Measuring the educational gradient of period fertility behaviour in Europe

Angela Greulich*, Laurent Toulemon[$]

Abstract

This article provides new measures allowing comparing within-country differences in current fertility behaviour in Europe. By mobilizing data from the European Union's Survey of Income and Living Conditions (EU-SILC), we measure the educational gradient of period fertility for a large set of European countries. A semi-retrospective approach serves to observe fertility behaviour of cohorts which are currently at childbearing age, while at the same time recording the educational level correctly. Bayesian statistics allow us obtaining credible intervals for the age-, education- and parity specific birth probabilities for each country. Our illustrated birth intensities by age put forward in how far differences in the timing of births, which appear during the beginning of the reproductive period between women of different education levels, can result in differences in the quantum of fertility at later ages. The study reveals important cross-country differences in the educational gradient of the timing and intensity of childbearing. This suggests that in several European countries, institutional barriers hinder some groups more than others to realize their fertility intentions. In comparison to studies focussing on cohorts which have already completed fertility, we find that in several European countries, it is not necessarily the highly educated women who are the most constrained when it comes to current fertility behaviour.

Keywords: total fertility rates, period fertility by education, tempo, quantum, Europe

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* Observatoire Sociologique du Changement (OSC), Sciences Po, Paris (France).

[$] Institut National d'Etudes Démographiques, Paris (France).

Extended abstract:

Summary

Fertility is currently stagnating or decreasing anew in many European countries, leading to total fertility rates that are below the replacement level (2.1 children per women) in most European countries. As the large majority of European citizens declare wanting to have two children, below-replacement fertility seems to be due to institutional barriers rather than to preferences.

It is rather well-documented today how these barriers differ between European countries, but little is known so far about which socio-economic groups within European countries currently face the most constraints in terms of family formation and why. Knowing which socio-economic group currently struggles the most in achieving fertility intentions within each European country is of absolute relevance to policy, as persistent institutional barriers to family formation cause a tremendous loss of social well-being. And if these barriers affect socio-economic groups differently, they represent an important source of social inequality.

This article intends to comprehensively describe and evaluate within-country differentials in period fertility behaviour in Europe. Due to new analytical methods and a data set that has not yet been used for this kind of demographic analysis, fertility differentials will be quantified for the first time for those cohorts who are currently at childbearing age, by covering the whole set of European countries. Measures of the educational gradient of fertility that exist so far are limited to cohorts who already have completed their childbearing ages; i.e. to cohorts whose fertility decisions were affected by past – but not current – policies. With its focus on period fertility, our results are highly policy relevant.

We will describe how the fertility behaviour differs between education groups, within each European country, for those groups which are currently at childbearing age. Furthermore, we will show to what extent the fertility differentials contribute to current fertility levels in each European country.

In order to deliver non-biased measures of the educational gradient of fertility behaviour for those cohorts who are currently at childbearing age, we will apply a 'semi-retrospective' approach. The use of socio-economic rather than demographic survey data will allow the whole list of European countries to be covered (32 in total), for a time period of 15 years.

Methodology

In order to describe and evaluate comprehensively the educational gradient of period fertility and its context dependency for all European countries, we will use socio-economic rather than demographic survey data: this allows covering the complete set of European countries and a time period of 15 years. Potential measurement biases will be eliminated by post-stratification. Educational gradients will be calculated in order to proxy socio-economic differentials in fertility behaviour. Education, as one important dimension of socio-economic inequality, is a strongly stratifying factor in many areas of socio-economic and demographic behaviour and has the methodological advantage that it evolves uniformly over age (in contrast to labour market participation and income).

To cover as many European countries as possible with the quantitative analysis, we will use the European Union Statistics of Income and Living Conditions (EU-SILC), which has been released on a yearly basis by Eurostat, since 2005. It provides individual and household data for 32 European countries.

Compared to more demographic surveys such as the GGS, the EU-SILC has the advantage of large country coverage and the provision of a broad set of socio-economic variables for all household members. For coverage and comparability reasons, EU-SILC is also preferred to national panel surveys. The availability of comparable socio-economic variables enables controlling for important aspects which are potentially linked to the educational gradient of period fertility (employment status or income, for example). These variables are not only observed for the woman, but for all household members including the (cohabiting) partner.

The EU-SILC data does not provide direct fertility measures, as there is no direct question on the number of children. However, as the survey covers all household members, it allows reconstructing childbearing behaviour by linking parents to children living in the household. With this “own child-method”, we can identify birth orders and attribute births to women of different ages and education levels. Applying the “own child method” with EU-SILC carries the risk of obtaining biased fertility measures caused by fertility-linked attrition and by unobserved children living outside the household. For this reason, the use of EU-SILC has so far been rather uncommon in demographic analyses. The small number of demographic studies that have already been undertaken with EU-SILC (Rendall et al. 2014, Klesment et al. 2014, Greulich et al. 2016, Greulich et al. 2017, Nitsche et al. 2018) so far mostly only model educational gradients of parity-specific transition probabilities, without giving information about fertility levels. One important challenge of this research project is thus to deliver non-biased educational gradients of age and parity-specific fertility rates, which will then be used to calculate total fertility rates by education.

Recent studies (Greulich and Dasré, 2017, 2018) have analysed and quantified country, age and parity-specific measurement errors of period fertility in EU-SILC, and have revealed that the biases mainly exist due to attrition. In contrast, unobserved children who live outside the household do not contribute much to the bias in period fertility. Attrition is fertility-linked in EU-SILC, as it often appears around the event of childbirth (families change homes due to the arrival of a new household member). This fertility-linked attrition leads to an underestimation of period fertility rates when childbirth is observed in or just before the year of the survey. As the cross-sectional samples are constructed from the longitudinal ones in EU-SILC, the cross-sectional samples are also affected by fertility-linked attrition, albeit to a lesser extent. Finally, and most importantly, there are no significant socio-economic differentials in the probability of attrition, which means that there exists no differential bias when calculating the educational gradient of period fertility.

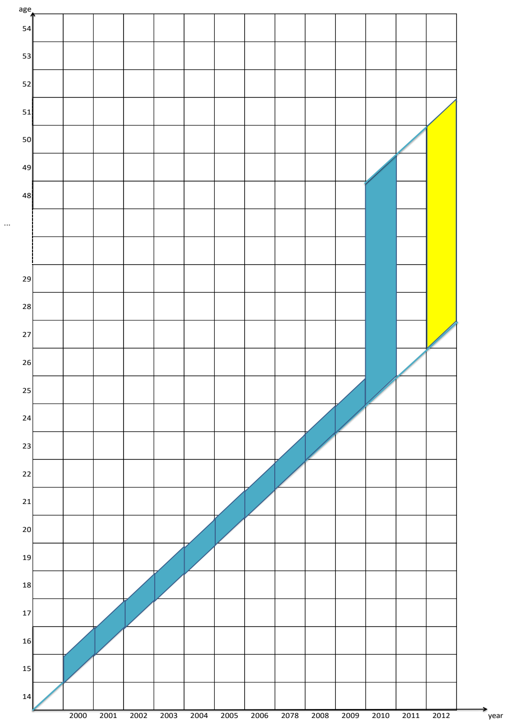
We mobilised this information to develop a strategy allowing the biases in SILC-based measures of period fertility obtained with the cross-sectional sample to be circumvented: in the large majority of countries, the bias can be circumvented by allowing for a *time delay of two years* between the year in which childbirth is observed and the survey year. This two-year delay will be applied when calculating measures of period fertility.

The cross-sectional data base of the EU-SILC will be used to calculate age and parity-specific fertility quotients by levels of education for cohorts at childbearing age. The cross-sectional samples provide nationally representative probability samples for all countries and are preferred over the longitudinal samples, due to their larger sample size. It is possible to use the cross-sectional sample for observing education-specific fertility behaviour as both education and childbirth are in general non-reversible events. Childbirth is observed in year *t-2* to reduce potential measurement biases caused by fertility-linked attrition.

In order to observe the fertility behaviour of women who are currently at childbearing age by correctly attributing the education level, a *semi-retrospective approach* is used[1]. This approach serves to observe the fertility behaviour of cohorts which are currently at childbearing age, while at the same time recording the educational level correctly.

The semi-retrospective approach combines a longitudinal with a cross-sectional approach. Figure 1 uses a Lexis diagram to illustrate the logic of our semi-retrospective approach (wave 2012 is used in this example). In addition, the figure shows that a minimum delay of two years between the childbirth year and the survey year is respected, which reduces measurement bias caused by fertility-linked attrition.

Figure 1: Semi-retrospective approach



For women of aged 15 to 25, a retrospective approach will be applied. Women aged 27 in the cross-sectional sample (2012 in this example) will therefore be selected. 27 is chosen because this is the age by which most women have completed their education in Europe, but sensitivity analysis will be conducted in order to take into account differences between countries and years. For these women, the cross-sectional sample delivers information on their "completed" education level (observed at age 27), as well as on the number and ages of the children currently living in their household. Based on this information, data on these women's order-specific fertility behaviour can be reconstructed, retrospectively, for ages 15 to 25, differentiated by education group. The age of 25 is used as a cut-off, in order to allow for a two-year delay between the year of childbirth and the year of the survey. From 26 onwards, age and parity-specific fertility behaviour by education is observed by applying a cross-sectional approach: the current education levels of women aged 28+ are observed, as well as their parity-specific fertility behaviour two years ago.

The mix of longitudinal and cross-sectional information allows a realistic picture of actual fertility behaviour to be obtained, without having to limit the analysis to older cohorts who already have completed fertility. Thus, in comparison to a complete retrospective approach for women aged 45+, this semi-retrospective approach allows the fertility behaviour of those women to be captured who were actually at childbearing age at the time of the survey.

Using this approach, it is possible to calculate women's probability of having a child – while differentiating by age, education level as well as by birth parity, for each available country and year in

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[1] As education is not completed at young ages (between 15 and 25), period fertility rates for low-educated women would be largely underestimated in a cross-sectional research design: everyone at age 15 would be considered as "low-educated", including those women who will continue education and who are likely not to have children at very young ages.

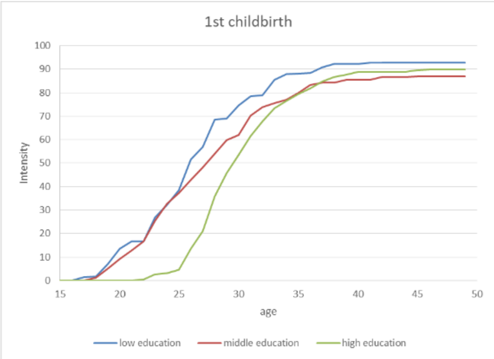
the EU-SILC survey. These age-specific probabilities are then grouped into a life table, in order to obtain conditional life time probabilities (birth intensities). By summing up the different parity-specific birth intensities, the total birth intensity can be obtained. For age 45, this total birth intensity can be interpreted as the average number of children that would have been born to a woman by the time she ended childbearing if she were to pass through all her childbearing years conforming to the age-specific birth probabilities of the observed time period.

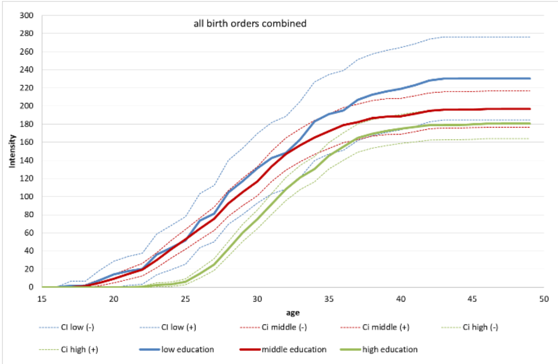
For countries in which sample size is too low to observe fertility behaviour which is at the same time education, age and parity-specific, *several waves will be grouped together*. In this case, a moving average procedure will be applied in order to be able to deliver year-by-year data. In addition, *Bayesian statistics* will applied in order to obtain credible intervals for the education, age and parity-specific birth probabilities for each country in the sample used here. More specifically, a posterior probability will be computed from the prior probability with Bayes' theorem: each age and parity and education-specific quotient is estimated based on a prior probability. The prior probability is the birth-order specific and education-specific quotient averaged over all ages. The posterior probability is then the age and birth-order and education-specific quotient based on the prior probability. In other words, the study will use knowledge of the situation-specific prior distribution by conditioning the probability of childbirth averaged over all ages on the specific ages of interest. The posterior probability is therefore a probability conditioned on randomly observed data. Hence it is a random variable. For a random variable, it is important to summarise its amount of uncertainty. One way to achieve this goal is to provide a credible interval of the posterior probability.

Figure 2 illustrates the kind of result that can be obtained with our approach by contrasting France and Sweden for the year 2010. The left-hand panels show birth intensities by age for women's first childbirth, while the right-hand panels combine all birth orders.

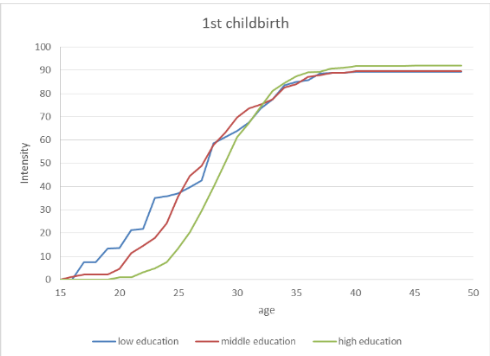
Figure 2: Birth intensities by age and education

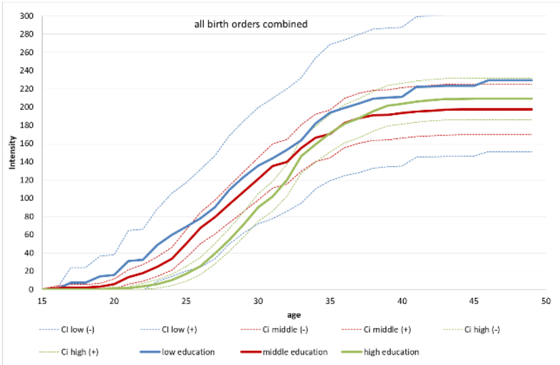
France:





Sweden:





For both France and Sweden, the left-hand panels of Figure 2 show that if women experience the different intensities of first childbirth over their lifetimes, they will have their first child later if they are highly educated in comparison to middle and low educated women. But highly educated women also have a slightly lower probability of remaining childless compared to the middle educated women. This suggests that in both countries the postponement of first childbirth can, if chosen due to education, facilitate family formation. It should be noted, however, that highly educated women in France postpone first childbirth more than their counterparts in Sweden. Integrating births of higher order into the analysis is now necessary to identify if higher intensities for first childbirth occur with higher overall birth intensities (all birth orders combined): this turns out to be the case for Sweden, but not for France, where the picture changes for births of higher order, as the birth intensities are lower for highly-educated women (figures not shown here). Consequently, when combining all birth orders (Figure 2, right panel), a classic educational gradient of fertility may be observed for France, with highest fertility levels for the low educated. By the age of 45, low educated women have on average 2.3 children, compared to 1.97 children for middle-educated women and 1.8 children for highly educated women. In Sweden, we see that the differences between education groups in the overall birth intensities are much lower than in France, mainly due to highly educated women having more children in Sweden than in France. This could be linked to the difference between the two countries in the timing of first childbirths by highly educated women. In Sweden, low educated women also have the highest fertility levels (2.29), but fertility levels are lower for the middle educated (1.97) than for the highly educated (2.09). The educational gradient of current fertility behaviour is therefore not negative in Sweden.

As our semi-retrospective approach is based on women of childbearing age, these birth intensities at age 45 act as measure of the educational gradient of period fertility levels for the year 2010. The numbers are close to the ones that a 'pure synthetic cohort approach' would yield, but less biased, as education levels were correctly attributed.

Based on this developed and tested method, we will deliver high quality measures of the educational gradient of period fertility for 32 European countries. The measures will be available on a yearly basis, starting from 2005. The advantage of this measure is that it delivers accurate information on the actual childbearing behaviour of women of a certain year. With a time-period of almost two decades, it will be possible to properly distinguish between tempo and quantum effects of fertility. The observed changes in the timing of birth will allow calculating tempo-adjusted fertility levels, similar to the method developed by Bongaarts and Feeney (1998). The dynamic setting will also enable to account for cross-country differences in the business cycle.

Furthermore, the availability of yearly data, in combination with information about the evolution of the distribution of education among women, will allow a variety of fertility analyses to be conducted that are highly policy relevant. We will identify, for example, which educational group contributes the most to the fertility decline that has recently occurred in several European countries, while taking into account potential structure effects (caused by the evolution of the distribution of education among women). One hypothesis that can be tested here is that, besides increasing difficulties for realizing fertility intentions due to labour market precarity (which may be higher for some education groups than for others), it is the increasing educational inequalities (as observed for Sweden in the recent years, for example, see Volante 2018) that contribute clearly to decreasing fertility levels.