Second birth rates across Europe: childcare as a mediator of the effect of women's level of education

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Abstract

Cross-country fertility differences in Europe today are to a large extent due to differences in parity progression after the first birth. This paper therefore addresses second birth rates across Europe. How and to what extent does the postponement of first births affect second birth rates in different social groups and countries of Europe? We argue that differences between countries in the compatibility between work and family life are crucial. Hence, we focus on the role of women's levels of education and on the availability of childcare, since childcare availability may be an important determinant of the opportunity cost of parity progression, particularly for the highly educated women. We use the third round of the European Social Survey, covering 23 countries. We find that in some countries, high education is associated with lower second birth rates while in other countries, the reverse is true. Where the highly educated have lower second birth rates than the lower educated, total fertility tends to be low, and vice versa. Next, we find that the effect of the timing of first childbirth seems to be mediated both by the level of education and by childcare service provisions. In countries where a large share of young children is enrolled in formal childcare, the higher educated exhibit substantially higher second birth rates. Childcare does not make any difference for the second birth rates of the women with a low level of education.

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Introduction

In the transition to Europe's current low fertility levels, two stages can be distinguished. During the first stage, starting from the latter part of the nineteenth century in most European countries, married couples limited their family sizes by earlier stopping: women stopped their childbearing careers both at a lower age and at a lower final family size. This first stage implied primarily a declining incidence of high parity births and the establishment of the two-child norm. It was temporarily and partly halted, or even somewhat reversed in some countries, during the post-war baby boom era. As to the timing of fertility, there was a shift towards childbearing at younger ages during this stage. During the second stage, from the 1970s, people started to postpone their first child. Since the latter part of the twentieth century, postponement is being compensated by recuperation at higher ages but the catching up is incomplete so that many second and higher order births are foregone altogether. As a result, period fertility has dropped to levels that are structurally below the replacement level (Lesthaeghe and Willems 1999).

Although the level of childlessness has been increasing gradually during the past decades in many countries (Sobotka 2004, Chapter 5), a drop of cohort first birth probabilities has not been the major driving force behind the emergence of very low fertility in Europe (Billari and Kohler 2004). Cross-country fertility differences today are to a large extent due to differences in second birth rates, and to a much lesser extent to an increasing rejection of parenthood. Apparently, the biological, psychological, and social incentives remain strong enough for most people to want at least one child (Kohler et al. 2006; Morgan and Taylor 2006). The gap between lowest-low and ordinary low fertility crucially depends on parity progression after the first birth: second birth rates are typically low in the very low fertility

countries of Southern Europe and Central and Eastern Europe. A notable exception is Germany, where low fertility is clearly linked with high childlessness rather than with very low parity progression after the first birth (Sobotka 2008: 39).

There are signs that second births may even become more critical for European fertility levels in the future. Among people who do want to experience parenthood, the two-child norm seems to have weakened somewhat during the past decades (Goldstein et al. 2003; Breton and Prioux, 2005). In most countries of the former EU-12, the proportion of young women preferring just one child has doubled during the 1980s (Coleman 1996). In Austria mean ideal family sizes have already reached the below-replacement level among recent generations of young adult women (aged 25-39) (Testa 2007). According to the "low fertility trap hypothesis", persistently low fertility levels may lead to declining fertility intentions and ideals as new generations of Europeans, brought up in a low fertility context, may adapt childbearing strategies of their parents and peers (Goldstein et al. 2003, Lutz et al. 2005). Such intergenerational, socialisation effect may be observable in German-speaking countries (Testa and Grilli 2006). Low mean personal ideal family sizes have been reported in Southern-European countries such as Italy and Spain as well (Testa 2007).

This paper addresses differences between second birth rates in 23 European countries. How are these connected with the postponement of first births? During the latter part of the twentieth century, tempo effects have played a major role in the decline of period fertility (Sobotka 2004). Yet, tempo-quantum interactions are to be expected in the sense that the postponement of parenthood is bound to spill over to some extent to the quantum of fertility, starting with parity progression to the second birth (Billari and Borgoni 2005). How do the effects of the timing of entry into parenthood on second birth rates vary by country and social group?

Research questions

Differences in the relation between postponement and catching up (i.e. tempo-quantum interactions) are likely to be an important factor behind the divergence of fertility levels in Europe. According to a hypothesis formulated by Kohler et al. (2006), the postponement of first births is associated with increasing investments in human capital, particularly by women, implying a higher wage-earning potential. Women who postpone motherhood are often those with more work experience and higher wages prior to the first births. This postponement-induced increase in women's actual and potential wages translates into higher opportunity costs, not only of first but also of second children. Given that the incentives to have at least one child appear to remain very strong, the higher child-costs associated with the delay of the first child are likely to translate particularly in lower parity progression rates *after* the first birth.

This hypothesis begs to be investigated systematically and thoroughly. We need to find out how it can be reconciled with the observation, made for a number of countries, that higher educated women tend to exhibit a weaker negative postponement effect on second births rates and shorter birth spacing than lower educated women (Köppen 2006; Neels 2006), while we know that the wage-earning potential of the former group is higher. More generally, it has been found for several countries that once higher educated women leave schools and universities, they have higher birth rates than their lower educated peers. This extends to second birth rates (Hoem and Hoem, 1989, Kreyenfeld, 2002, Köppen 2006; Neels 2006; Lappegard and Ronsen, 2005; Gerster et al. 2007). So, there is evidence of better catching up by highly educated women after postponement. Nonetheless, some studies do not confirm such results or effects (e.g. Liefbroer and Corijn 1999, Kantorova 2006, Gerster et al. 2007).

For Denmark, although the level of education was positively associated with second birth rates, there was no evidence that this was due to faster catching up after a later timing of the first birth by the highly educated (Gerster et al. 2007).

There are several reasons for expecting a faster catching up after postponement by highly educated women. First, a higher earning potential, all else equal, facilitates a bigger family thanks to an income effect. Second, highly educated women may be motivated to concentrate their births in a shorter period of time in order to resume their work-career sooner after attaining their desired family size (Köppen 2006). Third, a higher wage-earning potential need not translate *directly* into higher opportunity costs. Maybe higher educated women tend to have more resources and skills to reconcile paid work with raising more than one child. The double burden of mothers who pursue a career at work can be diminished in at least two ways. On the one hand, their partners can contribute more to household chores and childcare (cf. Torr and Short, 2004). On the other hand, the availability of formal childcare may facilitate investing in their career at work, especially in the context of dual-earner families that are most common among women with higher education degrees.

The compatibility of professional and family work may be at the heart of the matter of differential tempo-quantum interactions, not just at the micro-level within particular populations but also at the cross-country level in Europe. The differences between countries with high versus low compatibility of paid work and parenting may have important implications for the causal effects of delayed first births on second birth rates. The effects are expected to be particularly strong in the context of inflexible labour markets and insufficient availability of child care facilities (Kohler et al. 2006). If childcare, on the other hand, is more abundantly available and if it is culturally accepted to use it even for very young children, the opportunity costs of parity progression will go down. This would hold in particular for the

highly educated, given that they have the highest earning potential and, hence, the highest opportunity costs if parity progression cannot be combined with continued activity in the labour market.

Women who have made the transition to motherhood may be more aware of the difficulties and constraints that emerge from their double burden – with the second shift awaiting them at home, once they finish the paid work day (Dribe and Stanfors 2009). They may find it more risky to decide on having a(nother) child. Therefore, father's help in household work may have more significance for women with already one child than for women who are still contemplating first childbirth. Research in the United States has found that help by the male partner in the household indeed promotes parity progression after the first birth (Torr and Short 2004).

Family policy measures addressing the reconciliation of work at home and in the labour market may also be of special significance for women who have made the transition to motherhood and know about the double burden by own experience. This may help explain differences in second birth rates across Europe. On the one hand there are countries with relatively high fertility. France, for example, is well-known as a country with generous family policies, part of it particularly targeting the promotion of third order births (Ekert-Jaffé et al. 2002; Breton and Prioux 2005), presumably stimulating second births as well. In the Netherlands part-time work by mothers typically allows them to bring up children while still remaining part-time in the labour market (Mills et al. 2008). This may be facilitated by the availability of formal childcare services. In Scandinavian countries, enrolment rates into crèches and kindergarten are among the highest in Europe (Hoem 2005). In Sweden almost 80% of pre-school children attended formal childcare services in 2000 (Dribe and Stanfors 2009).

In contrast, the usage of formal childcare is typically low in the low fertility countries of Southern and Eastern Europe. On the one hand, this may be caused by the low provision of such services. On the other, it may be due to more cultural constraints such as attitudes towards childrearing. Moreover, it is likely that both components play a role here, with a mutually reinforcing effect. In many Mediterranean areas grandparents are very important childcare-suppliers (OECD, 2001). In Germany, women find it difficult to combine family and work career. While unemployment has been high in East-Germany, in Western Germany the belief that mothers themselves should be the (fulltime) care-givers of very young children is widespread. This leads to polarisation in two groups of women: a work-oriented group and a group who devote themselves to childbearing and home making (Köppen 2006).

We expect that the transition to the second birth is made more easily in countries with adequate childcare provisions and regulations aimed at diminishing the double burden of females. This is likely to be a case of Scandinavian countries and France (Olah, 1998, Del Boca, 2002, Köppen, 2006, Brodmann, Esping-Andersen and Guell, 2007). On the other hand, we think that second birth rates will be the lowest in countries where such provisions are poorly developed, like in Southern and post-communist, Eastern European countries. Additionally, in these countries people often struggle with an unstable and often poor economic situation, which also impedes the reconciliation of work and family and may lead to uncertainty about one's life plans.

Summing up, we will address the following research questions in this paper: (1) How large are differences between second birth rates in Europe and how are they distributed geographically across Europe? From earlier research with register data, we expect second birth rates to be lowest in Southern, Central, and Eastern Europe (including the Balkan, and with the exception of Germany, see Sobotka 2008: 39), and highest in Western- and Northern

Europe. We address this issue as a preliminary question as a way to validate the survey sample data that we will use in this paper. (2) How large are the effects of first birth timing on second birth rates and how do they vary by country? (3) How large is the effect of women's level of education on second birth rates and how does this vary by country? (4) How large is the effect of a country's enrolment rate in formal daycare and how does this vary by level of education?

Data

In our analysis we use data from the third round of the European Social Survey (ESS), edition 3.2 released in October 2008. Fieldwork was carried out using face-to-face interviews between end June 2006 and November 2007. The ESS is a biennial, cross-national, academic-driven and partly repetitive survey that allows exploring behaviour and attitudes of Europeans. The third round of the ESS was conducted in twenty-five countries: Austria, Belgium, Bulgaria, Cyprus, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Latvia, the Netherlands, Norway, Poland, Portugal, Romania, Russia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, and the United Kingdom (ESS Central Coordinating Team 2008).

Selection of cases

Ukraine had to be dropped from the analysis due to incomplete data. We also excluded Russia because we think that the cultural, institutional, historical, political and demographic differences with the rest of the European continent are too big to allow useful comparison. As a result, our study covers the remaining 23 countries. This holds for most of the analyses but not for the final regression model that includes national measures for enrolment in childcare

(see below). For that model, we had to limit the number of countries to 16 since we lack the comparable information on day-care enrolment rates for Bulgaria, Cyprus, Estonia, Latvia, Romania, Slovenia and Switzerland.

ESS respondents are selected based on four criteria: age, marital status, number of kids and living with a partner. We include only ESS respondents who already had given birth to or fathered at least one child, who never experienced a divorce and who were living with a partner at the time of the interview. ESS3 provides information on respondents' partners as well, and we restricted the age- and cohort range by selecting only couples when both his and her age was between 15 and 45 years (both age limits included). By applying these criteria, and after dropping cases with missing values for crucial variables, we achieve a sample size of 6186 couples.

Variables used

Table 1 gives basic descriptive statistics for the variables that will be used in the analysis. The following paragraphs discuss the construction of the variables about education and enrolment in childcare.

Education

As we are interested in differences in second birth rates among females with various educational levels, we need information on highest educational degree obtained by women. ESS3 contains an adequate variable 'edulvl'. The general structure of the question asked to respondents and the possible answers are following:

Question **F 6:** What is the highest level of education you have achieved?

Variable name and label: EDULVL Highest level of education

Values and categories

0 Not completed primary education

1 Primary or first stage of basic

2 Lower secondary or second stage of basic

3 Upper secondary

4 Post secondary, non-tertiary

5 First stage of tertiary

6 Second stage of tertiary

7 Refusal

8 Don't know

9 No answer

The similar variable is available for respondents' partners. Basing on these variables, we constructed separate variables for males and females with dummies for three general educational levels: low (categories 0-2 above), medium (categories 3-4) and high (categories 5-6).

Formal childcare

We use the OECD Family Database for information on childcare enrolment rates across Europe. More specifically, we select the enrolment of children aged 0-3 in day-care (variable 'chc0_3yrs' in our models). This is the percentage of 0-3 olds in principally formal day-care facilities. These services include crèches and other child-care centres, care provided by registered childminders looking after one or more children in their own places and by non-family members at child's home (OECD 2008).

We choose this indicator as it gives an insight into the current, real childcare provision across Europe. In contrast to all indices based on percentage of GDP spent on family services or policies, it is not directly influenced by the number of young children, and hence, by the second birth rate we will be modelling. As this measure is relative to the number of children in the country, we believe that it offers a reasonable, though crude, assessment of formal childcare practice. To some extent, enrolment rates will be driven by demand factors: if a large proportion of couples want to bring their young children to a crèche, enrolment rates will be higher, all else equal. To another extent, public policy will also influence enrolment rates: if many couples want to bring their young children to a crèche but policy does not stimulate formal childcare provisions, enrolment rates will be lower than in a country where a government is subsidizing formal day care facilities.

Still, there are some concerns about these data. OECD collects the data reported in its international database from various sources. Original statistics for some countries contained enrolment rates by single year of age, while others were given for three-year age cohort. All these data were reconstructed by OECD into average participation rates for the 0-3 year olds. In cases where an actual enrolment in childcare facilities was collected, OECD calculated the percentages by using population data as a denominator. The quality of the enrolment data obviously depends on the collection method: especially in case of medium sized household surveys, sampling issues may arise (OECD 2008). Furthermore, the year of reference is 2004, but there are several deviations (Ireland: 2000; Germany, Poland: 2001, France: 2002, Finland, Norway, Slovakia: 2003 and Denmark: 2005). Finally, as mentioned before, no data are available for Bulgaria, Cyprus, Estonia, Latvia, Romania, Slovenia, Switzerland what leads to the exclusion of these countries from our last model.

Another limitation is that the OECD figures do not take the weekly amount of time children spend in day care into account. Also, some children may be double counted when they are enrolled in more than one part-time programme. For example, in some countries, kindergartens are open only for half a day. It is therefore possible that a child could attend kindergarten in the morning and then family day care in the afternoon. These categories are commonly reported together and so the same child could be counted twice. This leads to an over-estimated participation rate.

Maybe a more important limitation is that most births analyzed in this paper occurred before 2004. Enrolment rates will have changed between the years when the analysed couples were having their children. As a working assumption, we assume that the rank order of countries will not have changed a lot and that the size of the differences between countries observed around 2004 are a reasonable proxy for the actual enrolment rates around the time of the births that we analyse.

Overall, there is a clear pattern in day-care use across Europe. First, as can be seen in Figure 1, differences in childcare use are large. While the average rate is 23%, there is large variety in percentages of 0-3 years-old children enrolled in formal childcare across Europe. High enrolment rates are observed in Scandinavian countries and in Belgium, with the peak of roughly 62% in Denmark. These are countries with well-established childcare policies, often assessed as generous welfare regimes. Low rates are reported in countries from Central and Eastern Europe: Poland (the lowest rate of 2%) and Hungary, and in the German-speaking area (See Figure 1 below). As mentioned before, in case of these areas, we may expect this to be an interplay effect of cultural, social and economical processes that result in lower childcare provision and lower willingness to use such services.

Figure 1 Enrolment in daycare for children under 3, OECD 2004.

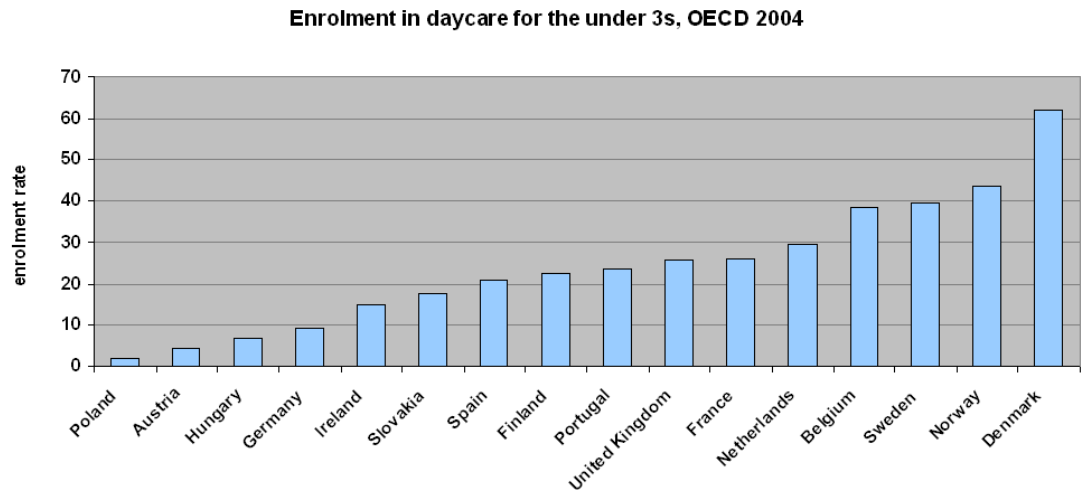


Table 1. Descriptive statistics of the dependent and independent variables used in the models

	Mean	SD	Min	Max	N	%
Dependent variable:						
Having at least two children						
- 0 = no					2159	34.9
- 1 = yes					4027	65.1
Individual-level characteristics of women						
Current age of woman	34.45	5.67	15	45	6186	
Age at first birth	25.65	4.63	14	44	6177	
Year first child was born	1997	5.9	1960	2007	6185	
Level of education						
- low					1462	23.8
- medium					2879	46.9
- high					1800	29.3
Characteristics of childcare (country-level variable)						
Enrolment in daycare for the under 3s, %, ca. 2004	23.22	14.8	2	61.7	16	

Method

Since we only know children's year of birth (not day or month), second birth rates are analysed with discrete-time event history regression models. More specifically, we model the yearly probability of progression to the second birth for people who have had a first birth, using multilevel logistic regression:

$$\text{logit}(h_{ij}(t)) = \beta_{0j} + \beta_1 t + \beta_2 t^2 + X_{ij}\beta_3 + Z_{ij}\beta_{4j}$$
$$\beta_{0j} = \gamma_{00} + (\gamma_{01} C_j) + u_{0j}$$
$$\beta_{4j} = \gamma_{40} + (\gamma_{41} C_j) + u_{4j}$$

$$u_{0j} \sim N(0, \sigma^2_{00}); \qquad u_{4j} \sim N(0, \sigma^2_{40}); \qquad \text{cov}(u_{0j}, u_{4j})$$

where

- $h_{ij}(t)$ is the probability to have a second birth in year t for couple i in country j;
- t is the number of years elapsed since the birth of the first child (with t=0 being the year of birth of the first child);
- X_{ij} is a vector of individual characteristics that are modelled to only have fixed effects;
- Z_{ij} is a vector of individual characteristics that are modelled to have effects that vary by country j;
- C_j is a vector with country characteristics.

(All other parameters have the conventional meaning in random effects multilevel modelling). As can be seen from the equation, we assume that the hazard rate is a second order polynomial function of the number of years since the first birth, allowing it to first go up, reach a maximum, and then go down. All models to be presented include a random intercept (β_{0j}) to explicitly allow countries to have different second birth rates. In the more complex

models, the effects β_{4j} of individual-level characteristics are allowed to vary by the country they live in.

While fitting the models, we applied the ESS-design weights in order to take care of differences between countries in sampling design. We did not apply population weights because our aim is not to estimate an average European effect (which would be dominated by the big countries due to their larger population size) but rather to look at differences between countries.

Results

We start with a simple model (Model I) that only includes the second order polynomial function of the number of years elapsed since the first birth, the calendar year when that first birth occurred (centred around its median value of 1996), and a random country effect, assumed to be a draw from a normal distribution.

Table 3. Model I

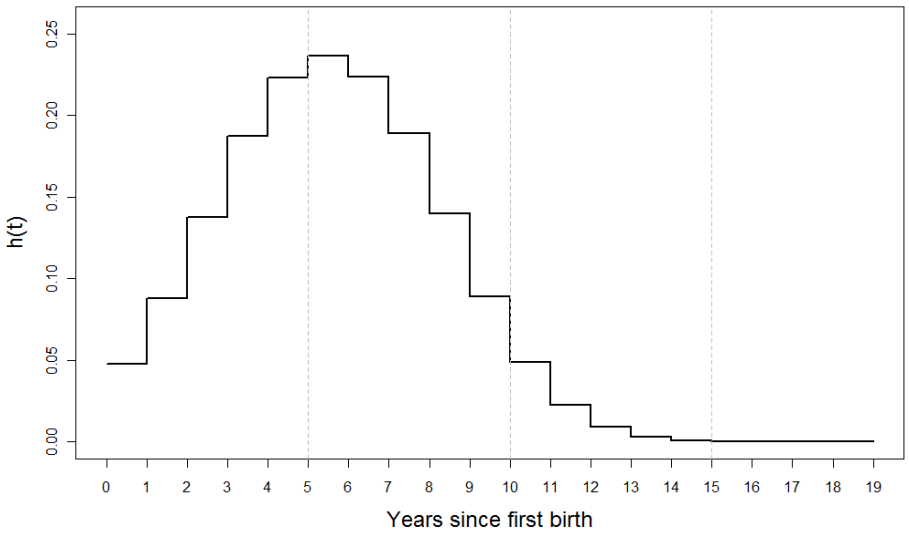
```
   AIC   BIC logLik deviance
 23571 23613 -11781    23561
Random effects:
 Groups Name        Variance Std.Dev.
 cntry  (Intercept) 0.15497  0.39367
Number of obs: 33482, groups: cntry, 23

Fixed effects:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) -2.998882   0.091758  -32.68   <2e-16 ***
Yr 1st brth -0.032597   0.003143  -10.37   <2e-16 ***
time         0.727643   0.021383   34.03   <2e-16 ***
timesquared  -0.072519   0.002349  -30.87   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

First note that the fitted linear time trend is negative and statistically significant, meaning that second birth rates were going down, on average across Europe. We will not

discuss this trend any further. The fitted shape of the baseline hazard rate is depicted in Figure 2. On average across Europe, the probability that a second birth occurred within the same calendar year as the first birth is estimated to be around 5%. This conditional probability (given a first birth and given a second birth has not yet occurred) then rises to reach a maximum in the fifth year after the first birth: if parity progression had not yet occurred by then, the probability that it does occur that year is around 23%. For the remaining parents with a single child, the hazard rates then goes down again.

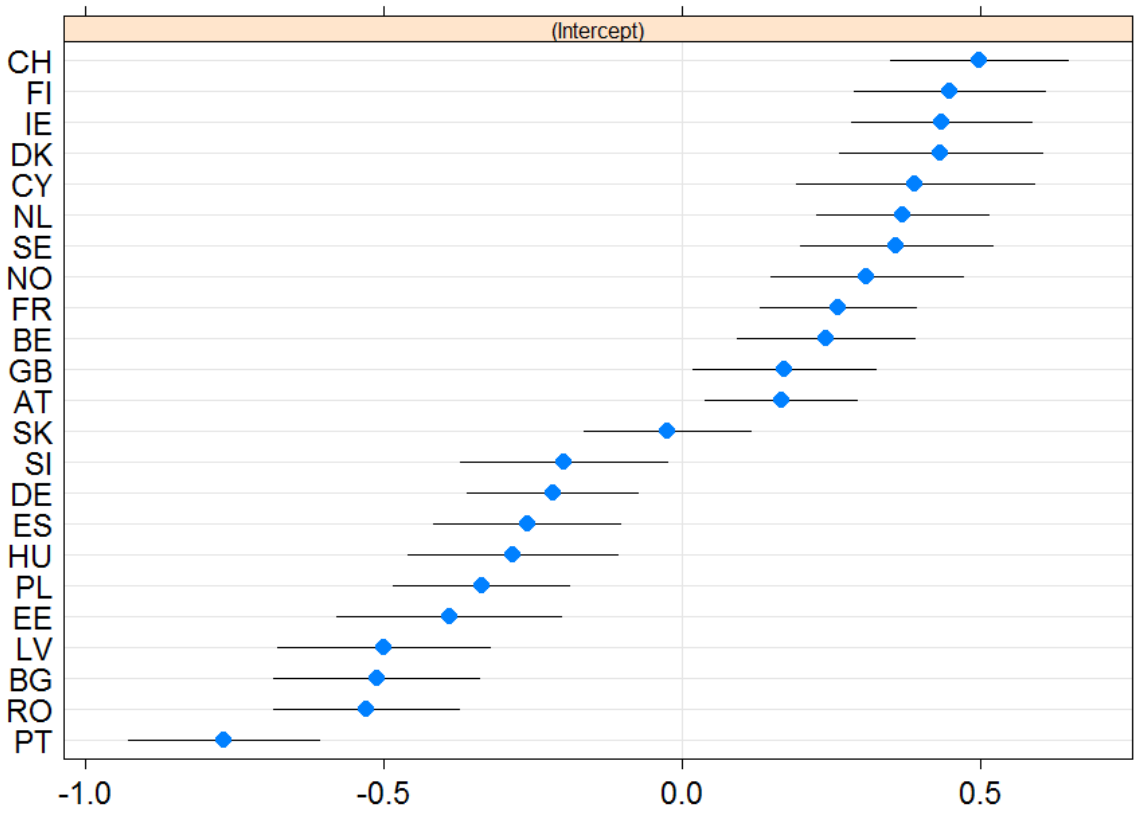
Figure 2 Fitted shape of the baseline second birth rate



There are significant differences between countries, as illustrated by Figure 3 and indicated by a likelihood ratio test (comparing the deviance for model I with the one for a model without country effects; $chi^2=428$, df=1, $p<0.001$). Second birth rates are estimated to be low, as expected, in Southern and Eastern European countries – with Portugal exhibiting

exceptionally low rates, presumably exaggerated due to sampling error. They tend to be high in Western and Northern Europe.

Figure 3 Best Linear Unbiased Predictors of the random country effects in Model I; effect are on the scale of the logit



In order to assess the size of these country effects, the implications of the country effects are plotted on a natural scale in Figure 4. In order to construct that figure, we calculated the proportions expected to have a second child within five years after the birth of the first child (assumed to be born in 1996) – so these are the complements of the survivor function. The figure shows that the heterogeneity in second birth rates in Europe can be considered large: the predicted percentages with a second child within five years range from

around 40% in the countries from Southern and Eastern Europe to around 65% in Northern and Western Europe. As can be seen in Figure 5, these differences are consistent with the idea that second birth rates are to a large extent responsible for making the gap between ordinary low and very low fertility countries (see also Figure 5).

Figure 4 Predicted probability to have a second birth within five years after first childbirth by country (first childbirth in 1996)

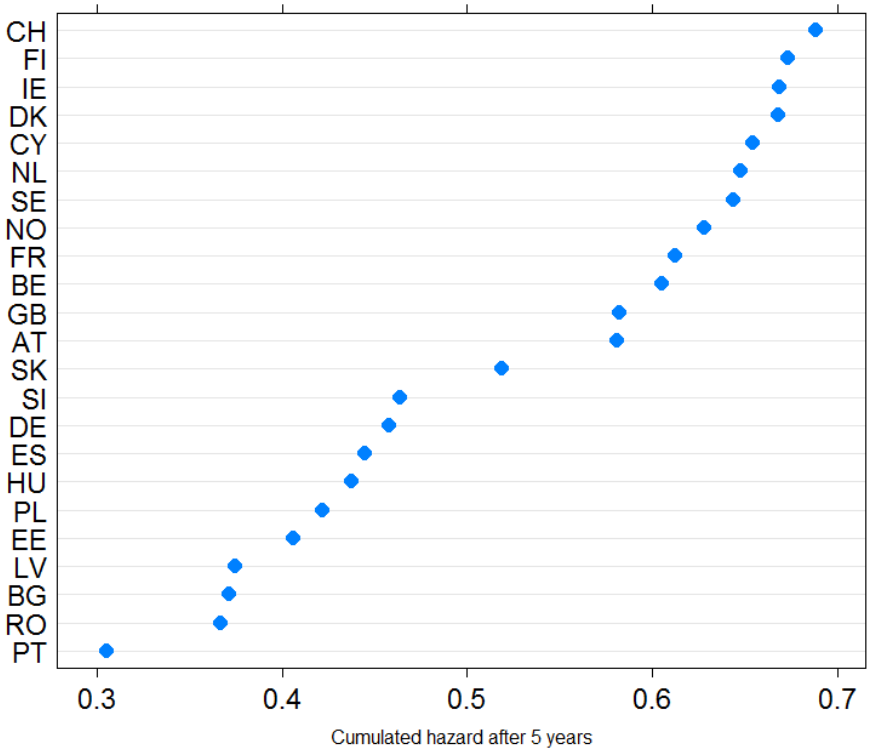
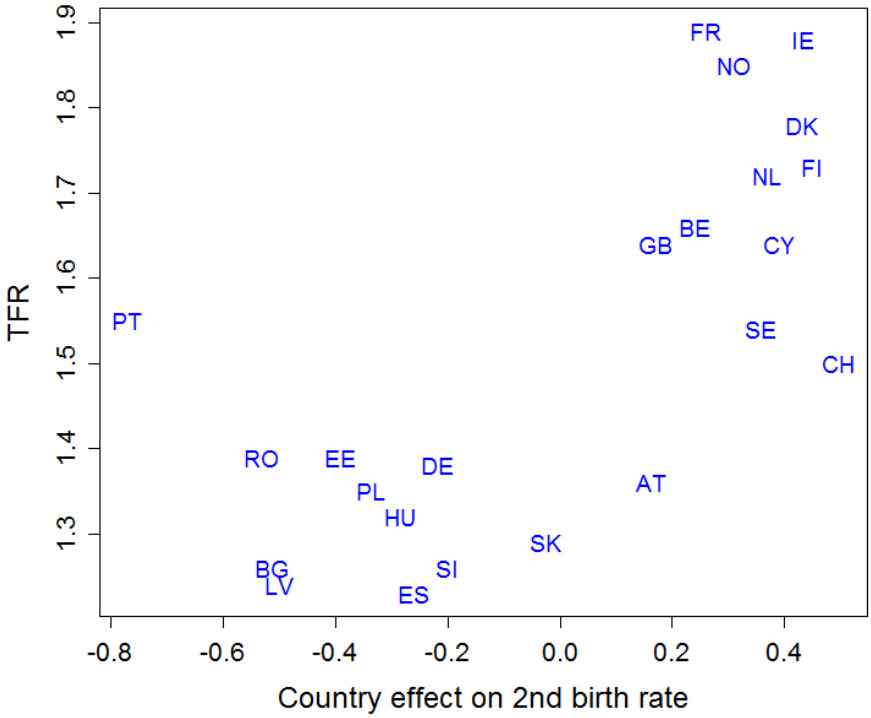


Figure 5 Scatterplot with estimated country effects on conditional second birth rates and total fertility rates for the year 2000



Model II just adds fixed effects for the mother's level of education (edumidw and eduhighw) and age at first birth in order to see to what extent these country differences can be explained by the heterogeneous composition of these countries in terms of these two characteristics. Age at first birth is centred around its median value of 25 years and is included as a second order polynomial in order to allow a non-linear effect (cage1bw and cage1bw2). Education is included with two dummies for a medium and high level of education, low education being the reference category. (No random slopes are estimated yet). Comparing the country effects of model I and II we learn that the differences cannot be explained by differential first birth timing nor composition by level of education. Figure 6

shows that inclusion of these factors hardly changes the random effects at all, and also the countries' rank order hardly changes.

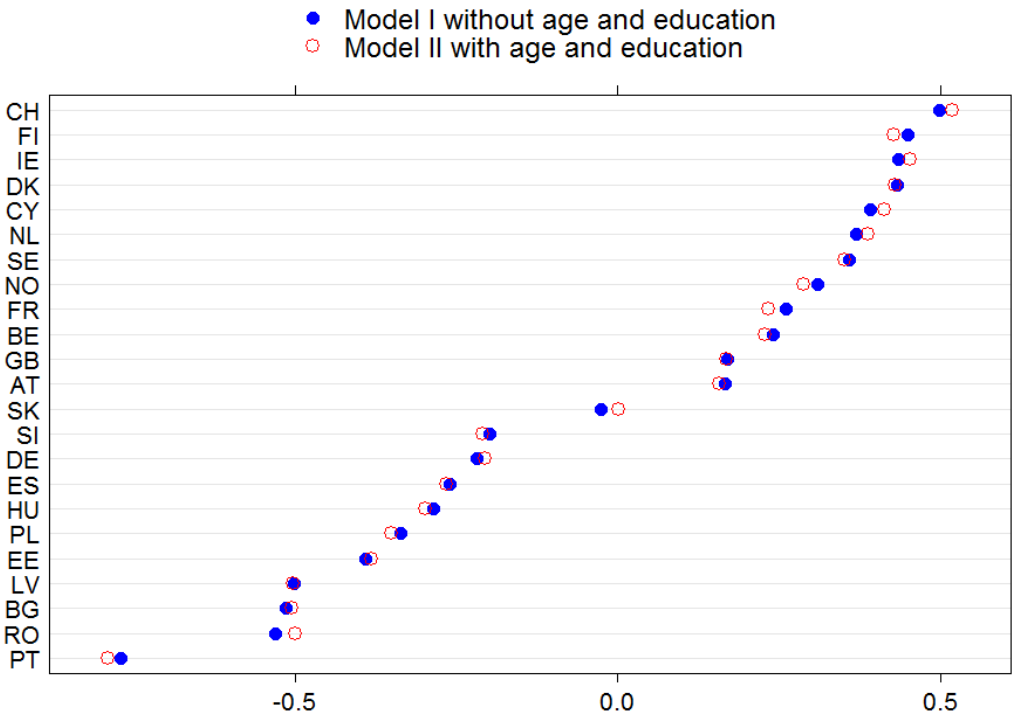
Table 4. Model II, adding the mother's level of education and age at first birth

```
   AIC   BIC logLik deviance
 23348 23424 -11665    23330
Random effects:
 Groups Name        Variance Std.Dev.
 cntry  (Intercept) 0.15547  0.39429
Number of obs: 33177, groups: cntry, 23

Fixed effects:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) -2.9551620  0.0995560  -29.68   <2e-16 ***
Yr 1st brth -0.0319937  0.0035538   -9.00   <2e-16 ***
time         0.7285181  0.0215007   33.88   <2e-16 ***
timesquared -0.0725720  0.0023625  -30.72   <2e-16 ***
cage1bw     -0.0035000  0.0050148   -0.70   0.4852
cage1bw2    -0.0012918  0.0006943   -1.86   0.0628 .
edumidw     -0.0800499  0.0468001   -1.71   0.0872 .
eduhighw     0.0706755  0.0540533    1.31   0.1910
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

In Model II, there is hardly an effect, if any at all, of age at first birth on second birth rates, on average across Europe. (The lack of a substantial effect is not due to the second order polynomial). This is surprising, given earlier findings that a later age at first birth is negatively associated with completed fertility (Toulemon 2004) and given the results of a simulation exercise suggesting that the postponement of first births leads to a rapid decline in second birth rates (Billari and Borgoni 2005). Yet, it is unsurprising given the empirical evidence for a number of countries (including Sweden, France, Denmark, and Austria) that substantial fertility delays have not actually led to declining second birth parity progression rates (Sobotka 2008: 39-40). Level of education also hardly has an effect according to model II. Presumably, the overall effects of first birth timing and education in model II are badly summarizing effects that are likely to be very heterogeneous across Europe.

Figure 6 Estimated country effect with and without including level of education and age at first birth (model II versus model I)



In Model III, the effects of age at first birth and the woman's level of education are explicitly modelled to vary by country by including random slopes. Overall, on average across Europe (not weighted by population size), it appears now that there is a negative effect of age at first birth, as indicated by the significantly negative effect of the quadratic term. Below, we will explore the country heterogeneity of the size of this effect on a natural scale of the dependent variable. The overall effect of the level of education across Europe is statistically not significantly different from null. Yet, there are statistically significant and substantially very important differences between European countries (see Figure 7).

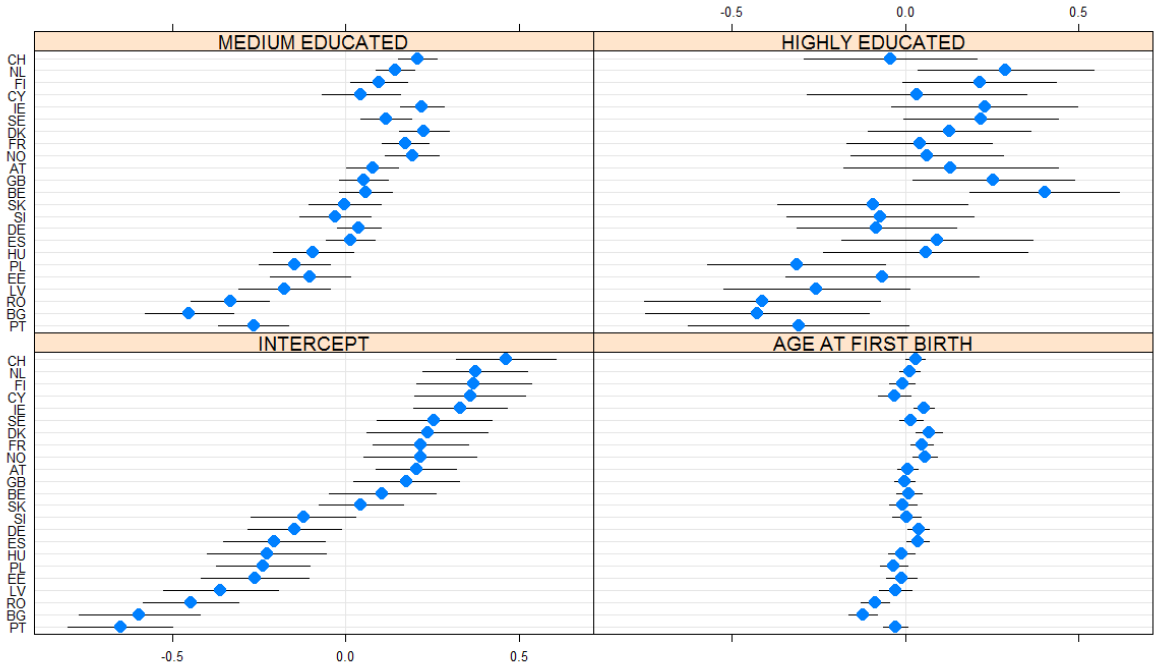
Table 5. Model III, adding random slopes for education and age at first birth

```
   AIC   BIC logLik deviance
 23278 23429 -11621    23242
Random effects:
 Groups Name        Variance  Std.Dev. Corr
 cntry  (Intercept) 0.1103035 0.332120
        cage1bw     0.0022565 0.047503 0.565
        edumidw     0.0338340 0.183940 0.884 0.885
        eduhighw    0.0686124 0.261940 0.627 0.531 0.654
Number of obs: 33177, groups: cntry, 23

Fixed effects:
              Estimate Std. Error z value Pr(>|z|)
(Intercept) -3.0358438  0.0894716  -33.93  < 2e-16 ***
Yr 1st brth -0.0325795  0.0035805   -9.10  < 2e-16 ***
time         0.7386993  0.0215796   34.23  < 2e-16 ***
timesquared -0.0729780  0.0023653  -30.85  < 2e-16 ***
cage1bw     -0.0101597  0.0112157   -0.91    0.365
cage1bw2    -0.0036158  0.0007818   -4.62 3.75e-06 ***
edumidw     -0.0525548  0.0605129   -0.87    0.385
eduhighw     0.0796625  0.0778365    1.02    0.306
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

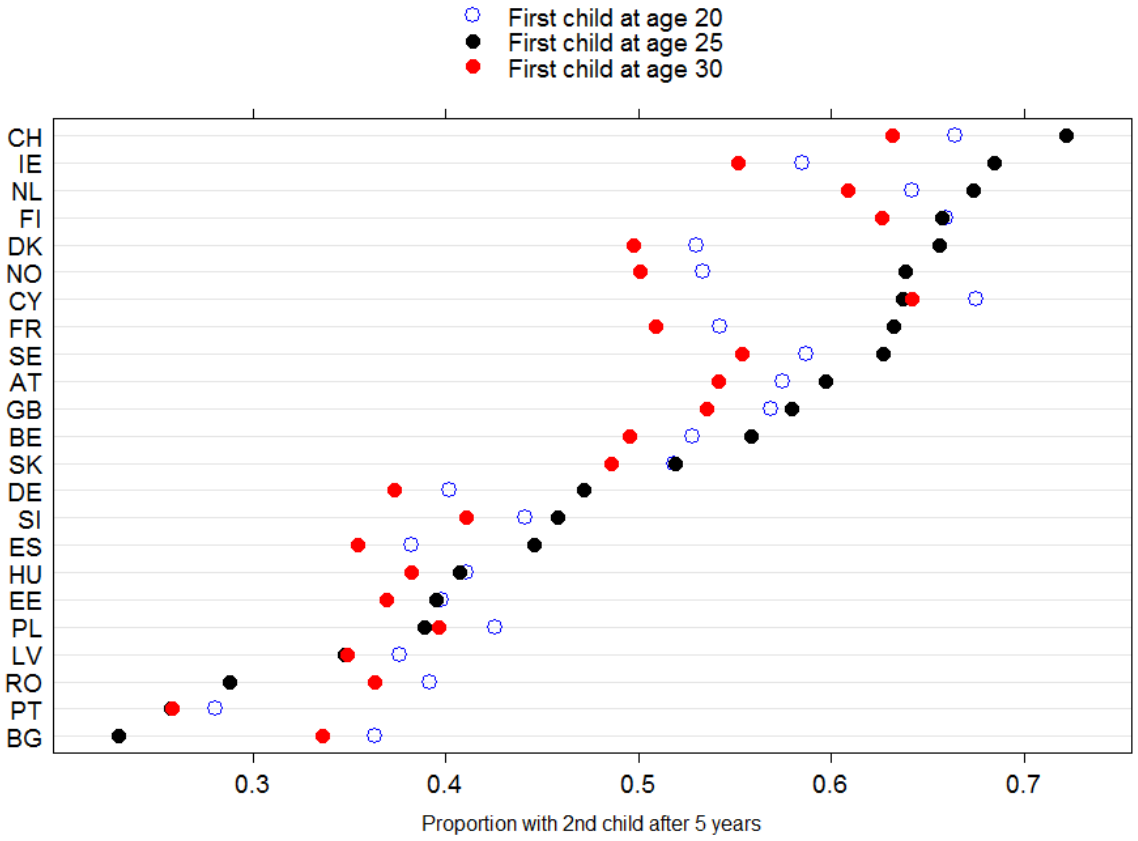
Figure 7 shows that in countries that have relatively high second birth rates overall, as indicated by their high-value intercept in the bottom left panel of the figure, the high and medium educated tend to have higher second birth rates than the low educated. This is the case, for example, in the Netherlands, Finland, Ireland, Sweden, Great Britain, and Belgium (see the top right panel of Figure 7). In countries that have low second birth rates overall (on the left hand side of the distribution of the bottom left panel of Figure 7), the high or medium educated tend to have lower second birth rates than the low educated. This is the case in Portugal, Bulgaria, Romania, Latvia, and Poland, for example. In some cases, the confidence intervals are quite large but the pattern is clear and consistent. It suggests that the behaviour of the well-educated is crucial in making the difference between ordinary low and very low fertility.

Figure 7 Country differences in the effects of level of education and age at first birth on the level of second birth rates



In order to asses the different sizes of the effects of age at first birth by country, we have calculated, in the same way as above, the predicted proportions having a second birth within five years after the birth of the first child. Since the effect of age at first birth not only differs by country but also is non-linear, it cannot be summarized in one number per country. Therefore, we calculated the predicted proportions with a second birth for three ages at first birth (20, 25, and 30), which can then be compared in order to see how big a difference they make for each country. The results are depicted in Figure 8.

Figure 8 Proportion with a second birth within five years by age at first birth and country



First, Figure 8 indicates that expected second birth rates (cumulated for five years) are most often the lowest when the first child was born when the wife had already reached age 30: the red dot is left in line for most countries. Yet, there are exceptions (Bulgaria, Romania, and Poland) and the size of the age-at-first-birth effect differs very much between countries. Second birth rates are particularly lower for women who became a mother at age 30 instead of age 25 in Ireland, Denmark, Norway, and France. The differences in second birth rates by these two ages at first birth are much smaller in Portugal, Cyprus, Latvia, Estonia, Poland, and Hungary. Secondly, second birth rates tend to be highest when the first occurred at an age that

is closest to the historically and culturally expected age at (marriage and) first birth. That is: in countries to the East of the Hajnal line, where family formation is expected to occur earlier according to a long-lasting cultural trait, second birth rates tend to be highest when the first child came at age 20. This is the case in Bulgaria, Romania, Latvia, Poland, Estonia, and Hungary. Yet, second birth rates tend the be the highest among women who had their first child at age 25 rather than at age 20 in countries where the Malthusian marriage pattern has historically been dominating the demographic regime, i.e. West of the Hajnal line. In the following countries, second birth rates are expected to be higher for women who had their first child at age 25 instead of at the young age of 20 years: Switzerland, Ireland, the Netherlands, Denmark, Norway, France, Sweden, Austria, Great Britain, Belgium, Germany, and also Slovenia and Spain. (The latter rather pertain to the Mediterranean marriage pattern).

This suggests that the effects of the timing of the first birth on second birth rates seem to be driven more by cultural forces than by a "biological clock". In countries where women are cultural-historically expected to become a mother at a young age, second birth rates tend to be highest when the first child was born at a young age. In countries where women are cultural-historically expected to become a mother at a more advanced age, second birth rates are highest when the first child came when the woman was indeed around age 25 instead of around age 20. Whether this interpretation is true or not, postponement effects on second birth rates across Europe are clearly not chiefly a matter of declining fecundity with age ("the biological clock").

The effect of the timing of the first birth may not only vary by country but also by level of education. Previous research suggests that higher educated women may be more successful in catching up when a first birth has been postponed than the lower educated. In order to assess whether there is such a pattern overall across Europe, Model IV includes

product terms allowing for an interaction between the effect of age at first birth and level of education. Table 6 shows that there is significant interaction. Figure 9 illustrates the importance and strength of the interaction.

Table 6. Model IV, adding interaction effect between education and age at first birth

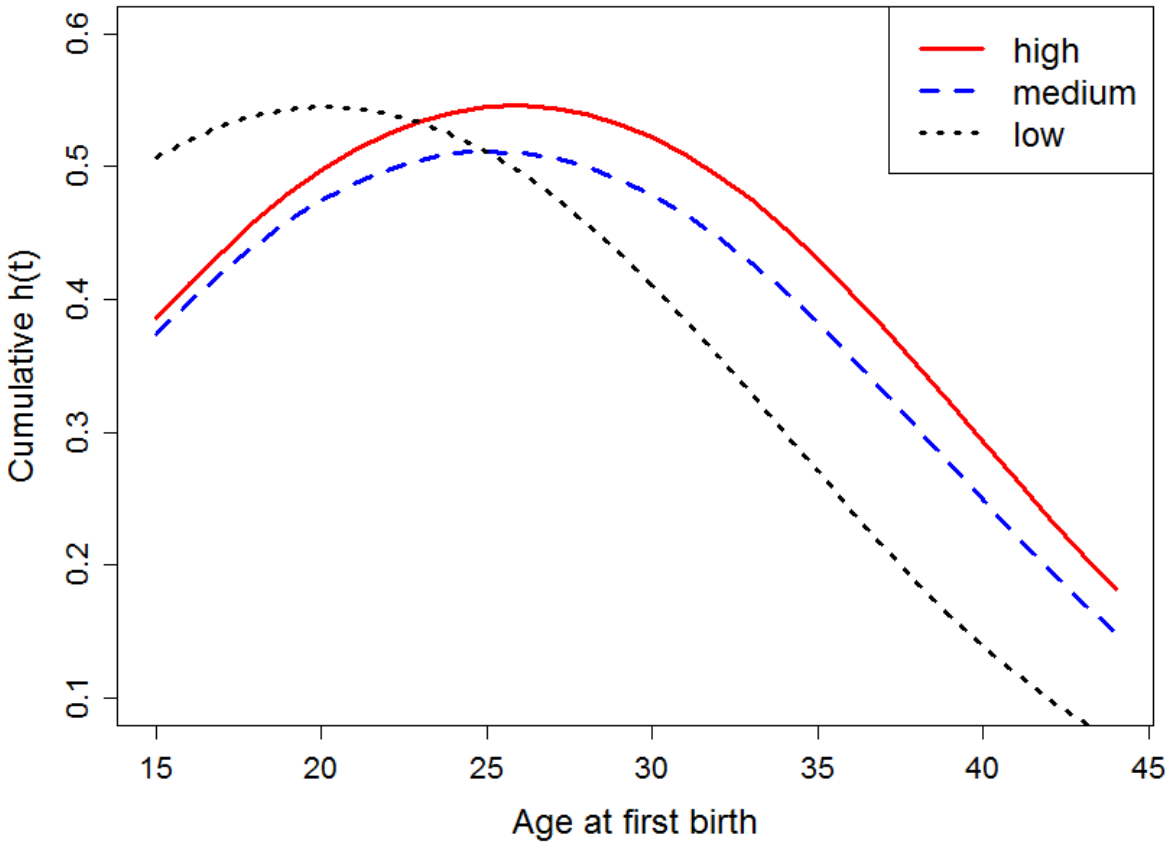
```
   AIC   BIC logLik deviance
 23264 23432 -11612    23224
Random effects:
 Groups Name        Variance  Std.Dev. Corr
 cntry  (Intercept) 0.1348998 0.367287
        cage1bw     0.0023376 0.048348 0.611
        edumidw     0.0151647 0.123145 0.990 0.714
        eduhighw    0.0473569 0.217616 0.514 0.254 0.498
Number of obs: 33177, groups: cntry, 23

Fixed effects:
                   Estimate Std. Error z value Pr(>|z|)
(Intercept)      -3.0774989  0.0961182  -32.02  < 2e-16 ***
Yr 1st brth      -0.0328254  0.0035830   -9.16  < 2e-16 ***
time              0.7410133  0.0216033   34.30  < 2e-16 ***
timesquared      -0.0731282  0.0023670  -30.89  < 2e-16 ***
cage1bw          -0.0428248  0.0136186   -3.14 0.001663 **
cage1bw2         -0.0044084  0.0008399   -5.25 1.53e-07 ***
edumidw           0.0011894  0.0554545    0.02 0.982888
eduhighw          0.1049150  0.0739401    1.42 0.155923
cage1bw:edumidw   0.0443285  0.0111801    3.96 7.34e-05 ***
cage1bw:eduhighw  0.0506134  0.0134496    3.76 0.000168 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

When women have their first birth around the modal age at first birth (age 25), there are hardly any differences, on average across Europe, between the lower, the medium, and the higher educated. Yet, when the first birth is postponed, big differences arise. When the first birth occurs around age 35, around 45% of the higher educated women are expected to have a least a second birth five years later. For the low educated, this is only around 25%. The medium educated are in between. So the model results are consistent with the idea that, on average across Europe, the higher educated are catching up more than the lower educated. If a first birth occurred at a particularly young age, say below age 20, then second birth rates are

modelled to be higher for the low than for the highly educated – who may at the time of their first birth still be enrolled in higher education; the level of education is measured at the time of the interview, which may be attained after the birth of the first child.

Figure 9 Predicted proportions having a second birth within five years after the first birth, by age at first birth and level of education



Finally, the question is to what extent these differences between countries and between levels of education can be explained by the availability and the use of childcare. Therefore, in a final step, we entered the day care enrolment rates into the equation as a country level covariate. Since this variable is not available for all countries, the number of

countries is limited to 16 in this analysis as opposed to 23 in the previous ones. The results are in Table 7.

Childcare enrolment appears to have a major effect on second birth rates, but not for all women. For women with a low level of education, it doesn't make a difference whether formal day care for young children is a widespread practice in their country of not. For highly educated women, it does make a big difference, as illustrated by Figure 10. Again, the medium educated are in between.

Table 7. Model V, adding childcare enrolment rates

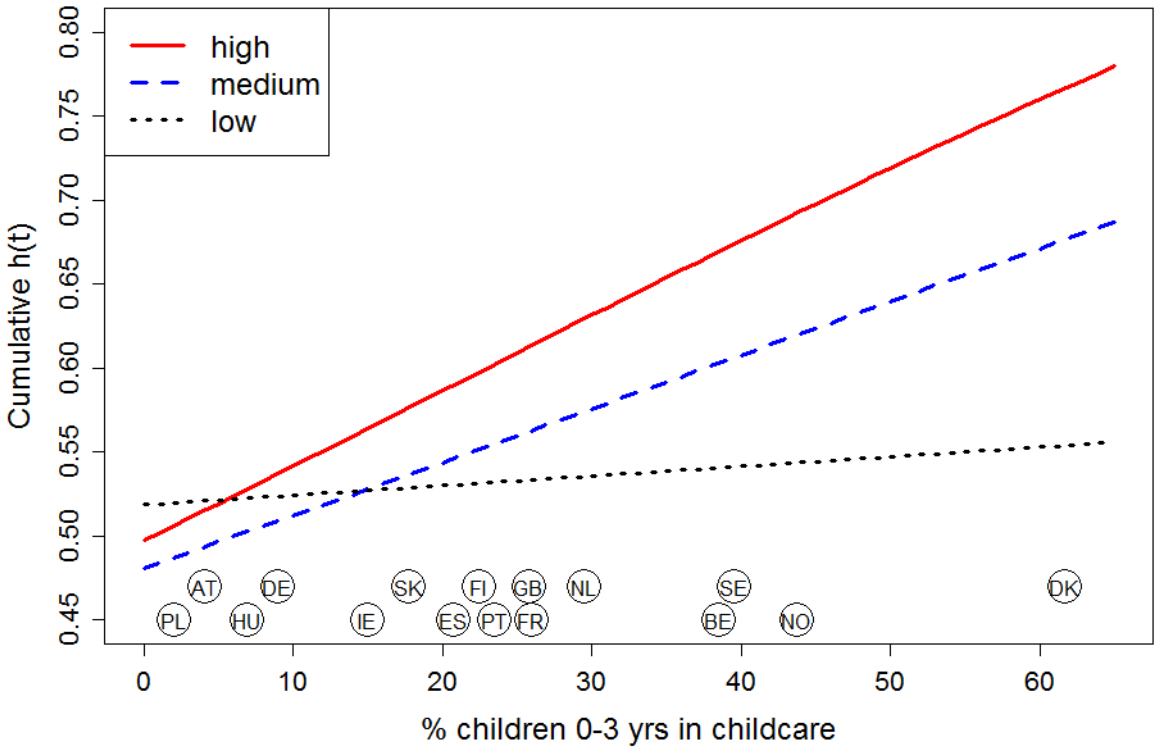
```
   AIC   BIC logLik deviance
 17257 17442  -8605    17211
Random effects:
 Groups Name        Variance   Std.Dev. Corr
 cntry  (Intercept) 0.08667810 0.294411
        cage1bw     0.00089308 0.029884  0.439
        edumidw     0.00562014 0.074968  0.122 -0.838
        eduhighw    0.05787217 0.240566 -0.005 -0.770  0.847
Number of obs: 23617, groups: cntry, 16

Fixed effects:
                     Estimate Std. Error z value Pr(>|z|)
(Intercept)        -3.1256208  0.1604232 -19.484  < 2e-16 ***
Yr 1st brth        -0.0338517  0.0042063  -8.048 8.42e-16 ***
time                0.7856800  0.0258184  30.431  < 2e-16 ***
timesquared        -0.0787182  0.0029102 -27.049  < 2e-16 ***
cage1bw            -0.0246045  0.0128448  -1.916  0.05543 .
cage1bw2           -0.0045388  0.0009453  -4.802 1.57e-06 ***
edumidw            -0.1185836  0.1046436  -1.133  0.25712
eduhighw           -0.0668076  0.1491016  -0.448  0.65410
chc0_3yrs           0.0017688  0.0057955   0.305  0.76021
cage1bw:edumidw     0.0520452  0.0131704   3.952 7.76e-05 ***
cage1bw:eduhighw    0.0479366  0.0153352   3.126  0.00177 **
edumidw:chc0_3yrs   0.0080244  0.0043984   1.824  0.06809 .
eduhighw:chc0_3yrs  0.0120030  0.0053889   2.227  0.02592 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

In order to show how high or how low enrolment rates actually were around 2004 in these 16 European countries, Figure 10 includes "country balls" at the bottom. Enrolment rates were lowest in Poland, Hungary, Germany, and Austria. They were highest Denmark but

also high in Belgium, Sweden, and Norway. The finding that high childcare enrolment is associated with high second birth rates among the higher educated but not among the lower educated is consistent with the idea the availability and acceptability of childcare helps bringing down the opportunity costs of having an additional birth, and that this particularly relevant for the highly educated.

Figure 10 Proportion predicted to have a second child within 5 years after the first birth by country-level enrolment rate in childcare and woman's level of education*



* Predicted proportions for women who had their first child at age 25 in the year 1996.

Conclusions

The country gradient of second birth rates is large across Europe. Estimated probabilities to have a second child within 5 years after the first birth range from around 40%, typically in Central and Eastern Europe but also in Portugal (just over 30%) and Spain (about 45%), to around 65% in Northern and Western Europe. The differences are a major driving force behind the gap between very low and ordinary low fertility.

The effect of the timing of the first birth on second birth rates is non-linear and differs by country. Second birth rates are typically highest when the first birth occurred at an age that is culturally considered "normal" or "expected". That is: East of the Hajnal line, second birth rates tend to be highest when the first birth occurred at a relatively young age (when the woman was under age 25), West of that line they tend to be highest when the woman was somewhat older when she became a mother (say between age 25 and 30). This suggests that socio-cultural expectations about the "proper age for motherhood" may be more important in explaining the effects of the first birth postponements than declining fecundity with age (the "biological clock").

The effect of the level of education differs strongly by country: in some countries, high education is associated with lower second birth parity progression rates than for the low educated. In other countries, high education is associated with higher second birth rates than for low educated women. The behaviour of the highly educated seems to be crucial for a country's overall fertility level: in countries where highly educated women have higher parity progression rates, total fertility tends to be relatively high overall. In countries where the high

educated have lower second birth rates than the low educated, total fertility tends to be very low.

High enrolment in childcare is strongly associated with high second birth rates, but only for the better educated. There is no effect of childcare, on average across Europe, on second birth rates for the low educated. This is consistent with the theory that the better educated have more to win from childcare availability and acceptability because they have a more elevated earning potential and, hence, face higher opportunity costs if bringing young children to formal day care facilities is not a realistic option.

This study has some important limitations. First, our measure of enrolment in childcare is rather crude. For example, it does not take into account the number of hours a child spends in day care per week. We know that there are large country differences in this matter. We have not taken these into account. There is a trade-off to make in any cross-country research: on the one hand, ideally, we would want to use more detailed information about childcare practices, but on the other hand, such data tend to be only available for some countries. And even if they are available, they are often incomparable. Therefore, we think that we need two kinds of studies. On the one hand, we need in-depth studies covering one or only a handful of countries but really addressing the issues in detail. On the other hand, we also need studies giving the big picture, without being able to get into the complexities of each single country. This study is clearly one of the second type.

Another limitation is that we have used enrolment rates for around the year 2004, while most children studied were born in the years before. Again, this is a data limitation that is not easily overcome. We assume for the time being that the rank order of countries has not changed a lot over the past two decades and hope that any within-country trends are not big

enough to invalidate our results. We need more study about this to be more confident about this issue.

Another limitation is that we were not able to address the importance of reverse causality, i.e. to assess to extent to which childcare enrolment rates are influenced by our dependent variable, i.e. second birth rates. Maybe highly educated populations who *want* more second births have also been putting more pressure on governments to invest in day care facilities. One way to get an idea of the extent in which this plays a role is to include country or region level cultural variables that capture the acceptability of day care: is it, or is it not, considered responsible parenthood when children under age 3 are brought to day care? If it is not considered appropriate and at the same time there is a negative association between enrolment and second birth rates, it is harder to imagine that the association is caused by the reverse causal mechanism outlined.

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