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RISING DISPERSION IN AGE AT FIRST BIRTH IN EUROPE: IS IT RELATED TO FERTILITY POSTPONEMENT?

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Abstract

This paper examines the dispersion of fertility across age and time which has rarely been studied. Using data from the Human Fertility Database, we examine fertility age schedules by looking at standard deviations in age at first births in European countries at different stages of fertility postponement. The standard deviation at first birth remained overall constant during the start of fertility postponement in the early 1970s, then it increased during the second stage marking the progression of postponement. It remained again constant at a higher level during recent years. The paper discusses the structural changes that might have caused these changes.

Keywords

Variance in fertility schedules, standard deviation of fertility, variance and stages in fertility postponement, fertility schedules.

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Rising Dispersion in Age at First Birth in Europe: Is it related to Fertility Postponement?

Dimiter Philipov

1. Conceptual Background and Research Topics

Fertility postponement is usually measured by an increase in mean ages at childbearing specified by birth order. While at the cohort level this trend leaves completed fertility unchanged, at the period level postponement temporarily decreases the number of births causing a decline in the total fertility rate (TFR) known as a tempo effect. When postponement recedes the tempo effect also recedes and the TFR increases, presumably to its initial value.

In a path-breaking study Bongaarts and Feeney (1998; BF for short[1]) highlighted this phenomenon and suggested a method for estimating a tempo-adjusted TFR which corresponds to the level of fertility without postponement. One of the methodological assumptions is that the shape of the fertility schedule should not change: it may rise or fall, move left or right but its shape should remain intact. This assumption implies that the variance of the schedule should not change across time. It was relaxed by Kohler and Philipov (2001) who extended the BF (1998) approach to include the effect of changes in the variance of age-specific fertility schedules. Their adjustment formula was rarely applied being too sensitive to the observed data; yet their study indicates that increase in variance introduces a specific component in the tempo effect along with the one caused by an increase in the mean age at birth. The BF (1998) formula estimates the latter.

While the BF (1998) approach was extensively used for research on fertility levels, much less attention has been paid to changes in the dispersion of births over age and related age-specific schedule modifications during the course of the postponement, beyond the Kohler-Philipov (2001) framework. Few researchers have addressed the matter: Frejka (2012) examined changes in fertility schedules over the postponement period; Burkimsher (2015) focused on first births over a short time period in her study of recent fertility recuperation, and Lesthaeghe and Permanier (2014) compared sums of age-specific fertility rates in the age intervals 20-30 and 30-40. Sobotka (2004) looked at trends in inter-quartile ranges to show that they increased: a sign of widening age fertility schedules and increasing variance around mean ages. Burkimsher (2017) examined bi-modality in fertility schedules.

Bongaarts and Sobotka (2012, BS for short) took an important step forward in the use of standard deviations (SD) around the mean age of fertility when explaining the use of the BF (1998) method in the analysis of fertility postponement in several European countries.

[1] A list of abbreviations can be found at the end of the paper.

Their discussion is based on simulated postponement transitions in what are named a "period world" and in a "cohort world" (BS 2012, pp. 96-98). In both cases a completed postponement transition is symbolically divided in two stages: the first one from 1965 to 1990 and the second from 1990 to 2015. During postponement in the "period world", age-specific changes are entirely period-driven by period-specific factors of change. The period age schedule will move to higher ages without changing its profile because all cohorts react in one and the same way to these period factors and therefore the variance will remain unchanged. The TFR declines during the first stage due to a tempo effect (BS 2012, pp. 92-94) and starts rising back to reach its initial level towards the end of the transition.

During postponement in the "cohort world", completed cohort fertility remains constant across a long sequence of cohorts and the cohort age profile remains unchanged, but moves to higher ages thus incurring an increase in the cohort mean age of childbearing. These changes will incur, at the *period* level, a decline in the variance of the period age schedule and in the TFR during the first stage and a rise to their initial level towards the end of the second stage.

After examining observed age schedules and SD deviations for first births in four countries (Czech Republic, Netherlands, Spain and Sweden) BS (2012) concluded that period factors of fertility change dominated over cohort effects during the postponement transition, based on the observation that the SD did not change considerably except for external causes such as the effect of immigration on fertility in Spain.

The definition of fertility postponement refers to cohort changes only when it is the aggregate of behavior of individual women who postpone births and recuperate them later in life. A similar individual-level interpretation is invalid at the period level, yet BS (2012) and other researchers discuss period fertility postponement. In the latter case, postponement represents the behavior of a population, not of individuals. Researchers analyze both period and cohort postponement using two major synthetic indicators of the fertility age schedule and its change in time: the mean age and the area under the curve (i.e. TFR or completed fertility). BS (2012) proposed a third indicator: SD (variance) around the mean age, which can have a crucial significance in better understanding the substantive background of postponement.

The main purpose of this paper is to highlight the importance of this third indicator. More specifically, looking at trends in the SD of the age schedule of period fertility might help in better understanding fertility postponement in European countries. To focus the discussion only first births are considered throughout the paper.

The paper is divided into three main sections. In section 2, we discuss measurement of change in SD. In section 3, we provide a descriptive analysis of trends in SD across European countries and question whether they can provide additional knowledge on fertility postponement in European countries. In section 4, we briefly explore plausible explanations for changes in SD and differences across countries.

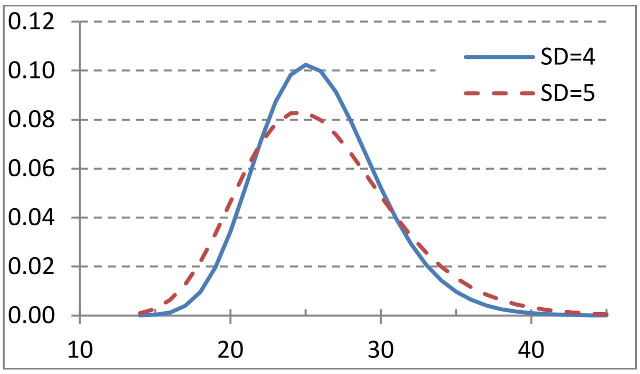
Data on fertility used in this paper are taken exclusively from the Human Fertility Database (HFD) and the adjoined Human Fertility Collection (HFC).[2]

2. Measurement of Changes in Standard Deviation

A special issue that requires caution is what changes in SD can be considered as small and what are large changes. We do not have a measure that can be used to evaluate their magnitude. In the case of the mean age at first birth for example, demographers would consider as hardly significant a rise of 0.1-0.2 years over a few years; however, when it persists for a decade and the rise is then around 2 years, demographers would conclude that there is a shift of fertility towards higher ages. In search for a similar demographic criterion we examine two simulated age schedules with one and the same TFR=1, one and the same mean age 26, and with different SD equal to 4 and to 5 years (Figure 1).

The schedule with the larger SD is more flat with a considerably lower mode; at the mode and close to it age-specific fertility rates are around 20% lower compared to the curve with the smaller SD. Given an equal TFR, the area between the two curves around the mode is compensated for by the area that lies closer to the tails of the schedules. In general the schedule with the higher SD differs significantly from the other one because it reflects fertility that is more dispersed across ages, i.e. it reflects higher heterogeneity in births by age. Similar observations have an essential role in explaining substantively changes in fertility.

Figure 1: Two hypothetical age schedules for first births, each with TFR=1 and mean age 26, and different standard distributions (SD) equal to 4 and to 5



When the difference between the two SD is 0.5 years, the difference in the age-specific fertility rates around the mode would be around 10% which is also a significant difference for demographers.

[2] Human Fertility Database. Max Planck Institute for Demographic Research (Germany) and Vienna Institute of Demography (Austria). Available at www.humanfertility.org.

As a rule of thumb we suggest a measure of the difference similar to that in the mean age. For example a 10% difference in the latter during a 10-year period would be around 2.5 years (when the mean age is around 25 years) which indicates a demographically essential shift in timing of first births; actually a difference of 2 years which is 8%, would also be a demographically essential shift. So a difference of 8 to 10 points in the SD can be considered as indicating a redistribution of births over age that should attract the attention of demographers. Analogously for other statistical indicators of variability such as the quartiles a difference of 8-10% can be considered as demographically significant.

3. Trends in Dispersion of First Births across Age

This section proposes a description of trends in the indicators of dispersion considered in this paper: SD and quartiles. More accent is given to the former because it is included in the methodological discussion provided by BS (2012) in their model of "period and cohort 'worlds'".

The discussion is organized along three major stages in period fertility postponement: its onset, subsequent progression, and decline. The three stages have been subject to extended analyses during the last two decades; BS (2012) and Lesthaeghe and Permanier (2014) provide short recent reviews. In most European countries these stages can be outlined in the following time periods:

- The onset of postponement which starts as of the first year when a sustained increase in the mean age at first births is observed. In many Western and Nordic European countries, this happened around the year 1972 (Sobotka 2004, p.53 table 3.3). In Southern Europe it occurred during the 1980s (1980 in Spain and 1983 in Portugal), and around 1990 in the ex-socialist countries.
- The progression of postponement: 1980 till around 2000-2005
- Expected decline and gradual completion of postponement which started around 2000-2005 (BS 2012).

3.1. Trends in SD1 of Period Age Profiles

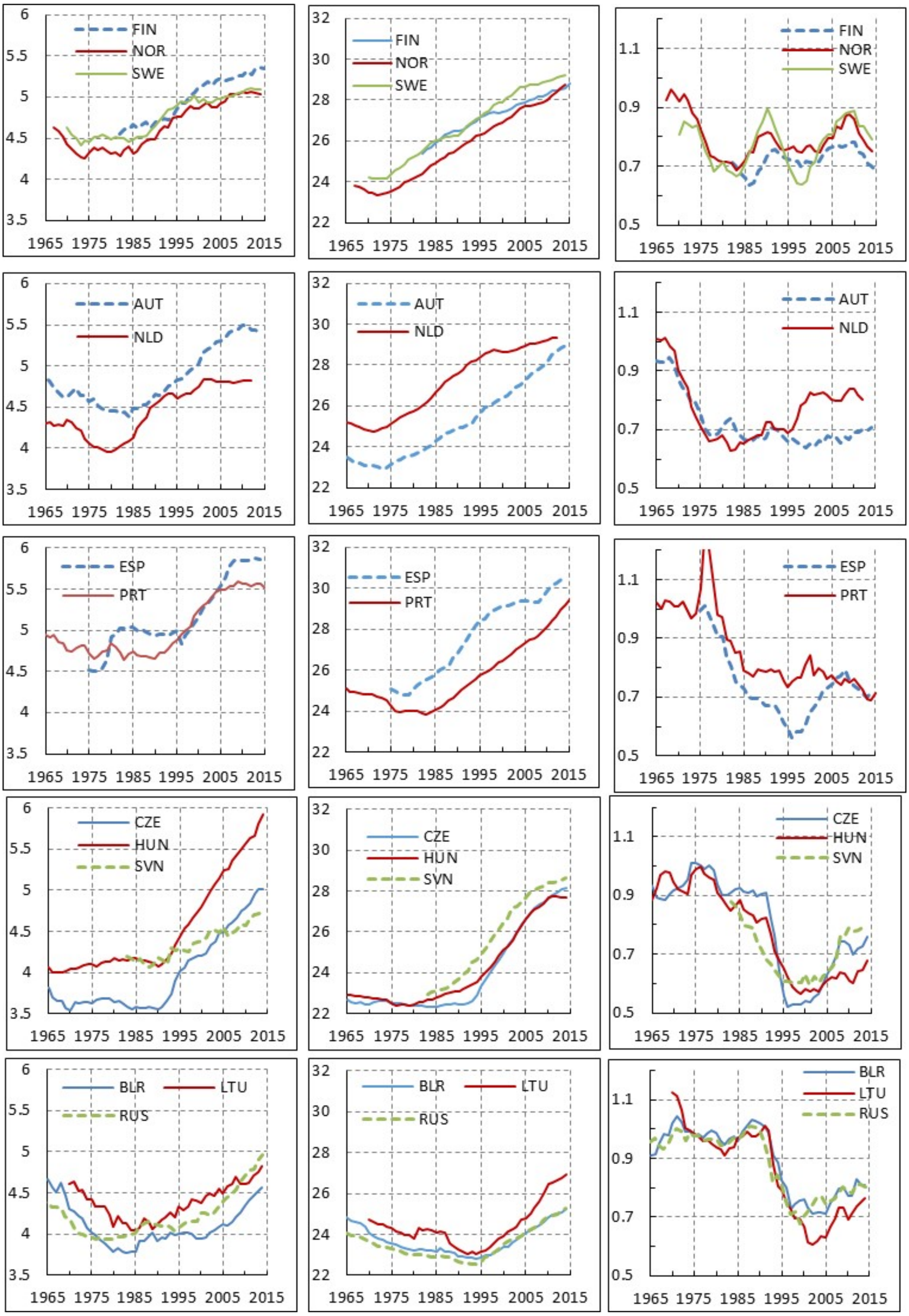
Figure 2 displays trends in the period SD for first births (SD1) in the left column, mean age at the birth of first child (MA1) in the middle column, and the first-order TFR (TFR1) in the right-side column, observed as of 1965 or later till around 2012-2015, depending on data availability. The five rows include 14 countries from different regions in Europe characterized by region-specific trends in SD1. Nordic, Central, and Southern European countries are referred to as belonging to Western Europe region, and Central-Eastern and ex-USSR countries as Eastern Europe. The main indicator of interest is SD1 whose trends can be visually compared with those in MA1 and TFR1. Table 1 gives the data for SD1 in selected years.

Table 1: SD1, selected years, 14 European countries

	1970	1980	1990	2000	2010
Austria	4.62	4.45	4.66	5.02	5.50
Belarus	4.30	3.78	3.91	3.95	4.35
Czech Rep.	3.54	3.64	3.55	4.2	4.78
Spain	4.52[a]	4.92	4.93	5.15	5.85
Finland	-	4.55[b]	4.70	5.11	5.26
Hungary	4.04	4.17	4.08	4.79	5.56
Lithuania	4.61	4.09	4.12	4.38	4.61
Netherlands	4.34	3.96	4.53	4.75	4.82
Norway	4.43	4.31	4.48	4.86	5.07
Portugal	4.76	4.85	4.66	5.25	5.56
Russia	4.18	3.93	4.11	4.25	4.79
Slovenia	-	4.19[c]	4.18	4.39	4.57
Sweden	4.63	4.49	4.65	4.94	5.07

[a] in 1975; [b] in 1982; [c] in 1983

Figure 2: SD (left column), mean ages (middle) and TFR (right column) of first births in 14 European countries



Note: countries (FIN=Finland, NOR=Norway, SWE=Sweden; AUT=Austria, NLD=Netherlands; ESP=Spain, POR=Portugal; CZE=Czech Republic, HUN=Hungary, SVK=Slovakia, SVN=Slovenia; BLR=Belarus, LTU=Lithuania, RUS=Russia. Source: HFD)

All three indicators were computed for the age span from 14 to 39 years. Since MA1 and SD1 can be sensitive to remote values the age span was cut to 20-39. The trends described on the figure would be the same for this age span, except that SD1 would be smaller and MA1 higher.

Towards 2010-2015 SD1 increased in all 14 countries with at least 10% relative to its value observed at the beginning of postponement. Based on the proposed measurement of change we conclude that SD marked a demographically significant rise during the period of postponement. It reveals increasing heterogeneity in European populations with respect to timing of first births observed in all 14 countries displayed on the figure, and in other European and non-European countries not included in this study with partial data in the HFD. Rising heterogeneity in timing of first births is a process adjoined to postponement of first births.

SD1 shows that the dispersion of first births differs significantly by age across countries. It was very low in the ex-socialist countries before the start of postponement (around 1990) and during the progression of postponement plummeted to high levels, except for the ex-Soviet countries where a significant increase was observed during the last 10 years. The upsurge of dispersion in Hungary is remarkable. SD1 is at very high levels in the two southern European countries all throughout the progression of postponement. This is surprising given the prevalence of familistic regimes in the two countries where relatives are expected to support a couple to care for their first child.

During the onset of fertility postponement, i.e. first 5-10 years after 1972-73 in Norway and Sweden, and after 1980 and 1983 in Spain and Portugal, the SD1 did not mark an increase (except for Spain in 1980; no data for Finland for this period) nor a decrease. This stability in SD1 is typical for the “period world” in the BS (2012) paradigm and it might indicate the prevalence of period factors influencing the start of postponement.

A decline in SD1 is observed in Austria for about 13 years (from 1972) and in the Netherlands for about 8 years. These periods are long and cannot be compared with similar short-term declines that might be observed in other countries. After reaching its lowest value SD started increasing in both countries and about 8 years later it assumed its value observed at the start of postponement. This initial decline followed by a rise is described by BS (2012) as a case of cohort-driven changes, i.e. in the “cohort world”. It is observed however only for a part of the period of postponement, during some 15-20 years.

With continued postponement, SD1 marked an increase in all countries indicating persistent increase in fertility heterogeneity across reproductive ages. Since increasing SD does not figure in the BS (2012) paradigm this pattern of progression of postponement cannot be characterized with their period or cohort world.

The rise of SD1 in ex-socialist countries from Central and Eastern Europe is remarkable: starting from low levels around 1990 it reached levels observed in Western Europe within some 10 years. No similar rise was observed in the ex-USSR countries.

In Nordic, Southern and Central European countries the growth in SD1 slowed down or flattened from around 2005. There are no signs that heterogeneity in the timing of first births would go back to its initial level observed before the start of postponement. This trend in the SD1 finds moderate support in recent trends in MA1 whose increase slowed down in all countries except Austria and Portugal. The TFR1 however renewed its decline in the Nordic and the Southern European countries while in the other countries it stabilized or increased a little. The recent financial and economic depression has played an important role in changes in the TFR1 (BS 2012).

3.2. SD1 in Cohort Age Profiles

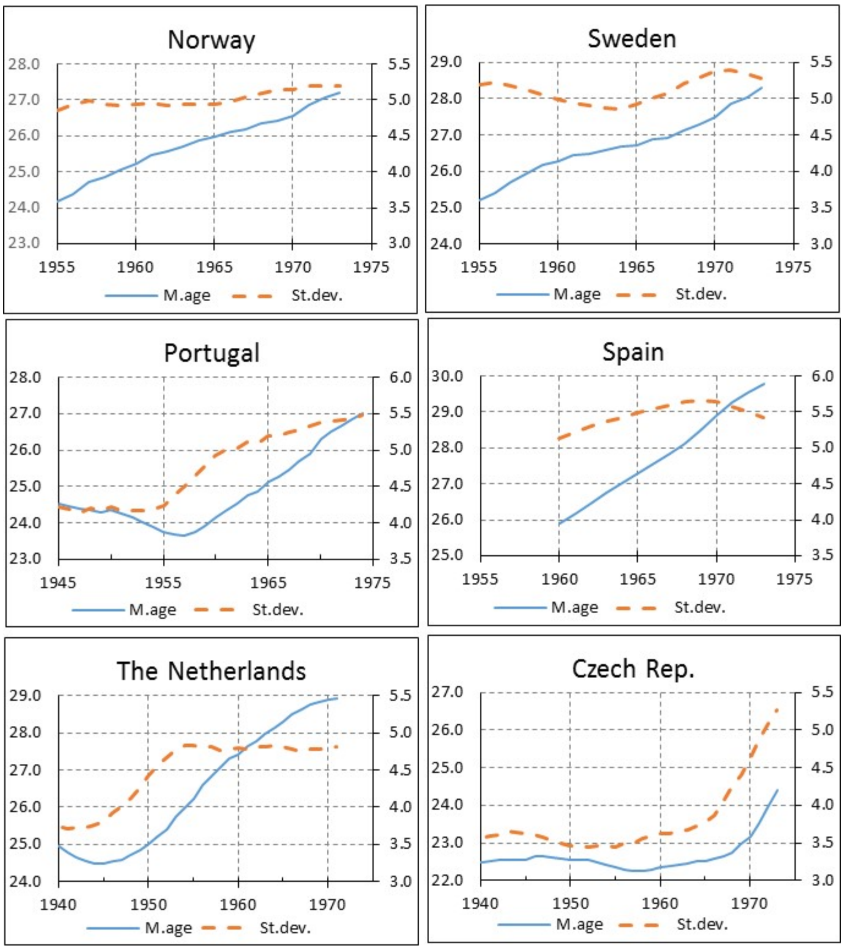
Trends in cohort mean age at first birth and its SD during a period of postponement were available in six countries: Norway, Sweden, Portugal, Spain, the Netherlands and the Czech Republic (figure 3). The indicators were estimated for the age interval 14-40; the last cohort was born in 1971 in the Netherlands; 1973 in Norway, Sweden, Spain and the Czech Republic; 1974 in Portugal. The earliest plotted cohort was born in 1940 in the Netherlands and the Czech Republic; 1945 in Portugal, 1955 in Norway and Sweden and 1960 in Spain.

Cohorts born in 1946-1948 were 25 years old in 1971-1973 which is the starting year of postponement from a period perspective in Norway, Sweden and the Netherlands. In Spain the series begin with cohorts who were 25 years old at the start of postponement in this country (1980). In Portugal longer series highlight satisfactorily the start of postponement from a period perspective (1983). The youngest cohorts were however at an advanced reproductive age (around 35) when end of fertility postponement (around 2005) is supposed to have been observed in the Netherlands, Norway and Sweden.

Starting with cohorts born around 1945 in the Netherlands; before 1950 in Norway and Sweden; during the second half of the 1950s in Portugal and before 1960 in Spain, the cohort MA1 was increasing continuously across subsequent cohorts. There are hardly any signs of its levelling among the youngest cohorts. Trends in the SD1 differ across countries. It fluctuated in Norway, Sweden and Spain and the initial and last values do not differ significantly. In the Netherlands and in Portugal the rise is steep with about one year. It was steep also in the Czech Republic.

It is indicative to compare cohort with period SD1, particularly for the last available years. A cohort SD1 is compared with this period SD1 which corresponds to the year of birth of the cohort augmented with a number of years equal to the mean age of first births of the cohort. Additionally the period SD1 for 2010 can be seen in table 1.

Figure 3: Mean age (left vertical axis) at first birth and its SD (right vertical axis) in six European countries for cohorts born from 1940 or later till 1972-1974



In the Netherlands the increase in SD1 was observed only for cohorts born between 1945 and 1954. These cohorts played a major role in the start of postponement in this country when the period SD declined for several years and later started to increase. The SD1 of the 1954 and subsequent cohorts remained at one level around 4.7-4.8. This is also the level observed for the period SD1 towards the last stage of postponement; specifically after 2001 (4.9–5.0; 4.8 in 2010, table 1). In the cohort perspective the SD1 in this country leveled off considerably earlier than in the period perspective.

In Norway and Sweden the data series start at a later year, yet it is likely to assume that similar trends developed like that observed in the Netherlands. In both countries the cohort SD did not change significantly being around 4.9–5.2 (except for temporary swings in Sweden). It is at the level observed for the period SD1 towards the end of postponement (5.0–5.1).

In Spain the available data span over a short period from 1960 to 1973, and they show an insignificant rise except for a temporary peak around the 1969 cohort. The cohort SD1 in this country is around 5.4–5.6. For the youngest cohort from 1973 it is 5.4. Since the mean age of this cohort was around 30 years its SD1 can be crudely compared with the period SD1 corresponding to the year 2003, namely 5.4. During the subsequent years SD1 increased up to 5.9 in 2013; no data for completed cohorts are available at present for direct comparisons.

In Portugal data are available for a longer period and they indicate a significant rise in the cohort SD1 which was weaker for the last cohorts. The level of SD1 for the last cohorts was 5.4–5.5 (5.5 for the cohort from 1975 whose mean age was 27.2 years). The period SD1 in 2002 (i.e. 1975 + 27) was 5.3 and towards 2013 it was 5.6. I.e. cohort and period levels in this country seem to have converged during the most recent years with data availability.

In the Czech Republic the cohort SD1 marked a significant rise to a level higher than the last period year, and there are no signs for a leveling-off. In this country the last available cohort is from 1973 whose effect on period fertility is around 1998; the SD1 for this cohort and this year are at around one and the same level.

In summary, changes in cohort SD1 are less pronounced than those in period SD1, and both indicators converge to similar levels during the third stage of period postponement when cohort data are compared with period data corresponding to the sum of the birth year of the cohort plus its mean age of first births. Changes in cohort SD1 where observed, were somewhat pronounced during the beginning of postponement.

The BS (2012) model assumes that in a "cohort world", cohorts postpone their births so that the age schedule remains unchanged. The data show that it changes during the initial period of postponement but the assumption remains valid during the progression of postponement.

Towards the last period of postponement the nearly constant level of period SD1 and cohort SD1 indicates that the shape of the age schedules of first births remained constant at the cohort and at the period perspective. So the assumptions for the cohort perspective made by BS (2012) and the assumption for the period perspective made by BF (1998) are both fulfilled. In the BF (1998) model which is the same as the period perspective of BS (2012), a similar trend can be observed when postponement has been progressing for long time and, within the framework of the model, cannot be interpreted as an indication of an approaching end of postponement. However when this trend is observed during the last period of postponement it may be considered as complementing the indication that stall in MA1 and the rise in TFR1 provide for a trend in childbearing towards end in postponement.

3.3. Quartiles of Age at First Birth

An increase in SD indicates that births disperse increasingly across age. The dispersion need not be symmetric with respect to the mean; it might be more pronounced on its left side (i.e.

the age schedule will be skewed to the left) or on the right side (right-skewed). Changes in quartile ages at first birth can help highlight what occurred.

For each country the panel on the left side in figure 4 (panel A) displays three quartiles: Q1 (25% of fertility schedule by age), Q2 which is the median of the age schedule, and Q3 which comprises 75% of fertility schedule; see also table 2.

At the beginning of postponement the interquartile range Q3-Q1 increased. For example in Austria it was 5.8 years in 1980 and 7.9 years in 2010 (table 2). This evidence supports the general inference made when analyzing SD1 that dispersion of first births across age increased during the progression of postponement (noted also by Sobotka 2004 for data till 2002).

Differences between adjacent quartiles also increased as illustrated by figure 4, panel B. The figure shows a cross-over between the trends in Q2-Q1 and Q3-Q2 in Portugal and Spain: while the former was smaller in 1980 it grew quicker and was larger than Q3-Q2 towards 2010. Thus the skewness of the fertility schedule turned from the right to the left. Postponement includes two processes: deferral of births and their later recuperation. The former appears at younger ages and the latter at older ages. Therefore the turn of the skewness to the left in the two countries indicates that while births are deferred over a widening age interval, they are recuperated at higher ages in a relatively more narrow age interval. Deferral has become more heterogeneous than recuperation.

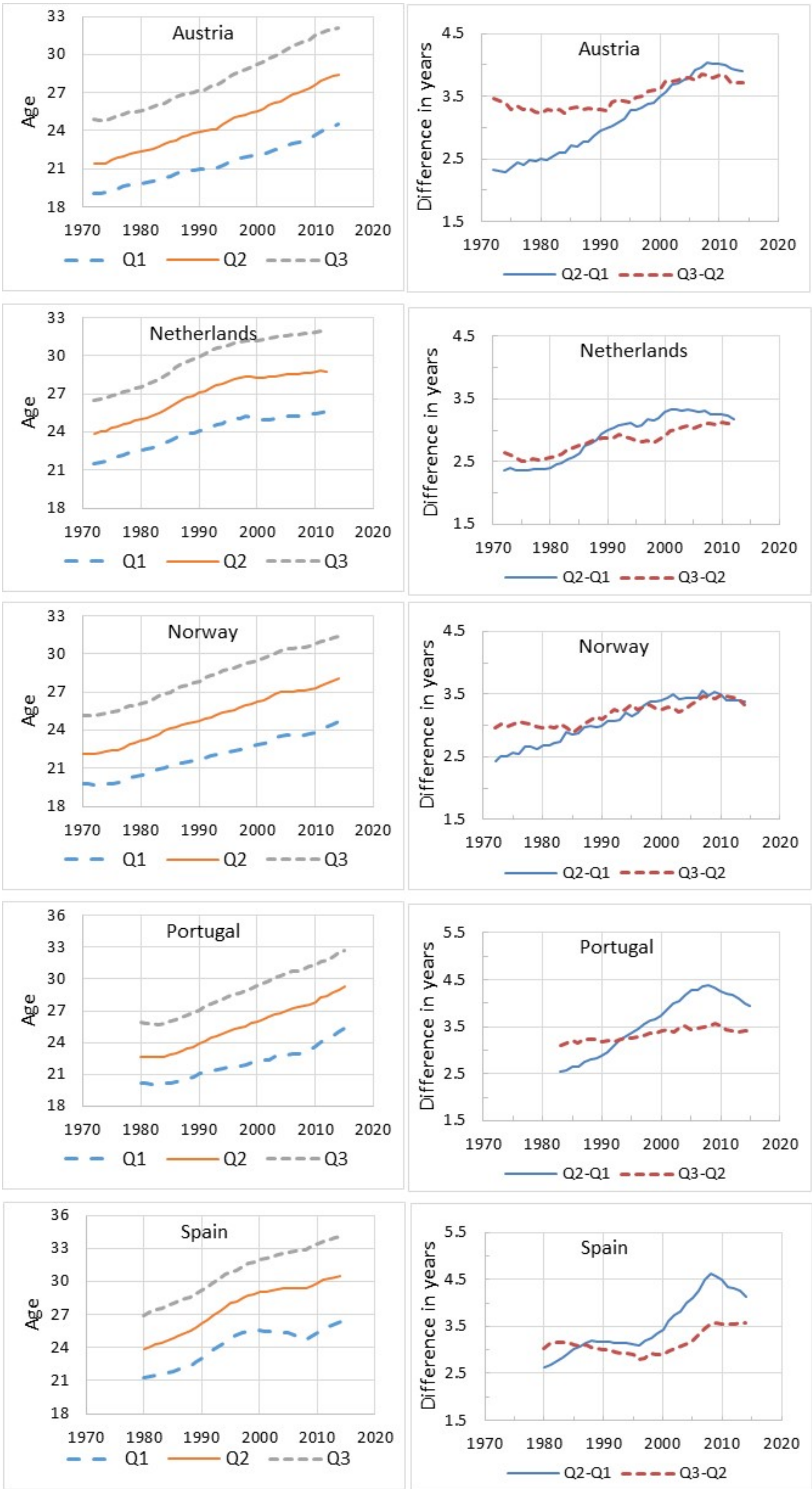
In Austria, the Netherlands and Norway the cross-over is smaller and hardly significant towards 2010 (fig. 4b). The fertility schedule has become nearly symmetrical to its median. During the beginning of postponement recuperation was more heterogeneous than deferral and towards the last years differences in heterogeneity declined. The two differences Q2-Q1 and Q3-Q2 remained around constant during the last years with available data, in correspondence with the equalization of the level of SD1.

Table 2: Age at first birth quartiles for five countries in 1980-2010

	1980			1990			2000			2010		
	Q1	Q2	Q3	Q1	Q2	Q3	Q1	Q2	Q3	Q1	Q2	Q3
Austria	19.8	22.3	25.6	21.0	23.9	27.2	22.1	25.6	29.2	23.6	27.7	31.5
Netherlands	22.6	25.0	27.5	24.1	27.1	30.0	25.0	28.3	31.2	25.5	28.7	31.8
Norway	20.5	23.2	26.1	21.8	24.7	27.8	22.8	26.2	29.5	23.8	27.3	30.8
Portugal	20.1	22.7	25.9	21.1	23.9	27.1	22.2	25.9	29.3	23.6	27.8	31.3
Spain	21.2	23.9	26.9	23.0	26.2	29.2	25.6	29.0	31.9	25.4	29.8	33.4

Figure 4: Age at first birth quartiles for five countries, 1970 to 2014. Panel A: First, second and third quartiles; Panel B: differences between second and first and between third and second quartiles

Panel A Panel B



4. Variance and Postponement: Links and Possible Explanations

The description of trends in SD1 and quartiles suggests several observations related to postponement which need additional discussion. They are as follows:

(1) In some countries the first stage of postponement was characterized by low constant levels of variance of first births which in the framework of BS (2012) can be interpreted as an outcome of prevalent period factors. In other countries SD1 declined and later resumed its initial values which BS (2012) comment as a result of cohort factors. How can this difference be interpreted? These groups of countries do not include the ex-socialist countries where fertility changes have their own specifics.

(2) During the progression of postponement variance increased in all countries. A similar trend does not correspond to the theoretical framework of BS (2012). Indeed they report its existence but find it is too small and hence does not challenge the assumptions in the framework. How can the trend be interpreted?

(3) The third stage of postponement is characterized by a stabilization of SD1 at high levels, with period and cohort SD1 converging to similar values. The age schedule has "aged" considerably and has become more symmetrical to its median. Do these observations indicate an end of postponement as it was indicated in the end of Section 3.2?

The inquiry into those three questions requires substantive and extensive demographic, sociological and other research related to postponement. Research on period versus cohort factors was briefly summarized by BS (2012, p.90) and need not be repeated here. This paper presents only a short glance over broad areas with reliance on the reader's acquaintance with the raised issues. To achieve a better focus, the discussion in the following sub-sections refers only to countries which started postponement in the early 1970s.

Statistically it is useful to consider two main types of variance: inter-group and intra-group (or within-group) variance. Inter-group variance refers to a population distributed in several groups where the process in question (i.e. childbearing) is running unchanged within-groups. However, changes may still occur when the weights of the different groups vary in the population. In demography this process is known as causing a composition effect. It is evident for populations divided by level of education, ethnicity, religion, immigration background, etc. Different groups have usually different fertility levels, mean ages, and variance. Changes in the proportion of one or more groups to the total population cause corresponding changes in the indices for the overall population, although within-group characteristics do not change. Intra-group, or within-group, changes have also been considered although not as frequently. Increase in mean ages and variance within educational groups was reported by Rendall et al. (2010). It is often the case that the fertility of immigrants (particularly for the second and subsequent generations) converge to the fertility levels of the native population. This change is heterogeneous within a group and thus intra-group variance rises.

4.1. Start of Postponement: Period or Cohort Factors?

During the initialization of postponement SD1 did not change significantly in Nordic and Southern European countries while in others, namely in Austria and the Netherlands, it first declined and 8-10 years later started increasing. The first case is described by BS (2012) as indicating the prevalent effect of period factors on postponement, and the second suggests the prevalence of cohort factors. To highlight better this case figure 5 gives the age schedules observed in 1972 and 1977 in Austria and in Norway and table 3 gives the corresponding values of the two indicators.

Figure 5: Age schedules for first births in 1972 and 1977 observed in Austria and Norway (vertical lines at age app. 23.3-23.5 indicate where the mean age cuts the schedules)

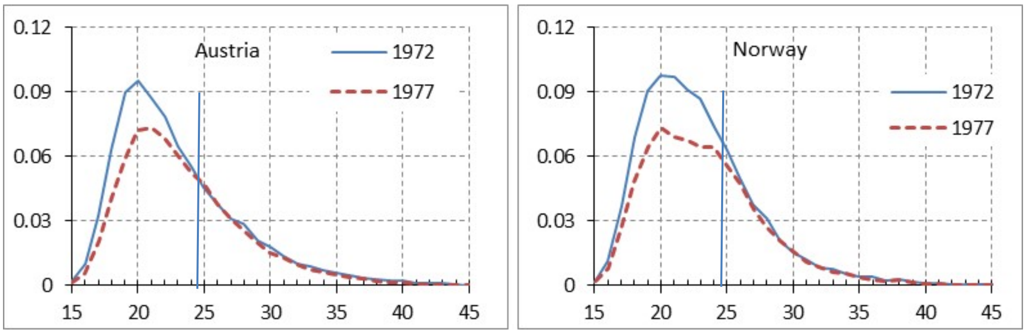


Table 3: Mean ages and SD for first births in Austria and Norway, 1972 and 1977

	MA1		SD1	
	Austria	Norway	Austria	Norway
1972	23.0	23.4	4.7	4.3
1977	23.4	23.7	4.5	4.3

In both countries first births decline drastically at ages below 24 in Austria and below 26 in Norway. Changes at higher ages are minor and considerably less significant for the values of MA1 and SD1. In Austria nearly the entire decline was to the left of the mean age of the schedules and apparently this one-sided change has caused a decline in the SD. In Norway part of the decline lied to the right side of the mean age and it had an effect on the SD1, preventing it from a decline as the one in Austria. So differences in the initial trend in SD1 in the two countries is due to a slight difference of 1.5 years in the age span where first births declined drastically for a period of five years; apparently this decline, conjoined by an increase in MA1, was due to deferral of births to later ages when recuperation emerged and increased. The commonality between the two countries is more important: first births declined considerably below age 25.[3] In both countries this deferral of births for a period of five years is significant: the area below age 25 between the two schedules occupies 15% of the TFR1 observed in 1977 in Austria and 24% in Norway.

Is deferral of first births below age 25 at the start of postponement due to a period or a cohort effect? A period effect is expected to influence births in a broader age interval, such as from 16-17 to 33-35 years. However period factors may influence only a part of the age span. For example in the beginning of the 1970s increase in educational enrolment usually took place at ages below 25. Blossfeld and Huinink (1991) noted that first births are usually timed shortly after completion of education and their finding should hold also for the early 1970s. They also showed that a similar effect might be contributed to having a first child after starting work and working career; a relevant study is also the one by Brehm and Engelhard (2015) although they referred to a period starting in the mid-1980s. Age around 25 acquires a special significance because at the time of the onset of fertility postponement in the early 1970s major early life course events, including completion of education, family formation and starting work and career, were densely concentrated for most women into a narrow age band below age 25 (Rindfuss 1991). Therefore period factors might have exercised pronounced effect in this age span. (BS 2012, p. 90, include a text with literature review directly relevant to this issue).

Increase in human capital – which is studied here with education attainment – and increase in labor force participation of women have been discussed extensively during the recent decades as two key factors affecting fertility. Table 4 indicates that education did increase significantly during the five years from 1970 to 1975 in these two countries and also in the Netherlands and Sweden. The age group 25-29 was selected because it most closely reflects changes in education during the preceding five years: this is of importance when evaluating the effect of education during the period 1970-1975.

The table shows a significant increase in post-secondary education in the period 1970-1975 in all countries when compared with subsequent 5-year periods, and a significant decline in the share of women with lower-secondary degree. These changes had an important compositional effect on timing of births and consequently on SD1. Data for the selected countries were not available to follow increase in labor-force participation of women by age during the same time period. Data for labor-force participation of women aged 20-24 were available for Sweden and they show a rise from 65.2% in 1970 to 73.7% in 1975 (http://stats.oecd.org/viewhtml.aspx?datasetcode=LFS_SEXAGE_I_R&lang=en#). The rise by nearly 10 points for a period of 5 years is significant to justify postponement of childbearing.

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[3] Following the logic of BF (1998) it would be appropriate to compare shapes of fertility schedules using ratios of age-specific fertility rates for each age. When the shape does not change, this ratio would be about one and the same by age when the two mean ages are about equal. Experiments with observed schedules with equalized mean ages showed that this method is too sensitive to small changes in the rates.

Table 4: Distribution of women aged 25-29 by three levels of education, 1970-2010

Age 25-29	1970	1975	1980	1985	1990	1995	2000	2005	2010
Austria									
Lower secondary	48%	39%	37%	32%	26%	22%	21%	17%	14%
Upper secondary	42%	49%	48%	49%	52%	52%	50%	48%	46%
Post-secondary	9%	12%	15%	19%	22%	25%	29%	35%	40%
Norway									
Lower secondary	38%	32%	29%	33%	30%	25%	21%	21%	18%
Upper secondary	45%	47%	45%	38%	37%	38%	36%	32%	30%
Post-secondary	17%	21%	26%	29%	32%	37%	43%	47%	51%
Netherlands									
Lower secondary	60%	52%	45%	38%	33%	29%	24%	19%	16%
Upper secondary	26%	28%	32%	37%	41%	43%	44%	45%	45%
Post-secondary	14%	20%	23%	25%	26%	29%	32%	35%	39%
Sweden									
Lower secondary	33%	26%	20%	17%	14%	12%	11%	12%	10%
Upper secondary	43%	45%	47%	49%	50%	49%	43%	39%	38%
Post-secondary	24%	29%	32%	34%	36%	39%	46%	49%	52%

Numbers may not sum to 100% for some years due to rounding.
Source: www.wittgensteincentre.org/dataexplorer

The oil crisis of 1973 led to a rise in youth unemployment and, assuming the validity of the discussion provided by Sobotka et al. (2011) on the evidence of the impact of economic crises on fertility, timing of births might have changed in a direction towards higher ages as indicated also by Brehm and Engelhardt (2015). This is a clear period effect acting among young adults aged mainly below 25. Education is a period factor when powerful new policy measures encourage longer educational enrolment. This happened in Austria in the first half of the 1970s under the socialist government of Kreisky. Technological progress had a significant role with the emergence of new professions and demand for new knowledge and skills.

From a cohort perspective, young cohorts may differ from their older companions in their value systems that effect family life (Ryder 1965). They may have different views on personal realization, on personal choices related to family and births, on personal career; they may feel less dependent on institutional arrangements and specifically on the pressure exercised by social norms and normative expectations. For women, new values include achievement of increased personal autonomy and gender equality. Higher education and working for pay are fundamental *instruments* for realization of aims set on the basis of new values. The effect of ideational changes has been considered as crucial for the start of postponement and for the spread of new forms of family arrangements and relative behavior. They are discussed frequently in the context of "the second demographic transition"; Lesthaeghe (2015) provides a recent overview.

Spread of efficient birth control after the discovery of the pill and its dissemination in the end of the 1960s helped women effectively control the timing of their (first) birth (Goldin and Katz 2002). The pill was an important factor for women to reach goals that correspond to new values, such as personal autonomy and independence, and in this respect is a tool similar to education and work. The pill was a period factor because it influenced all ages as the demand for it was hardly centered only on younger cohorts. Indeed if the pill or other modern contraceptives were not available, postponement might have started again although at different time and rate; in ex-socialist countries where modern contraceptives were in short supply fertility was as low as elsewhere.

This broad spectrum of relevant issues distinguishes as *proximate* determinants of change in variance the effect of human capital exemplified with education, starting work for pay, and improved methods for birth control. They act as period factors. Their action can be triggered by *driving forces* such as ideational changes, other cohort-specific factors or technological development and rising consumerism. The latter have no direct but an important indirect impact on births as they drive the period-specific factors. Understanding changes in the fertility schedule and its variance requires understanding proximate factors which are period-specific, while driving forces contribute to deeper substantive understanding of fertility change.

The United States is not among the countries considered in this paper but fertility postponement was progressing there as well having started in the beginning of the 1970s (the MAB1 started increasing in 1971). Goldin (2006) in her comprehensive analysis of fertility change in the U.S. comes right to the point of our discussion when she addresses change in factors (series in her study) which we also consider: "*In almost all cases, the turning points of the series are strikingly similar by cohort. For marriage age, college graduation, and professional school enrollment, the turning points were all around 1970. Changes in occupations occurred in the early 1970s. For earnings relative to comparable men, the turning point was a bit later, around 1980.*" (p. 8)

Thus in the framework of the BS (2012) model unchanging variance suggests that factors with direct influence on timing of births matter more than the cohort-dominated drivers.

The same inference refers to Austria and the Netherlands where the decline in SD1 was due to specific combination of effect of period factors and shape of the age schedule.

4.2. Progression of Postponement: Why Did Variance Increase?

The SD increased during the progression of postponement in all countries where data were available. This trend adjoined postponement and its universality across Europe (and in other countries included in the HFD) shows that it is a typical feature of fertility postponement characteristic during its second stage. In addition, age at first birth quartiles showed that birth deferral was becoming more heterogeneous than fertility recuperation and hence its effect on increasing variance was larger. This effect gradually diminished during the third, final, stage.

The previous sub-section presented a discussion on factors causing deferral of births. Their impact obviously continued during the progression of postponement. Table 4 illustrates a continuous increase in education and especially of the post-secondary level that requires longer enrolment. Numerous research supports the role of education (e.g., Ní. Bhrolcháin and Beaujouan 2012, Castro Martin 1995)

Women's labor force participation rates also have been on an increase as indicated by labor-force statistics (not illustrated here; see Ekert-Jaffé 2002, Engelhardt et al. 2004, Gustafsson and Kalwij 2006, Neels and De Wachter 2010). Due to high demand modern contraceptives spread rapidly to nearly total coverage.

The effect of these factors has changed during the progression of postponement and they are insufficient to explain increase in variance. On one side, the population exposed to their effect, i.e. women aged below 25 in the beginning of the 1970s, is heterogeneous and defer births for different periods. Some postpone first birth until the time they complete secondary education, others until they graduate from university, some plan to have a child soon after starting regular work, others later after pursuing work career; and some may first postpone a birth for one reason and later for another. On the other side new cohorts enter reproductive age and they get exposed to the factors of deferral. They face additional factors of socio-psychological nature: they form expectations and take decisions influenced by the behavior of their predecessors. Diffusion of new behavior and specifically of deferral of first births, arises supported by the driving forces and their instrumental factors described above. Gradually with time the new behavior becomes the mode and so a norm of conduct. It becomes socially accepted to delay family formation and entry into parenthood when traditional normative pressure weakens.

Drivers of changes in fertility timing, such as the quest to pursue personal autonomy, self-fulfillment and other forces linked to new value orientations continue playing an important role and they encompass large proportion of the population. So does technological development, which leads to rising demand for higher-quality human capital, as well as expanded labor markets that stimulate higher education and increased labor force participation rates among women. Yet when new behaviors become more widely accepted it becomes established as a new social norm and may influence women to postpone births. Therefore, the rise of new norms with weak proscriptive but strong prescriptive power acts as an additional factor of birth deferral. Personal choices become more multifaceted. Increasing diversity in sequencing and timing different life course events induces diversification of life courses referred to as de-standardization of life courses or life trajectories (Elsinga and Liefbroer 2007; Hofäcker and Chaloupková 2014; Kohli 2007; Huinink 2013) to mean the increased individual freedom and responsibility in making decisions about the self.

In the framework of this discussion some women can be considered as forerunners of new behavior. These women strive towards personal autonomy, economic independence from men, and self-fulfillment. Other women might prefer more "traditional" pathways of a homemaker staying at home and caring about the family; they might postpone births following the prevalent behavior but not as late in life as women from the first group. A third group might express "in between" preference for combining work career and family life (Hakim 2003). It is likely to expect that changes in this classification may cause compositional effects on timing of births.

Mills and Blossfeld (2005) discuss rising uncertainty in times of globalization and its effect on the early life course of young adults. Family formation and entry into parenthood are crucial life events whose timing is significantly influenced by increasing uncertainty. Their postponement is risk aversion (McDonald 2002). Uncertainty and risk aversion may affect individuals differently and hence timing of births may differ.

De-standardized life courses, differentiated preferences, winners versus losers, are among characteristics of societies where personal choices increasingly dominate over institutional restrictions. This societal environment, concisely presented here in a nutshell, forms a background for increasing diversity in timing of births and resulting increase in their variance.

The discussion in this sub-section suggests that while period factors preserved their effect on increasing variance the cohort drivers increased their influence along new dimensions. Their dominance is supported by the constant level of cohort SD1 which indicates prevalence of cohort factors in the framework of the BS (2012) model.

4.3. Third Stage of Birth Postponement: Convergence and Possible Decline?

The third stage is characterized by three important observations. First is levelling off of period SD1, although observed only for a couple of years. The attention to this levelling off is enforced by a similar observation for MA1. Second, the level of period SD1 approached that of cohort SD1 and both indicators converged to a similar level. Third, the fertility schedule, which was initially skewed to the right, became more symmetric to the median.

Do these observations tell anything about decline in postponement in addition to the changes in tempo effect discussed by BS (2012)?
The substantive discussion from the previous two sub-sections can be continued here. After a long-run of drivers and associated factors of change over several decades, increasing heterogeneity in timing of first births stalled and new cohorts show the pattern of first birth timing that does not differ much from that of immediately preceding cohorts. Specific changes in the effect of factors and drivers are due to the increase of MA1 which towards 2010 was around or close to age 30. GGS data show that the mean age at completion of higher education is considerably lower, by about 4 years (Philipov et al. 2016, table 4.1.2). As an example, consider Austria where the GGS was taken in 2009: the latter mean age was 25.9, and MA1 was 29.6 among women aged 22-39 (op. cit.). According to FFS data (1995-1996) the mean age of completion of higher education was 24.6 and MA1 was 22.5 years (Billari and Philipov 2004, tables 1 and 3). That is, during the recent years childbearing usually takes place long after the completion of lower or secondary education, and even after the completion of higher education.

When the interval between the mean ages for completion of education and first births is very long, it can be expected that the effect of completion of education is not as direct as it were in the past. It is likely to expect that it was intermediated by other factors whose effect is to postpone still further the birth of the first child. Factors with this role might be linked with labor force participation or non-participation. After completion of education it is likely to expect that a person would search for realization of the accumulated human capital on the labor market, in terms of an appropriate working place and profession, and adequate payment. These demands need time for their fulfilment. In times of rising economic uncertainty this demand may remain increasingly more difficult to satisfy; high level of unemployment and high levels of partial employment are familiar factors determining the labor market position of young adults (Mills and Blossfeld, 2005).

The previous paragraph discussed the causal link "from education to establishment in the labor market to birth of first child". This link might be interpreted as follows: first education leads to postponement of the birth of the first child, then labor market conditions take over to force a further postponement. It is not clear however why the link leads to a stall in the SD1 which signals a kind of slightly increasing homogeneity in the population with respect to timing of first births. During the period of stalling SD1 there were no signs of decline in youth unemployment or in economic uncertainty. An increasing homogeneity may lead to a decline in the SD1 and timing of first births may converge closer to the value of MA1. Indeed the variance of deferral and of recuperation declined, as depicted in figure 4, panel B. It can therefore be expected that a stalling SD1 and its likely decline are likely to signal an end to fertility postponement. The issues require deeper analysis of sub-groups of the population, defined by levels of education and position in the labor market.

4.4. Other Countries: The Case of Abrupt Societal Changes

The ex-socialist countries in Eastern Europe experienced radical societal changes as of around 1990 including rapid fertility decline and postponement (for a recent review see Sobotka 2011). Researchers have suggested diverse explanations for the fertility changes. One includes the accelerated progression of changes that had occurred earlier in the West, such as higher education expansion, the spread of efficient contraception, or new opportunities that opened up with the breakdown of state socialism. A second includes the effects of rise in impoverishment, unemployment, and relative deprivation for some and enrichment for others. Another is based on ideational changes which were no longer hindered by the restrictions of the totalitarian regime. A fourth group of explanations includes the rise in anomie. It refers to the period that started after the sudden break of social norms that dominated during the pre-transition times, and continued with the slow establishment of new norms. The four groups of changes gave rise to personal insecurity and uncertainty. A rational response to this situation, as mentioned above, is risk aversion (McDonald 2002): avoidance and postponement of crucial life events such as start of a family and having children.

The theoretical considerations discussed for Eastern Europe can also be valid for other countries. A sweeping political transformation was observed in Spain after the end of the Francoist State in 1978 where postponement started in 1980. During the 1970s, important political upheavals also took place in Portugal and Greece.

5. Summary and Open Questions

This paper examines levels and trends in dispersion of first births across age among women in European countries measured with SD around mean age and quartiles. We found that dispersion differs across countries and that it marked an increase during the progression of fertility postponement. It is an indicator of increasing heterogeneity in a population with respect to timing of first births; a process adjoined to postponement of first births.

It was unexpected to find a higher dispersion of (first) births in countries from Southern Europe, specifically in Portugal and Spain, as compared to Western and Northern European countries. Familistic regimes constitute a cultural trait in these countries and it can be argued that the childcare support wider families can provide would trigger the decision to have a child earlier in life. Yet, these decisions are dispersed across age more widely than they are in the countries where extensive support of families with children is provided by social policies.

Very low dispersion was observed in Eastern European countries before the start of the transition around 1990. It is due to the homogeneity in the life course where personal choices were restricted by totalitarian regimes. Once these regimes imploded, variance in age at first birth increased steeply within a short time, hand in hand with the rise in the mean age and decline in TFR1. In short, before the onset of fertility postponement variance in age at first birth was low in countries where the mean age was low, and it was high in societies where the mean age was high; the statistical coefficient of variation might be of use but it was found too sensitive to changes in the mean age.

Trends in the SD1 after the start of fertility postponement indicated three distinct periods: an initial one when SD1 did not increase; a longer trend observed during the progression of postponement, where SD1 increased, and a final stage where the SD1 stopped increasing and seems to stabilize, without signs of returning to levels observed before the start of postponement. Following the model described by BS (2012) I concluded that the initial period of postponement was period-driven although it did not affect all age groups and, at the start, it was observed only among young women up to age 25. Concise substantive discussion discerned factors directly affecting fertility decisions such as prolonged educational enrolment, increased entry in the labor force, availability of new methods for birth control, from factors that have an indirect impact such as ideational and technological changes in domestic appliances; the latter factors drive the effect of the former. While ideational changes are well known as influencing cohorts, the immediate influence of direct factors was found to be period-specific at the start of postponement, when becoming a parent was taking place at a young age. During the progression of postponement when the mean age increased, new cohorts reach reproductive age and they "learn" new behavior from their predecessors. The domain of factors increased to encompass diffusion of postponement. This mixture of cohort and period factors caused an increase in variance in age at first birth. Towards the last stage of postponement some of the factors such as increase in education might have diminished their direct influence as the mean age of first births reached a level considerably higher than that of completion of educational enrolment; they might have been intermediated by other factors. Diffusion of new values linked to personal autonomy, economic independence and work career became more common and their achievement evolved into the new standard for large groups of the population. This broad picture skips some important explanatory aspects. For example, trends in union formation are important, including postponement of marriage and spread of cohabitation.

This paper discussed only first births and would be further enriched when fertility dispersion across ages at higher-order births was added in the analyses. A range of issues needs to be studied more deeply in the future, including checking the validity of the presented inferences. In general, an open issue is whether intensity of the effect of selected explanatory factors on childbearing changed in time. For example, can we say that while education is an important factor all throughout postponement, its influence lessened somewhat during the last years (i.e., the intensity of its influence might have lessened)? Did diffusion play the role assigned to it in explaining the progression of postponement? To what extent do country idiosyncrasies influence the course of fertility postponement?

List of Abbreviations

BF (1998)	Bongaarts and Feeney (1998) in the list of references
BS (2012)	Bongaarts and Sobotka (2012) in the list of references
FFS	Fertility and Family Survey
GGS	Generations and Gender Survey
HFD	Human Fertility Database
HFC	Human Fertility Collection
MA	Mean age of childbearing
MA1	Mean age of first births
SD	Standard deviation from the mean age of childbearing
SD1	Standard deviation for first births
TFR	Total fertility rate
TFR1	Total fertility rate for first births

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