the coupling of the two events via back-to-back hazard curves as demonstrated above. Our conclusion is that an anticipatory research strategy will not unravel intentional behavior.

In all fairness to the presentations in the literature we want to point out that the differences between the two types of curves (as in Figures 1 and 4) become less dramatic if one chooses a different representation of the facts. What makes Figure 1 so striking is that the

fertility rate is given as a single curve point plotted against the left-hand start of each age group (for the child). In reality, the occurrence/exposure rates have been computed for (single-year) age intervals as usual. Plots where the rates are given as step functions over the corresponding intervals (Figures A1 and A2 in the Appendix) give a more realistic picture where the differences are more muted but still considerable.

Figure 4: Back-to-back hazard rates per 1000 woman-months.

Note: The sample comprises West German women aged 30 to 39 at the time of interview. The hazards are estimated for single years of age. The hazard rates are plotted against the start of each age interval.

Source: German Family and Fertility Survey 1992 (our own estimates)

5. Conclusions

The goal of both parts of this two-part paper has been to discuss pros and cons of anticipatory analysis in life course research and to indicate that there are safer non-anticipatory research strategies, although they also sometimes have their problems. In Part 1 (Hoem

and Kreyenfeld 2006), we addressed the interrelation between education and fertility and found it cumbersome to provide summary fertility indicators for women at different educational levels without conditioning on the future. A major problem was that the data on educational attainment was very incomplete. In the present Part 2 we have focused on the empirical analysis of two parallel event-history processes for which one has "complete" information. We have shown that an anticipatory procedure makes marriage intensities appear to increase in anticipation of parenthood, while a non-anticipatory approach provides a different picture.

We make no pretense that this paper provides anything really novel in the methodological literature. We feel, however, that our contribution has clarified some matters that need not remain problematic, the way they appear in the current empirical literature. We hope that our two case studies can serve as a reminder that the risk of bias inherent in most anticipatory analysis can be avoided if one uses procedures not much more difficult than a simple extension of age-old life-table methods.

6. Acknowledgement

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Appendix

Figure A1: First-marriage rates per 1000 women months, by age of first child, represented as a step function. Compare Figure 1.

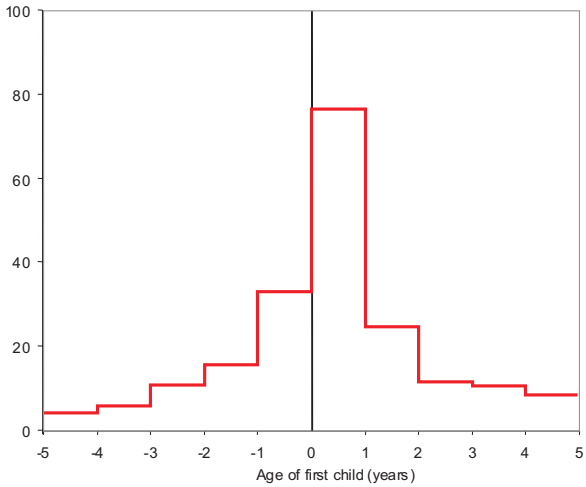

Figure A2: Back-to-back hazard rates per 1000 woman-months, represented as step functions. Compare Figure 4.