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Analysing fertility trends through Schmertmann's model: Italy and Sweden compared

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Abstract

Using age specific fertility rates of Italian and Swedish women aged between 15 and 49 years old I examine the presence of fertility postponement in period and cohort outputs. Period data consist of standard five-year age group rates ranging from 1960 to 2005. Cohort data are arranged on age specific year groups born between years 1930-1970. The method used in this work is based upon quadratic spline interpolation procedure, developed by Carl P. Schmertmann (2003), in which three index ages determine the schedule's shape. The recent fertility postponing behavior is investigated through the help of five index ages, which show the dynamics of postponement both in cohort and period data.

Keywords

Second Demographic Transition, fertility trends, postponement, quadratic spline interpolation, Italy, Sweden

Introduction

The present work aims at studying postponement trends of fertility in two industrialized European countries, Italy and Sweden, through interpolation of age specific fertility rates into quadratic spline functions.

Recent fertility trends in most Western industrialized countries describe a sharp descent in fertility, with peaks of lowest-low fertility in Southern and Eastern Europe. The European Union concern about under replacement level fertility and lowest-low fertility is a proof of the importance the topic recently reached among European governments.[1] A major threat would be a long lasting situation of poor fertility levels, which lead to significant demographic changes in the population structure, such as further aging of societies and significant population decrease. How much is this scenario realistic?

An important contribution to the answer is played by a recent phenomenon in fertility behavior in industrialized countries, the so called postponement of childbearing, which shifts the beginning of childbearing to later ages. Shifts in fertility tempo are seemingly common over centuries,[2] but how does it really affect fertility nowadays and to what extent? These are the questions I investigate and answer in this work. To analyze and compare fertility postponement trends I have chosen two different industrialized European countries, Italy and Sweden. I will demonstrate that Second Demographic Transition (SDT) and postponement of childbearing do not necessarily imply low and lowest-low fertility, as shown by the Swedish fertility level analysis.

The method used to fit data is based on the quadratic spline interpolation model elaborated and described by Carl P. Schmertmann in his article “A system of model fertility schedules with graphically intuitive parameters”.[3] It proposes age specific fertility schedules, in which three index ages provide the shape of the schedule. These constrained quadratic splines have easily interpretable parameters and are flexible enough to fit a variety of schedules well.

Data analysis

This section reports the output obtained through quadratic spline-interpolation of period and cohort Age Specific Fertility Rates. Data used to compute spline functions are composed by age specific fertility rates on a national scale, based on women aged between 15 and 49 years old. Period data consist of standard five-year age group rates. The sources used for period analysis are The Council of Europe, Recent Demographic Developments in Europe 2006 for Sweden and from Council of Europe, Recent Demographic Developments in Europe 2006 and ISTAT 2006 for Italy. Data referring to period specific parity come from EUROSTAT. Cohort data are arranged on age specific year groups. Institute National d’Études Démographiques and Swedish Statistiska Centralbyrån provided cohort data for Sweden, for cohorts born between 1930 and 1989. Italian cohort data have been released by Max Planck Institute for Demographic Research and include cohorts born between 1902 and 1981 classified by parity. Data comment is based upon five indexes Alpha, Peak Age Fertility (P or PAF), Half Way Fertility (H), Stopping (S), and Delay (D) and on period and cohort fertility rates. These indexes are illustrated in figure 1, which shows the spline curve for the Italian 1930 birth cohort. I have decided not to consider the spline knots to focus on postponement trends of childbearing rather than on the usefulness of spline models in analyzing fertility trends, since it has successfully been done in Schmertmann (2003).

[1] European Ministries Resolution, 29th June 2000.
[2] Chesnais (1996).
[3] Schmertmann (2003).

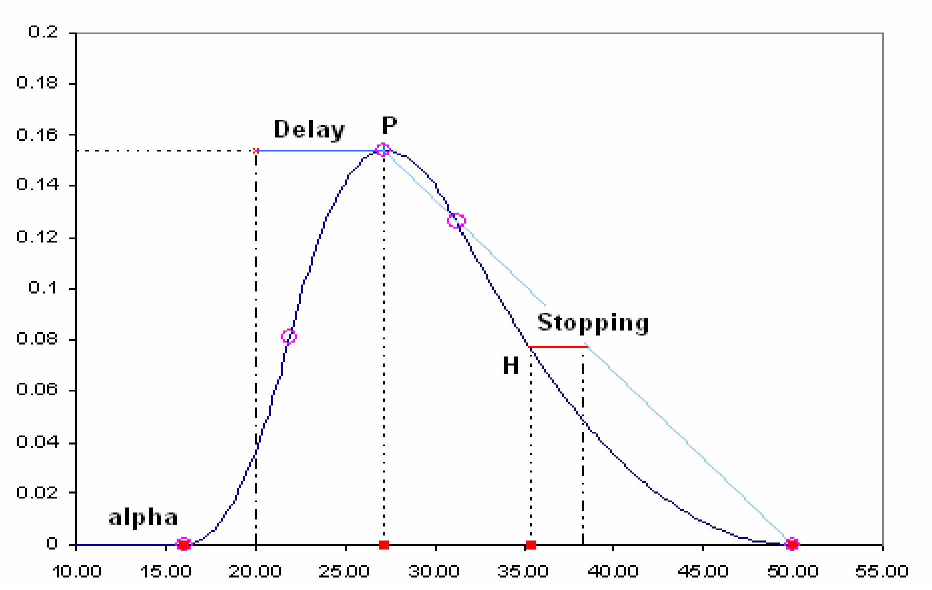


Figure 1. Italian spline curve for 1930 birth cohort

Period analysis

Period analysis refers to calendar years 1960-2005 for Sweden and 1960-2005 for Italy, computed according to quadratic spline interpolation using yearly age specific fertility rates (ASFR) data-sets: each year consists of standard five-year age groups, from 15-19 to 45-49 years-old.

Alpha

The first index used to analyze fertility is alpha. In figure 2 this index decreases from 1960 to 1963-1965 for Italy and Sweden respectively, according to Total Period Fertility Rate (TPFR) evolution, declining as TPFR rises. Indeed, in both countries alpha reflects the "baby-boom" years, declining during the first half of the 1960s.

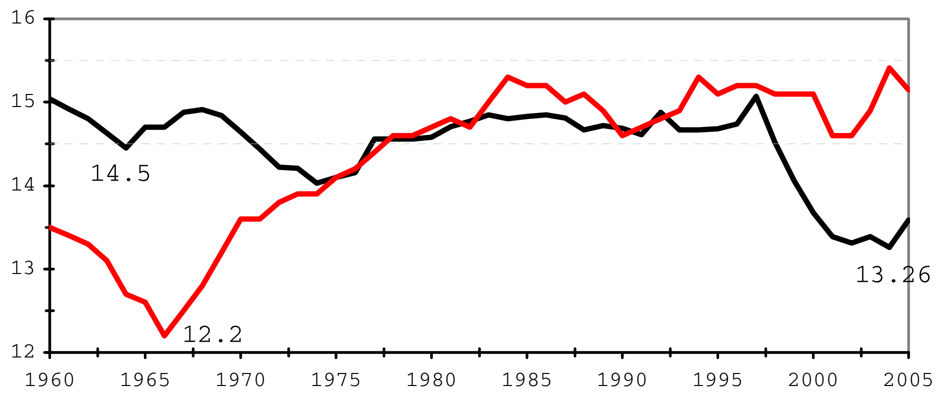


Figure 2. Alpha, Italy (black) and Sweden (red)

Alpha rises in Sweden during the late 1960s and 1970s, stabilizing on values between 14.5-15.5 years old from late 1970s onward. This behavior can be explained through the influence of social norms and family policies on childbearing. Indeed, social norms in Sweden act to postpone the beginning of fertility after the end of studies,[4] which "delay" fertility and

[4] Compulsory education in Sweden takes the form of a nine year comprehensive school for children aged 7-16, fully implemented in the whole country since 1971-1972.

shift its beginning to around 16 years old. This feature is supported also by family policies, which indirectly promote incentives to those mothers who complete education.[5]

In Italy, alpha starts at a higher level in 1960, as a result of strong social norms, which frame fertility inside marriage;[6] indeed, extra-marital births have always been very low and marriage rates extremely high over time. This let alpha set on a higher level with regard to Sweden, during 1960s. These norms relaxed during the following years, especially by the late 1990s, and alpha falls down to 13.3 in 2001. This decrease may also depend on ASFR distribution, especially with low "fertility intensity", that is to say not concentrated around a certain age but spread along the age line axis, as for Italy, or it may depend on birth interval. Indeed, the Italian birth interval is usually wider than the Swedish.

This concept is graphically demonstrated in figure 3 which shows the interpolation of Italian and Swedish data for year 2001. The "intensity of fertility" is shown by the slope of the left hand side of the spline curve. Indeed the Swedish spline curve starts with a higher slope, "concentrating fertility" around P.

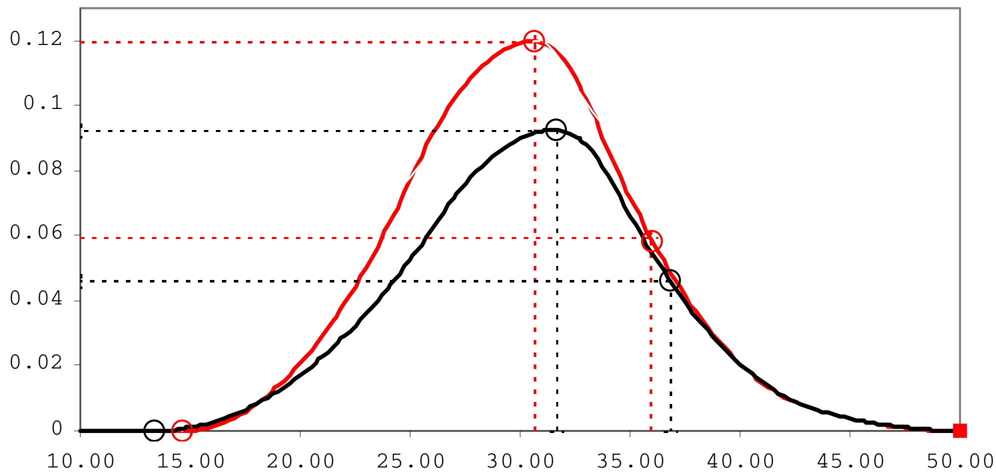


Figure 3. Spline curves for year 2001. Italy (black) and Sweden (red)

This is clear looking at TPFR (for data see table 3, p. 11). Ten percent of period fertility is reached at 20.0 years old in Sweden versus 22.3 in Italy in 2005, even though Swedish alpha is 1.6 years higher than the Italian. In Italy alpha is too high to indicate the presence of the "baby-mothers" phenomenon. Nevertheless, it suggests that the distribution of the ASFR is not concentrated around a certain age.

Peak Age Fertility

Peak Age Fertility (PAF) represents the age at which fertility reaches its maximum. In figure 4, the two lines show a similar evolution for Italy and Sweden.

In Italy PAF started decreasing in 1960, falling from 26.6 years old down to 24.9 in 1977. This decrease partly relates to the "baby-boom" years, especially if one considers the first half of 1960s. The increased wealth of society played an important role in the decrease of mean age at childbearing; indeed, it let couples marry and have children earlier. Nuptiality increased up to mid 1970s and mean age at first birth was still decreasing in 1980, 23.8 years old, opposing Western Europe's general trend. After 1977, the increase in PAF was fast, reaching 30.1 years old in 1995. Nowadays it reaches 31.7 years old.

[5] Björklund (2006), p. 10
[6] Santini (1995)

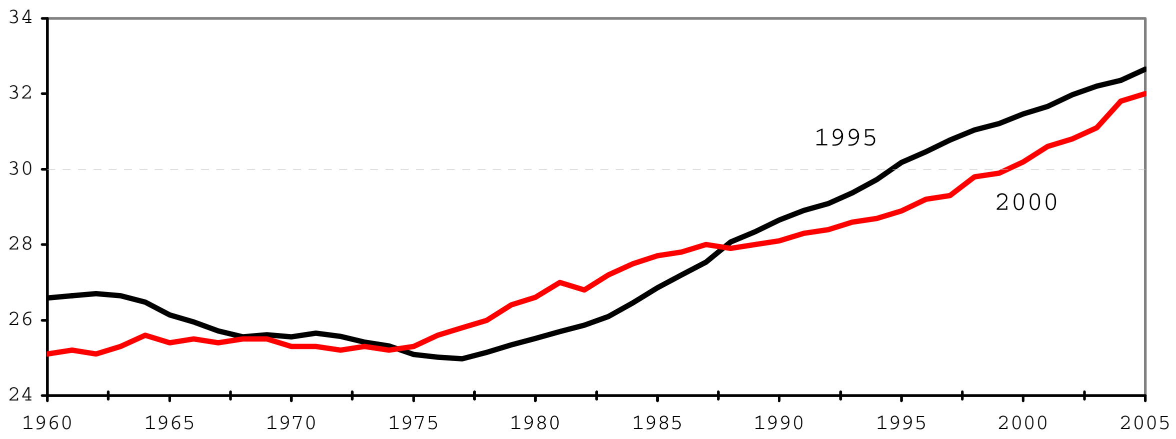
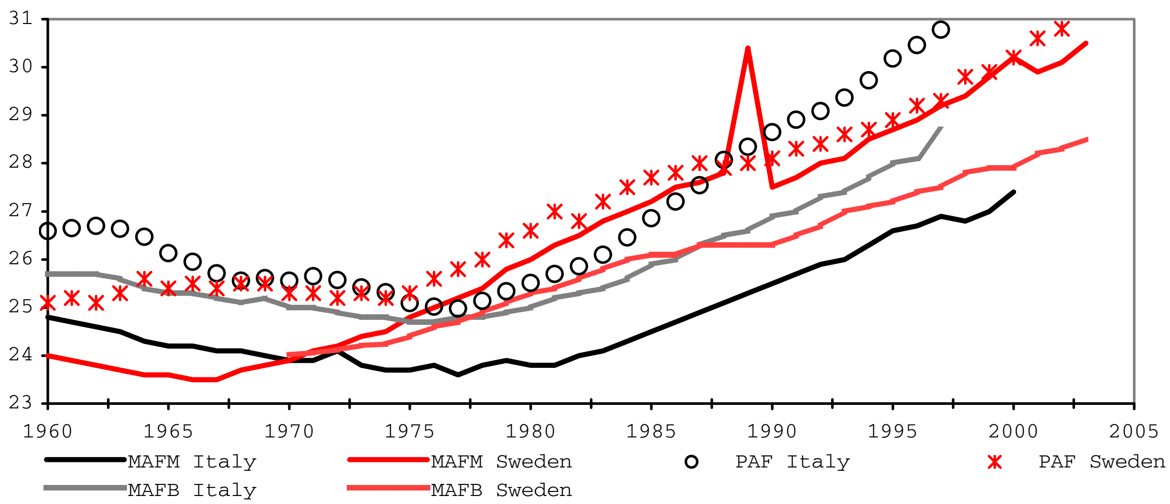


Figure 4. PAF, Italy (black) and Sweden (red)

On the other hand, in Sweden PAF rise has been slower. From 1960 to 1975, PAF was almost stable, between 25.0 and 25.5 years old, registering some swings in 1981 and 1987. Swedish PAF overtook the Italian between 1974-1988 reaching 30.0 years old in 2000. In 2005 PAF assess on similar levels in Italy and Sweden, 32.7 and 32.0 years old respectively, denoting a postponement of childbearing in both countries. Even though Italian and Swedish PAF show a similar path, these countries have extremely different fertility tempo. This is clear in figure 5, which depicts childbearing dynamics and how events like marriage and first childbirth are distributed over the age axis.



Source: Eurostat.

Figure 5. Mean age at first birth (MAFB), mean age at first marriage (MAFM) and PAF

The first important difference between the two countries concerns mean age at first birth (MAFB) and mean age at first marriage (MAFM). Italian MAFB stands well above the MAFM line. In Sweden, MAFB is below MAFM[7] and first births anticipate marriage by an increasing value; if in 1973 this measure is 3.6 months, in 2003 it is 2.0 years. This means that cohabitation is a usual experience among couples since the early 1970s. Italy registers the opposite trend; marriage is just the first step toward family formation. Indeed, the gap between marriage and first childbirth increases over time, from 10.8 months in 1960 to 21.6 months in 1997. Moreover PAF lines compared to MAFB show a similar distancing path. This may be interpreted in different ways, given Italian and Swedish TPFR levels. Even

[7] The rise in Swedish MAFM in year 1989 has been investigated by Andersson (1999).

though in 1977 the gap between PAF and MAFM is almost the same for both countries (25 months for Italy and 22 for Sweden), the different level of the respective TPFR suggests a smaller gap between subsequent births in Sweden.

From PAF analysis we can deduce that postponement occurred earlier in Sweden. In 1975, PAF was still decreasing in Italy, while in Sweden it began to rise. Then, in Sweden, PAF stabilized at a lower level of increase. It is remarkable that Swedish PAF increased by 5.9 years in forty years, while the Italian PAF increased by 7.4 years in only twenty-seven years. This may suggest a possible stabilization of Swedish PAF and that Swedish postponement reached equilibrium.

The gap between these two countries must be traced in the labor market dynamics as suggested by Björklund (2006). Female participation to labor force (FPL) has always been high in Sweden, and seems to have particularly influenced fertility choices of Swedish women, concentrating fertility around PAF, that is to say after schooling and after continuous employment. In addition, regular and continuing employment brings higher benefits from family policies; incentives to stay in the labor market are higher. This is not true for Italy, where FPL has always been modest, one of the lowest in the European Union. Fertility is indeed postponed, but the effect of postponement is distributed over a longer age path, reducing the fertility recuperation on TPFR.

Half Way Fertility

Half way fertility, H, represents the youngest age at which fertility falls to half of its peak level. H together with PAF is a useful instrument to study postponement fertility trends. In figure 6, the two curves present a similar V shape trend, although the Swedish line is shifted to the left with respect to the Italian. A possible explanation (left hand side of V) is given by the anticipation of fertility up to the mid-late 1970s and symmetrically to a decrease in TPFR after the "baby boom" years. The right hand side of the V is produced by an increased childbearing postponement and recuperation fertility, which shifts H to the right. Italy starts decreasing at a higher level, meaning that later ages fertility is high among women, mainly thanks to higher order births.[8]

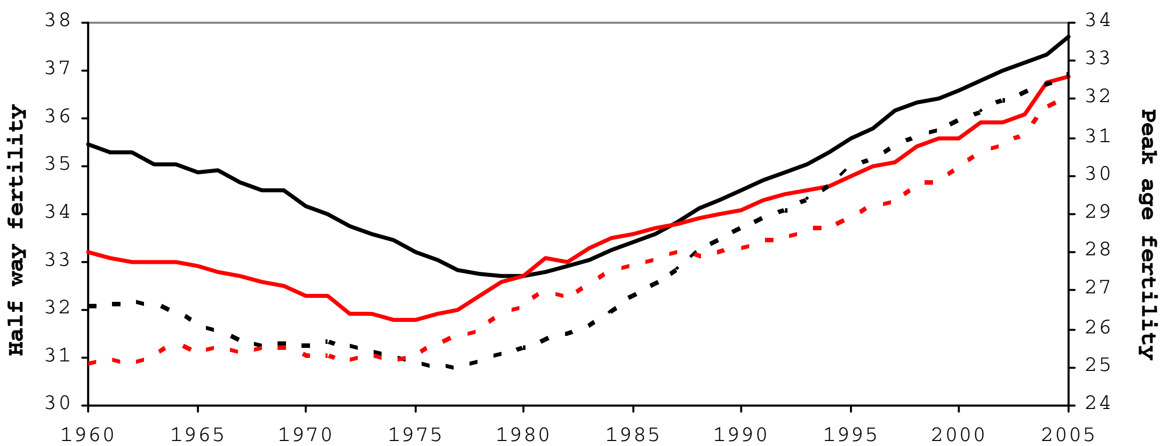


Figure 6. H and PAF (dashed), Italy (black) and Sweden (red)

The role played by H is clear looking at table 1, which presents the results of a quadratic spline simulation of TPFR for values of H from 27 to 36 with the other parameters held constant (cohort maximum fertility rate, R = 0.30, alpha = 15, PAF = 23). The result shows that TPFR varies, rising as H rises, decreasing as H decreases.

[8] Castiglioni and Dalla Zuanna (2001)

Table 1. Simulation of the relationship between H and TPFR, R=0.30, Alpha=15, PAF=23

H	TPFR	H	TPFR	H	TPFR	H	TPFR	H	TPFR
27	2.60	29	3.27	31	3.95	33	4.50	35	4.96
28	2.93	30	3.63	32	4.24	34	4.74	36	5.18

The lowest values of H reached by Italy and Sweden are 32.7 years old in 1979 and 31.8 years old in 1974 respectively. In year 2005 H sets at 37.73 in Italy, and 36.88 in Sweden. The rise in H means that Italian and Swedish women postpone childbearing to older ages, rather than recovering for higher order births, which have dropped substantially during the most recent decades, especially in Italy.[9] Comparing H to PAF trend, it is interesting to point out that from mid 1970s in Sweden and from late 1980s in Italy, these two indexes increase in a similar way. For example, if H decreases and PAF is stable (Sweden 1960-7), S rises reducing late fertility. Since the 1990s the distance between the two lines, PAF−H, keeps quite constant at about 5-6 years. This path depicts the picture of two postponing countries in which there is a clear attempt of fertility recuperation in later ages, even though Swedish recuperation is more effective. The main differences between the reproductive behavior of these two countries and the respective postponement is explained clearly if H and PAF are compared to delay and stopping.

Delay and Stopping

Delay, D, and Stopping, S, are two other important instruments to observe and study postponement of childbearing. Schmertmann (2003) used these two indexes to measure postponement trends in period fertility rates.[10] D and S work together to depict the timing of childbearing. D is a measure of "delay" between biological peak of fertility,[11] set at 20 years old, and PAF computed by the quadratic spline model. On the other hand, S represents the difference between a linear decrease from the peak of fertility to 50 years old and the fitted decrease down to half way fertility, formally $S = \frac{(P+50)}{2} - H$.

Looking at figure 7, we can see the evolution of D and S from 1960 to 2005.

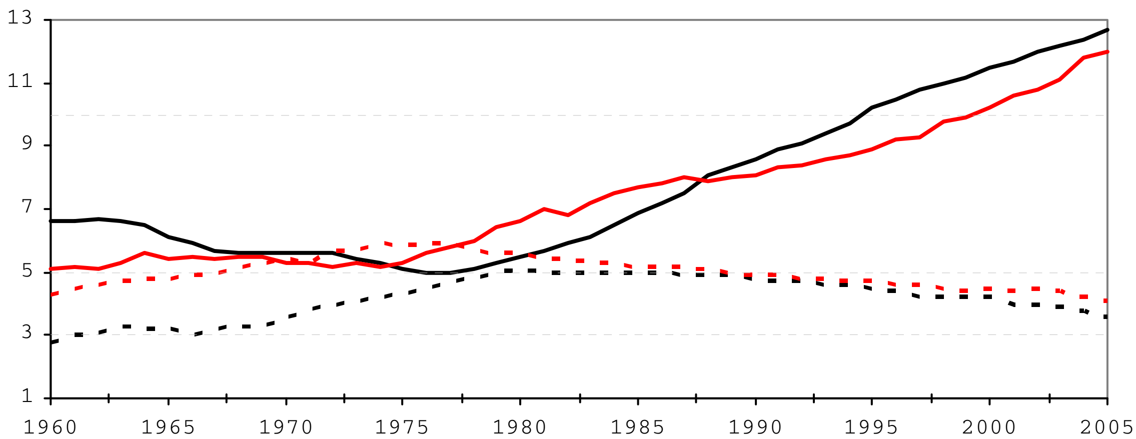


Figure 7. Delay and Stopping (dashed line), Italy (black) and Sweden (red)

Both Sweden and Italy register a similar trend; indeed, after 1975 D rises, while S falls slightly, almost during the same years. Delay is a measure directly influenced by another

[9] De Sandre, Ongaro, Rettaroli and Salvini (1997)
[10] Schmertmann (2003)
[11] Coale and Trussel (1974)

index, PAF. Indeed, the path of D reproduces exactly PAF. Italy and Sweden register a rather stable ondulatory trend up to the late and mid 1970s. In 1960 D is 6.6 years for Italy and 5.1 years for Sweden. At the end of the time-line, in 2005 Italy registers 12.7 years while Sweden 12.0 years. The gap between 1960 and 2005 has been filled in through an upward trend begun during the 1970s.

One difference between these two countries is the way D reacts during the "baby boom" years. Sweden does not experience a fall of D values, which is indeed relatively stable between 1960 and the mid 1970s, as figure 7 shows. Both Italy and Sweden start rising around the second half of 1970s. Swedish D rises faster, to stabilize then on a lower growth level, 12.0 in 2005, increasing each year by 1.8 months on average. On the other hand, Italian D started increasing almost linearly and remains on this growth path, 12.7 in 2005, increasing each year by 3.6 months on average.

It would not be wrong to think that a high value of D leads to a low value of TPFR. A high value (e.g. >10, that is to say PAF>30) of D would suggest that fertility is being postponed into older ages, D rises if PAF rises, which implies that the biological potential is being reduced. On the other hand, a low value (e.g. <5, that is to say PAF<25) of D indicates that PAF is near to the biological fertility peak, that is to say 20 years old. This is investigated through figure 8, which compares D to TPFR. Figure 8 does not show any clear connection between D and TPFR especially for Sweden. This may indicate that the increase in D is dictated by a change in family planning decisions, which do not necessarily lead alone to fertility level variation, as the Swedish lines suggest. Fertility is indeed a complex phenomenon, which involves many factors to affect total fertility rate. It is important to point out that similar levels of D and S do not mean similar levels of TPFR; indeed in 1988 D=7.9 years and S=5 years, but TPFR is equal to 1.37 in Italy and 1.9 in Sweden.

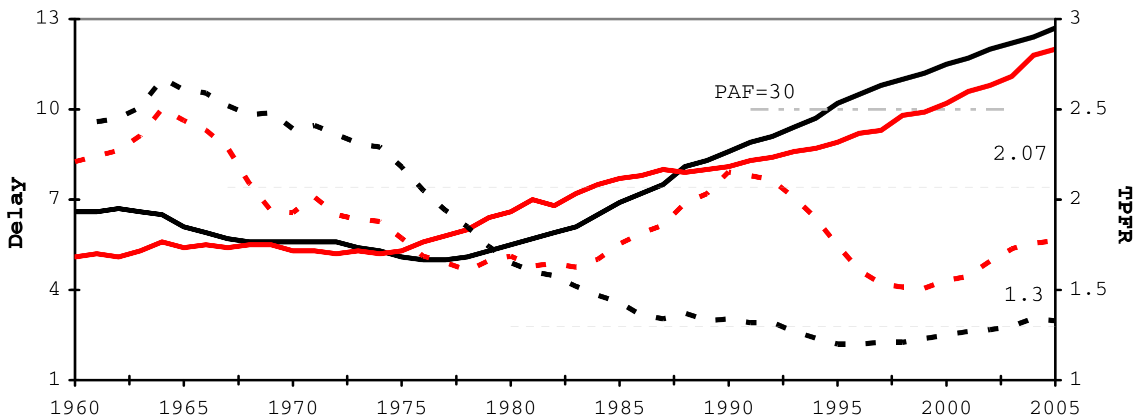


Figure 8. Delay (S) and TPFR (dashed), Italy (black) and Sweden (red)

In figure 9, the trend of S traces an upside-down V. In 1960, Italy and Sweden have different levels of S, 2.8 and 4.3 respectively, even though their TPFR is similar. What is remarkable about Italy and Sweden is that the S trend from the 1980s on seems to take a common path. As with D, S does not show a direct connection with TPFR. A low value of S means that the difference between PAF and H is high, that is to say, fertility after PAF is high, and there is postponement.

In 1960, S started to rise slowly, starting from 2.8 years in Italy and 4.3 years in Sweden. It is remarkable that the Swedish D−S gap is less than one year in 1960, while the Italian D−S gap measures almost 4 years. In Italy PAF occurs later but late ages fertility is higher than in Sweden, since Italian S is lower; in Sweden PAF and late ages fertility are lower. This means two different things, given D and S levels: first, if childbirths are concentrated at younger ages and S is low, the spline curve moves to the left. This situation usually presents high TPFR, well above the replacement level, since higher order births still play a crucial role in the definition of the fertility rate. Second, if fertility is postponed into older ages, higher order births play little role in the definition of TPFR. This can be explained either by fertility rates close to replacement level, as for Sweden, or by lowest-low fertility rates, as for Italy. It is remarkable about S that the Italian and the Swedish values approached each other and followed a similar path around 1980.

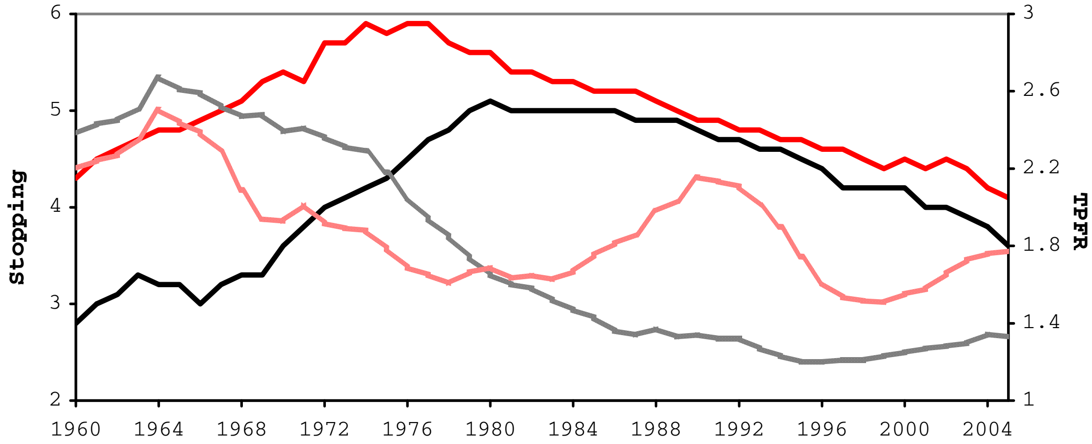


Figure 9. Stopping (S) and TPFR (dashed), Italy (black) and Sweden (red)

Total Period Fertility Rate

TPFR computation refers to years 1960-2005 both for Italy and Sweden, as reported in table 2. TPFR stands well above replacement level in 1960, especially in Italy, at 2.38 children per woman. During the subsequent years, fertility starts rising up to the mid 1960s, reaching 2.67 in Italy and 2.504 in Sweden, in 1964. The mid 1960s are also known as "baby-boom" years, characterized by high nuptiality and fertility rates, as well as by rising economic wellbeing; factors, which contributed jointly to fertility rates rise. During the second half of the 1960s, the fertility level slowly starts to decrease.

The subsequent decrease in TPFR has been discussed widely by demographers, who suggest a concomitance of social and cultural events such as the rise of female participation in the labor force, spread of contraceptive measures among the population and diffusion and confirmation of values, which Inglehart connects to "post-materialist societies".[12]

Table 2. Computed TPFR in Italy and Sweden

year	Italy	Sweden	year	Italy	Sweden	year	Italy	Sweden
1960	2.382	2.209	**1976**	2.052	1.687	**1992**	1.322	2.108
1961	2.433	2.242	**1977**	1.940	1.650	**1993**	1.273	2.011
1962	2.452	2.271	**1978**	1.849	1.606	**1994**	1.225	1.897
1963	2.514	2.353	**1979**	1.739	1.663	**1995**	1.201	1.744
1964	2.670	2.504	**1980**	1.652	1.687	**1996**	1.202	1.610
1965	2.610	2.438	**1981**	1.596	1.633	**1997**	1.213	1.534
1966	2.594	2.385	**1982**	1.576	1.647	**1998**	1.213	1.516
1967	2.516	2.286	**1983**	1.520	1.626	**1999**	1.228	1.508
1968	2.472	2.088	**1984**	1.471	1.668	**2000**	1.251	1.552
1969	2.479	1.938	**1985**	1.432	1.753	**2001**	1.266	1.577
1970	2.395	1.928	**1986**	1.363	1.813	**2002**	1.281	1.657
1971	2.406	2.014	**1987**	1.340	1.858	**2003**	1.297	1.727
1972	2.357	1.917	**1988**	1.370	1.979	**2004**	1.343	1.759
1973	2.312	1.891	**1989**	1.334	2.032	**2005**	1.329	1.772
1974	2.292	1.880	**1990**	1.343	2.153			
1975	2.178	1.786	**1991**	1.317	2.133			

[12] Van De Kaa (1987)

To effectively investigate the possible origin of TPFR decrease, it is necessary to look both at "tempo" and "quantum" of fertility. The shift in "quantum" fertility is shown in figure 10. The first grey line, set at 2.07 children per woman, delimits the border over and under replacement fertility, the second line set at 1.3 children per woman designates the area under which fertility is called "lowest-low". The first difference between Italy and Sweden can be seen in the two TPFR trend lines. The Italy line has a more defined trend, a descending one. The Sweden line varies more, but never goes below 1.5 children per woman, and registers two peaks, one during the "baby boom" in 1964, the second in 1990. The 1990 peak is remarkable, since it is the highest fertility level that Sweden reached since 1967. Indeed, Sweden depicts a peculiar situation among industrialized and comparable countries because of the swing in fertility reported during the 1990s. Swedish rates fell under replacement level eight years before the Italian, but then the pattern reversed increasing the fertility level up to 2.15 in 1990. Then fertility plummeted again during the subsequent years, down to 1.508 in 1999. No other industrialized country registered such a high swing in fertility. Many studies suggest this behavior to be partly due to a concomitance of opposing factors: on the one hand, Swedish family policies indirectly helped keep fertility high;[13] on the other hand, the economic crisis and subsequent unemployment reduced the value of policy benefits.[14]

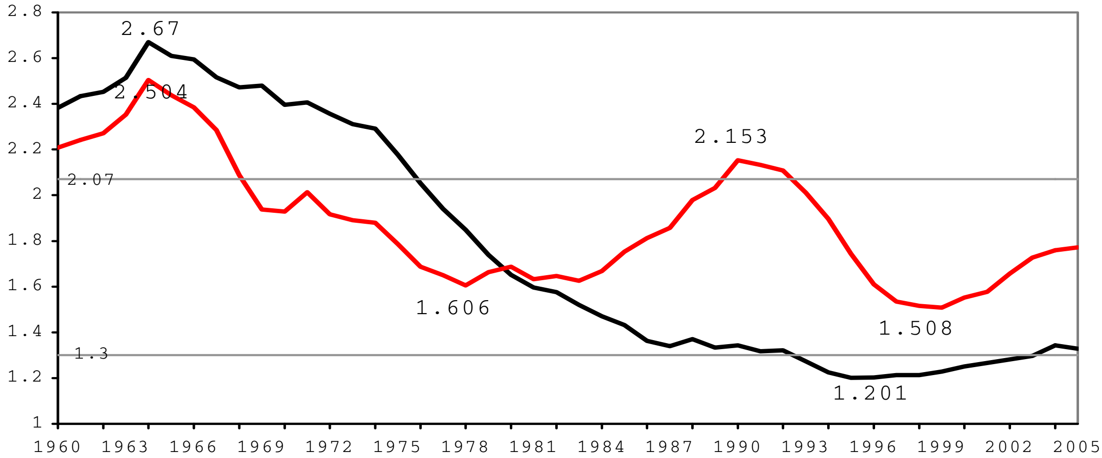


Figure 10. TPFR in Italy (black) and Sweden (red)

Italian rates depict a rather different situation. They start to fall irreversibly in 1970, reaching 1.201 children per woman in 1995, the lowest TPFR Italy has ever had and the lowest rate registered in Europe that year. During the following ten years, TPFR had a modest increase, rising by 0.02 average-points each year and by 0.127 points from 1997. The shift in "quantum" fertility cannot itself explain the decreasing TPFR. To better understand the determinants of this deterioration in fertility it is necessary to look at "tempo" fertility.

Table 3 displays cumulative age contributions to first births. The variation column reports the difference between 1980 and 2000 for Italy and 1975 and 2005 for Sweden. The last two rows for each country measure the interdecile and interquartile range. If we look at the interdecile and interquartile variation, the last two rows of the last column show similar results, +0.2/+0.3 and 0. Indeed, interdecile and interquartile range are almost the same, even though the Italian computation has been produced on a smaller sample.

The increase in age contribution to first births has been "symmetrical" in percentage terms, albeit with different intensity in the two countries. Indeed, 10% and 90% of age contribution to first births have both risen by approximately 3 years in Italy and 2 years in Sweden. On the other hand, 25% and 75% rose by 4 and 2.8 years respectively. This variation suggests a stronger postponement for Italy, 1.2 years greater than that of Sweden.

[13] Björklund (2006)
[14] Hoem (2005)

Table 3. Age contribution to first births

		1975	1980	1985	1990	1995	2000	2005	Variation
Italy	10%	–	18.5	19.1	20.0	21.0	21.3	–	*+2.8*
	25%	–	20.2	21.1	22.1	23.3	24.2	–	*+4*
	50%	–	23.2	24.0	25.0	27.0	27.1	–	*+3.9*
	75%	–	26.1	27.0	28.0	30.0	30.1	–	*+4*
	90%	–	30.0	30.0	31.0	32.9	33.0	–	*+3*
	90%-10%	–	*11.5*	*10.9*	*11*	*11.9*	*11.7*	–	*+0.2*
	75%-25%	–	*5.9*	*5.9*	*5.9*	*6.7*	*5.9*	–	*0*
Sweden	10%	18.6	19.2	19.7	19.8	20.2	20.3	20.3	*+1.7*
	25%	20.2	21.1	21.1	21.5	22.2	22.5	23.0	*+2.8*
	50%	23.0	23.2	23.9	24.1	24.9	25.2	25.2	*+2.2*
	75%	25.1	26.0	26.1	26.1	27.1	27.2	27.9	*+2.8*
	90%	27.1	28.0	28.1	28.1	28.5	29.0	29.1	*+2*
	90%-10%	*8.5*	*8.8*	*8.4*	*8.3*	*8.3*	*8.7*	*8.8*	*+0.3*
	75%-25%	*4.9*	*4.9*	*5.0*	*4.6*	*4.9*	*4.7*	*4.9*	*0*

Source: Eurostat 2006. NB. Italian column for year 2000 refers to year 1997 rates.

Cohort analysis

Standard cohort analysis[15] covers cohorts from 1930 to the late 1940s and mid 1950s for Italy and Sweden respectively. Swedish complete ASFR schedules reach the 1955 cohort, while Italian ASFR schedules reach 1947. The subsequent incomplete cohorts, up to the 1961 birth cohort for Italy and 1968 for Sweden, have been used to obtain Complete Cohort Fertility Rate (CCFR), alpha, PAF, H, D and S through forecast of missing spline tails. The method is described in appendix 1. I chose not to interpolate incomplete ASFR cohort schedules, since interpolation using the forecast provided more realistic output, as explained in the appendix. The following analysis refers to cohorts from 1930 up to 1961 and 1968 in Italy and Sweden respectively. In the figures in this section the solid line represents complete cohorts, while the dotted line represents the output obtained through fertility forecasting.

Alpha

As pointed out in period analysis, alpha has an important meaning when studying the reproductive behavior of populations. Figure 11 depicts alpha between the 1930 and 1961 birth cohorts for Italy and between the 1930 and 1968 cohorts for Sweden. Italian and Swedish alpha shows an undulatory trend, with maximum and minimum peaks registered almost at the same time. Sweden also reports an increase from 1956 on, in accordance with the trends in figure 11. Italy has a higher level of alpha with respect to Sweden, showing an increasing undulatory evolution toward younger birth cohorts.

In 1932-1945 and 1940-1950 Italian birth cohorts registered minimum and maximum peaks respectively. It is remarkable that the first minimum and maximum (1932 and 1940) correspond to a similar phenomenon in CCFR (maximum and minimum); after 1943 birth cohort alpha has no reasonable influence on fertility level, this could be due to the spread of contraception awareness during the 1960s. The subsequent decrease of Italian alpha, cohort 1951 onward, is due to an anticipation of fertility, as will be shown later in detail in discussion of CCFR.

A similar reasoning can be done for Swedish alpha. The first minimum and maximum correspond indeed to a maximum and minimum in CCFR respectively. The Swedish dotted curve presents a huge variation among the later cohorts. This upward increase is not

[15] By "standard" I refer to the analysis done on complete cohorts. The "non standard" analysis refers to truncated cohorts, whose missing values have been estimated through R-processing, as described in Appendix 1.

unrealistic, since Sweden often presents huge variations in fertility behavior. This trend is particularly marked in cohorts born after 1960, and is reasonably attributable to strong social norms, which shift childbearing after education. The Italian dotted line is realistic, low values of alpha correspond both to a polarization of childbearing, especially at the extremes of the age axis, and to a scarce "concentration" of fertility around a certain age.

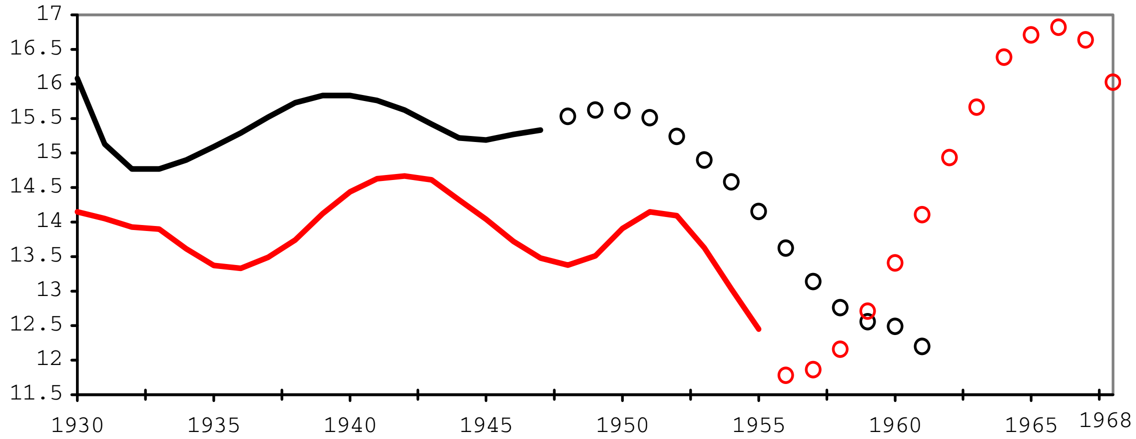


Figure 11. Cohort alpha, Italy (black), Sweden (red)

Peak Age Fertility

Cohort PAF represents the age at which a given cohort reaches its fertility maximum. Figure 12 depicts the trend of this index in Italy and Sweden from 1930 to 1961 and 1968 respectively.

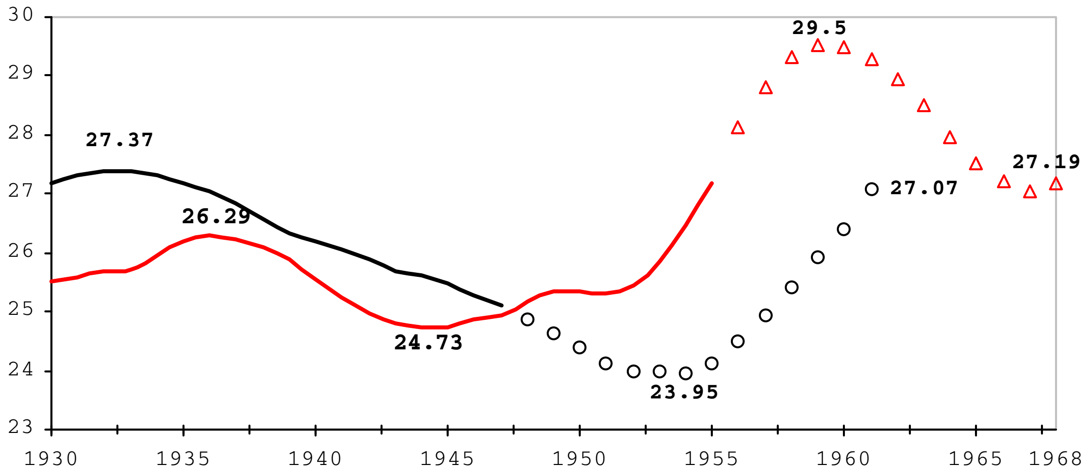


Figure 12. Cohort PAF, Italy (black), Sweden (red)

In Italy, PAF starts decreasing from 1933 cohort onward at a higher level with respect to Sweden, down to 1954 cohort, falling from 27.37 to 23.95. This result is comparable to period output; indeed, up to 1978 PAF is well under 26 years old. In Sweden, on the other hand, PAF does not follow a homogeneous increasing or decreasing path. The index varies from 1930 to 1951 cohort, starting from 25.5 and reaching a minimum with 1944 birth cohort, 24.73.

After 1944 birth cohort, PAF undergoes a constant increase, which speeds up after 1951 birth cohort. It is remarkable that PAF does not follow any particular change in CCFR, that is to say an increase or decrease in PAF does not correspond to an increase or decrease in CCFR. This is very important, both period and cohort output lead to the same conclusion, postponement of PAF does not necessarily lead to a decrease in fertility. Indeed, CCFR varies over time and tends to increase, at least up to 1955 cohort. This situation could be reasonably due, as explained by Björklund (2006), to the implementation of family policies started in 1960, which led women to postpone childbearing into older ages.

The area in figure 12 can be divided into two parts by the 1947 birth cohort, which designates the point where the Swedish PAF level overtakes the Italian. This is also the cohort which registers the increase in CCFR after a fall started by the 1933 cohort. If we compare cohort PAF to period PAF the path depicted by this index is very different. Indeed, from figure 4 it would be reasonable to think that both Sweden and Italy have undergone postponement of childbearing during the same period and with almost the same intensity, since the path of the two PAF lines is very similar. Looking at figure 12 the situation changes markedly: Italy experiences postponement only from 1955 on. Probably, there would be a more marked rise of PAF with a broader sample of cohorts.

Half Way Fertility

H (the age at which fertility falls by half of its peak level) may vary relative to an increase or decrease in R and also to a change in PAF. Figure 13 depicts the path of H from 1930 to 1961 and 1968 in Italy and Sweden respectively.

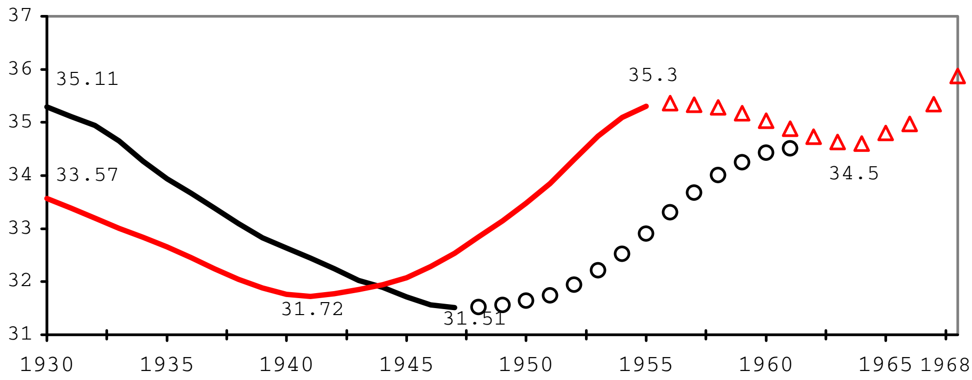


Figure 13. Cohort H, Italy (black), Sweden (red)

Cohort H evolution is not different from that of period H, if we start comparing 1930 cohort results to 1960 output, since the cohort has already started to experience childbearing and 1960 half way fertility is bigger than 30 years old. Indeed, cohort H measured for 1930 Italian and Swedish cohort is 35.11 and 33.57 years old respectively, while period H measured in year 1960 is 35.45 and 33.2 for Italy and Sweden respectively.

Italy starts its decreasing path at a higher level with respect to Sweden; they both decrease, for 11 and 17 years respectively, to rise afterwards. The real difference between cohort and period H is the timing and the intensity of the Italian H rise. Italian H shows a constant decrease from the 1930 cohort down to the 1947 cohort, falling by four years, from 35.29 to 31.71, meaning that late ages fertility is being reduced. If we sum the decrease in H to the decrease in PAF and look at CCFR we can notice that this leads to a constant decrease in fertility since recuperation fertility in later ages loses power. Swedish H decreases less, from 33.5 to 32.0 in 1941 to rise afterwards. The rise in Swedish H anticipates Italy by six years, this means that fertility postponement began earlier among the Swedish cohort, indicatively around 1941. On the other hand, Italian H rises with a smaller slope with respect to Sweden, signal of slight postponement of fertility into older ages.

Delay and Stopping

Cohort D and S show a different evolution towards birth cohorts. Figure 14 compared to figure 7 is far more intricate: the path of the four lines is wavy and, unlike figure 7, Italian S overtakes a declining D, without decreasing along with Swedish S.

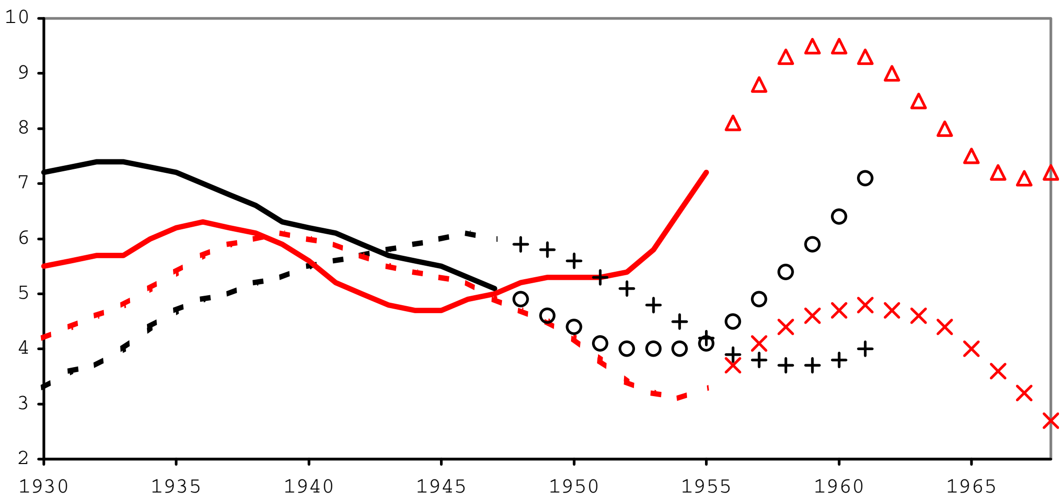


Figure 14. Cohort Delay (solid) and Stopping (dashed), Italy (black) and Sweden (red)

As in the period analysis, Italian D and S start at an upper and at a lower level with respect to Sweden, which registers a small gap between the two parameters, 1 year approximately. Italian D decreases between the 1930s and mid-1950s. The first half of this fall is connected to the "baby-boom" years, which involve birth cohorts 1930-1945. The second half continues to register a descent bound to CCFR decrease; indeed, S overtakes D between 1943-1955, characterized by decreasing values of PAF and H. This produces an anticipation of fertility not accompanied by catching up at later ages, as represented by S. From the 1955 birth cohort, D rises as PAF does, meaning that fertility is being postponed but catching up does not fully recover the fertility deficit produced by the increase in D. As the next section shows, CCFR registers a marked decrease, falling from 1.8 for 1955 to 1.61 children per woman for the 1961 birth cohort, and the Swedish path for D and S resembles the CCFR trend. The main difference between Italy and Sweden is in the failure of Italy to catch up at later ages, which decreases CCFR.

Complete Cohort Fertility Rate

Complete Cohort Fertility Rate (CCFR) is considered for birth cohorts born between 1930 and 1961 for Italy, 1930 and 1969 for Sweden. Figures 15 and 16 depict an ideal lifetime fertility graph of the calendar years involved, to better understand the relationship between cohort and period results. The four lines have been computed by adding the values of alpha, PAF and H to the year of the birth cohort, in order to obtain the corresponding calendar year of beginning, peak and half way fertility. The β line (straight red line) represents end of fertility, set by Schmertmann's model at 50 years old. To depict the relationship between H and the β line more clearly I shifted the β line to start at the 1930 birth cohort value for H. The CCFR axis reports cohort fertility rates with respect to the cohort path, connecting each value to a different birth cohort reported on the secondary x axis (lower). The secondary y (right) ordinates display TPFR value for the corresponding calendar year reported on the specular y axis (left). To investigate the calendar years involved by birth cohorts, e.g. for the 1940 birth cohort as shown on Figure 15, look at the ideal straight vertical line defined by alpha and H (reported on the left ordinates 'calendar years'), for the 1940 cohort, years 1956-1973. The corresponding CCFR is 2.11 reported on the primary x axis (CCFR). TPFR values reached between 1956 and 1973 are reported on the right ordinates, 2.382 and 2.395 respectively.

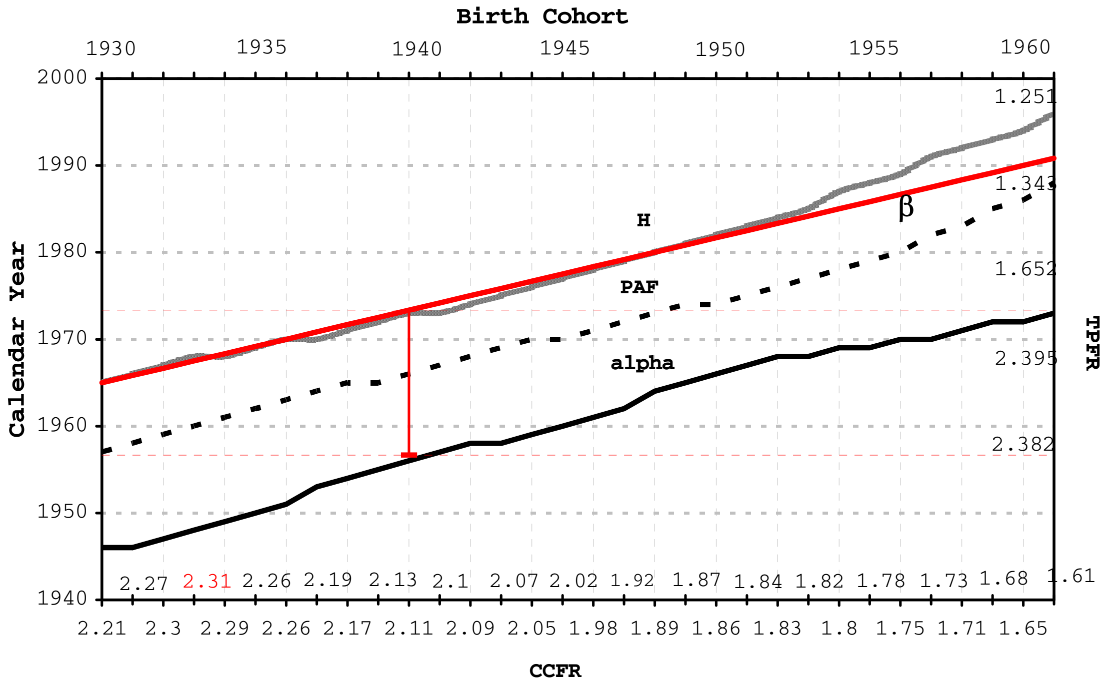


Figure 15. "Tempo" fertility of cohorts born between 1930-1961, Italy

Italy (Figure 15) presents three ascending straight lines, which register no substantial perturbation, except from H. The first relevant detail is the distance between the lines alpha-PAF and PAF-H. These values are not constant but vary over time; in particular the first increases and the latter decreases. This suggests the presence of anticipation fertility, also according to PAF and H analysis. Looking at the H- β trend, it is remarkable how H overtakes β after the 1953-1955 birth cohorts, indicating a possible beginning of postponement, as shown in the PAF, H and D−S analyses.

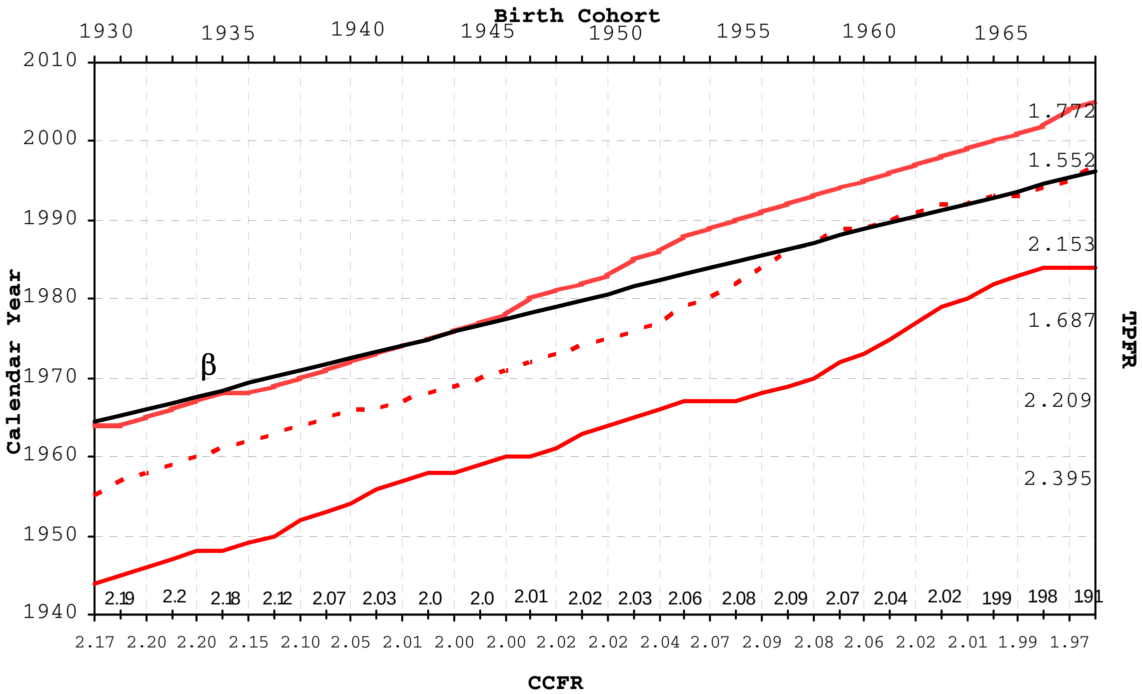


Figure 16. "Tempo" fertility of cohorts born between 1930-1969, Sweden

Figure 16 depicts a different path: Sweden's "tempo" dynamics seem more variable over time, especially for the most recent birth cohorts. The Swedish H line overtakes β substantially before the Italian, that is to say around 1945 birth cohort. Moreover, Swedish PAF is on average nearer to β than the Italian, further evidence that postponement occurred earlier among Swedish birth cohorts. Alpha increases substantially, approaching PAF; the result is the shortening of the time gap between fertility beginning and its peak level.

The difference between the two countries is clear looking at table 4, which reports the relative distance between alpha and PAF (shown as P–alpha in the table) and PAF and H. The main difference between Italy and Sweden is represented by the gap between PAF and alpha. In Sweden it registers a huge increase from the 1953 birth cohort, 1960 cohort reaches 16.09 years of gap as a result of an increasing trend, which produces a "belly" shaped alpha line between 1953 and 1963 birth cohort. The same Italian birth cohort registers 13.91 years of gap. The distance between PAF and H is, on the other hand, obviously narrower, since 49 years old represents an upper limit to fertility. The low value of the Italian 1945 birth cohort is caused by a marked decrease in H, bigger than that in PAF. On the other hand, Sweden's low value of H–PAF for the 1960 birth cohort is caused by a higher increase in H with respect to PAF.

Table 4. Spread of indexes

	Italy			Sweden		
Cohort	**P-alpha**	**H-PAF**	**β–H**	**P-alpha**	**H-PAF**	**β–H**
1930	11.10	8.12	14.71	11.34	8.07	16.43
1935	12.09	6.76	16.06	12.82	6.47	17.34
1940	10.36	6.45	17.36	11.12	6.21	18.24
1945	10.29	6.23	18.29	10.70	7.33	17.93
1950	8.77	7.25	18.36	11.43	8.14	16.52
1955	9.98	8.77	17.91	14.73	8.12	14.70
1960	13.91	8.04	15.56	16.09	5.54	14.97
1965	-	-	-	10.82	7.27	15.2
1968	-	-	-	11.17	8.69	14.12

CCFR for complete cohorts, shown in Figure 17, depicts a continuous decreasing trend for Italy. Indeed, after a maximum peak for birth cohort 1933, the path is strictly descending. Italian CCFR falls under replacement level with 1943 birth cohort, to decrease constantly afterwards. On the other hand, Swedish CCFR registers two main peaks, the first one in 1933, 2.2, and the second one in 1955, 2.08. It falls under replacement level between 1939 and 1953 birth cohort, but without going under 2.0 children per woman.

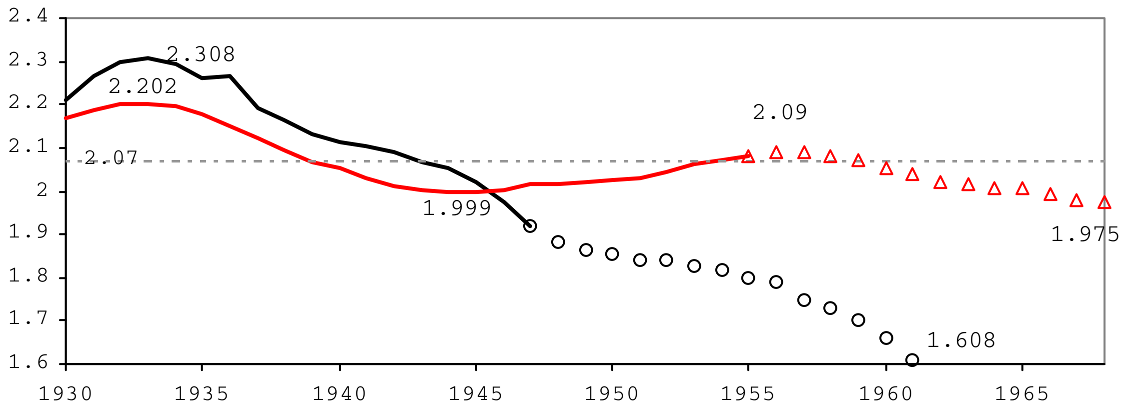


Figure 17. CCFR. Italy (black) and Sweden (red)

The CCFR obtained through fertility forecast represented by the dotted line strengthens the difference between Italy and Sweden. Italian CCFR continues its fast decreasing path, while Swedish CCFR increases up to 1957 birth cohort to fall slightly afterwards. The following decrease does not lead to low values of fertility, CCFR between 1957 and 1968 falls by 0.116 children per woman to register levels around 2 children per woman, e.g., 1.97 for 1968 birth cohort.

The difference in the fertility levels of these two countries can be seen not only in numbers, but also in birth order. Figure 18 depicts the contribution of first (straight line) and second (dashed line) birth order to CCFR, from women under 30 years old, that is to say women aged 15-29 years old. Even though Swedish second birth contribution from 1945-1955 cohort decreases along with the Italian curve, after 1955 it sets around 43%. On the other hand, the steady decrease in Italian contribution of first and second births to CCFR suggests that fertility is being delayed after 30 years old, without a significant catching up.

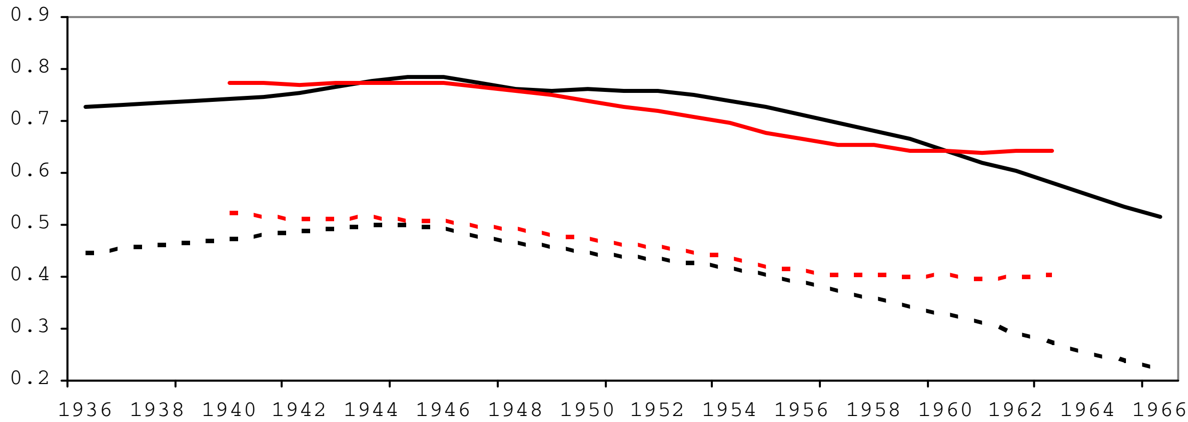


Figure 18. Contribution of 1st and 2nd births to CCFR by women under 30, Italy (black) and Sweden (red)

Postponement is not a simple phenomenon to study; indeed, there is no agreement on an ideal tool to use in order to measure its intensity. CCFR cannot itself explain the difference among countries and among age groups. Lesthaeghe[16] proposes a system based on cumulated fertility difference profiles, comparing cohorts to a benchmark, a cohort which has the characteristic of not having yet experienced postponement or recuperation. This procedure has the advantage that it is possible to represent and graphically compare the differences among birth cohorts and age groups. This technique was applied to the Italian and Swedish cohort data. The data are presented in appendix 2 and illustrated in figures 19 and 20.

Figure 19 shows the pattern of Italian cohorts' cumulated fertility deficits. The grey lines indicate where postponement for the age 15-19 group does not occur, that is to say it is equal to 0. The red line indicates where postponement for 15-19 age group is negative, that is to say the trend line stands above the benchmark cohort. Black lines indicate that postponement is occurring. The Italian pattern is characterized by a steady level of postponement into older ages up to 1960 birth cohort; moreover, by age 20-24, the cumulated deficits are of very similar orders of magnitude, especially from cohort 1960 onward. The 1948, 1949 and 1950 cohorts show no fertility deficit at 15-19 years old, and a relatively high catching up at 25-29 years old, which decreases among subsequent cohorts.

These three cohorts show a high CCFR, 1.86 on average. Catching up progressively decreases further as does CCFR. The second group of cohorts, 1951-1955, is characterized by high catching up in the 15-19 age group and lower at later ages. This feature is reflected by a decrease in alpha and means that fertility is being anticipated. It is reasonable to conclude that Italian cohorts recuperate very little as the corresponding level of CCFR has been dropping steadily. Sweden depicts a radically different pattern as shown in figure 20.

[16] Lesthaeghe and Neels (2002)

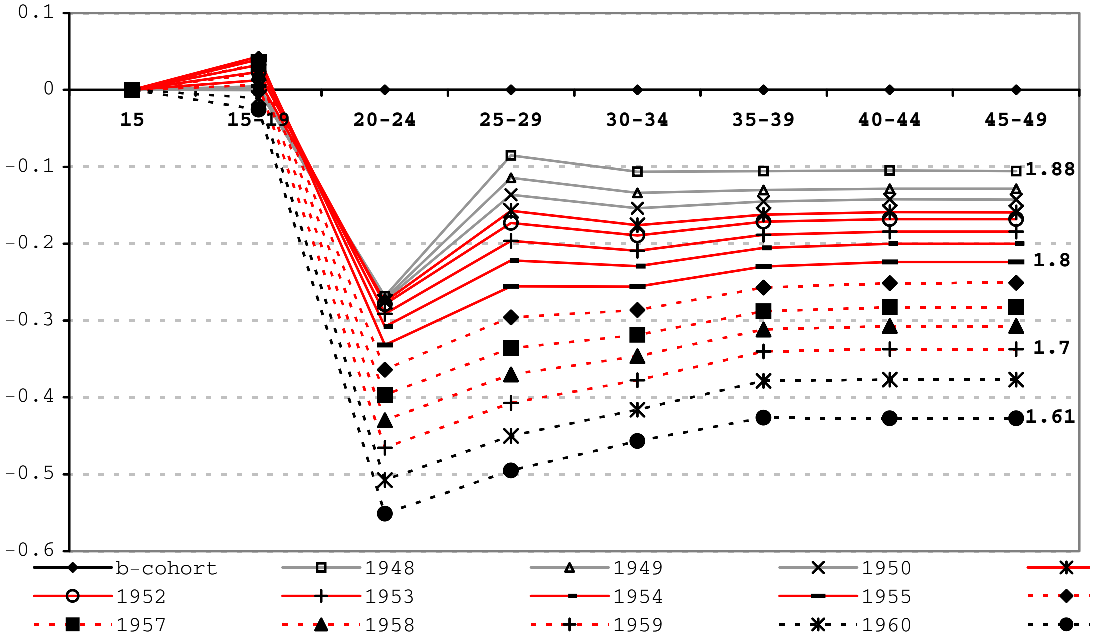


Figure 19. Italy. Cumulated fertility deficits of cohorts born in 1944-1947, benchmark cohort CCFR= 2.040.

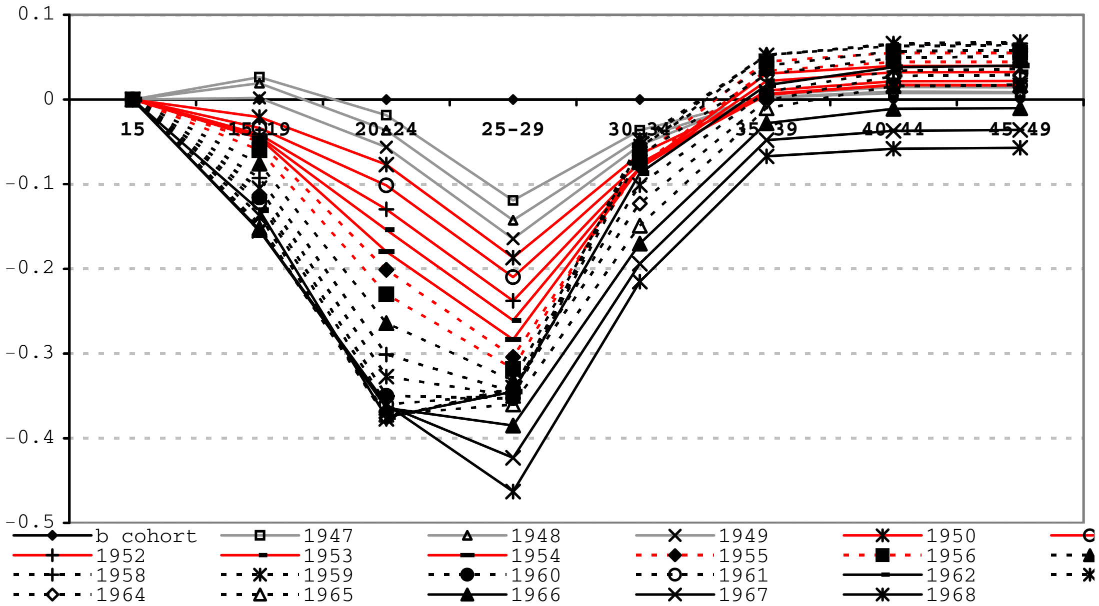


Figure 20. Sweden. Cumulated fertility deficits of cohorts born in 1943-1946, CCFR= 1.97

In Sweden, fertility recuperation is high, particularly up to 1965 birth cohort. The first three cohorts, grey lines, show fertility deficits only for 20-24 and 25-29 age groups. The red lines and dotted black lines indicate cohorts with catching up above the benchmark cohort. Straight black lines indicate cumulated fertility deficits among all age groups. The peculiarity of the Swedish graph is the presence of three agglomerating points. The first one is represented by age 20-24, which involves 1960-1968 birth cohorts. The second one, at 25-29 age group, involves 1957-1965 birth cohorts. The last one, at 30-34 age group, involves 1947-1962 birth cohorts. Given the large number of cohorts involved in each agglomerating point, it would be reasonable to think about the presence of social norms,[17] which prevent the

[17] Billari and Liefbroer (2004)

fertility deficit or postponement of fertility, from a progressive increase. Another explanation would be the presence of *ad hoc* policies which provide incentives for fertility around certain ages.

The following graphs (figures 21 and 22) exploit the computation done for figures 19 and 20 to compute an index which can measure the slowing down of postponement.[18]

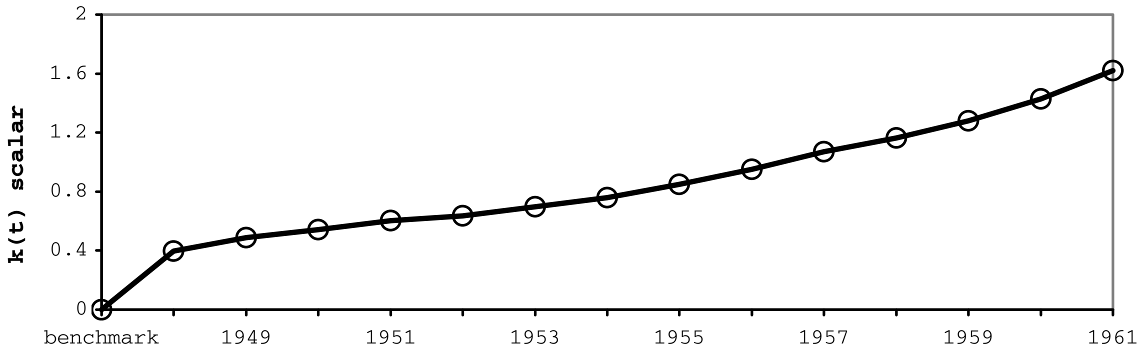


Figure 21. Slowing down of postponement in Italy

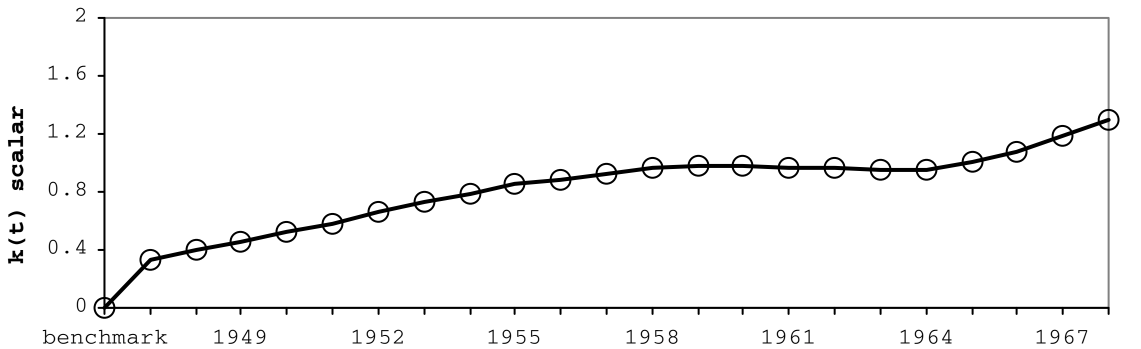


Figure 22. Slowing down of postponement in Sweden

Figure 21 depicts Italy as a fast postponing country. Given the previous conclusions, it is reasonable to think that Italy is delaying fertility faster than its ability to catch up. On the other hand, the Swedish curve (figure 22) has a lower slope, which explains the ability of Swedish cohorts to catch up fertility in later ages.

Conclusions

The aim of this study was to investigate postponement dynamics in Italy and Sweden. There are different ways to measure and analyze postponement trends in fertility. The method I chose provides simple and understandable indexes, which depict fertility evolution both in period and cohort output, making comparisons between the two countries possible.

Period and cohort output present different levels of postponement for each country. Period output suggests a delay in peak age fertility for both countries as well as an increase in catching up at later ages, namely the increase of half way fertility age. The linear path stopping reached during the last twenty years, which swings between 3 and 5 years, consolidates later ages fertility catching up, since low values of stopping imply high values of half way fertility. These characteristics compared to TPFR show two different situations. Swedish TPFR does not seem to be negatively affected by fertility postponement, as shown

[18] Lesthaeghe (2001)

by 1990 TPFR. This suggests that Swedish fertility postponement has reached an equilibrium. On the other hand, the descent of Italian TPFR over the last thirty years and the subsequent stabilization around lowest-low fertility values suggest possible tempo distortions driven by huge postponement not (yet) followed by a reasonably high catching up at later ages, rather than a possible fertility implosion. Indeed, there is catching up at later ages, but looking at the share of first births on total TPFR it is not wrong to suggest a possible negative effect of childbirth interval. Italy's modest catching up at later ages is confirmed by cohort output.

Cohort output shows a huge difference between Italian and Swedish postponement. Italian postponement is a recent phenomenon among cohorts: catching up at later ages plays little role in CCFR, suggesting that postponement is not able to recover the young-ages fertility deficit. Italian cohort output indeed shows a delay in childbearing around the 1950-1955 cohorts, that is to say, when PAF and H started rising. It is notable that, between these cohorts, childbirth interval began to rise. Sweden started postponing around the 1940 birth cohort, well before Italy, as shown by the PAF, H and S trends. Symmetrically, its high fertility values demonstrate a higher ability to catch up with respect to Italy.

Acknowledgements

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EUSI, European System of Social Indicators, Social Indicators Department, ZUMA, Mannheim, 2006.
INED, Institut National d’Études Demographiques.
ISTAT, Istituto Nazionale di Statistica, Statistiche Demografiche.
MPIDR, Max Planck Institute for Demographic Research.
SCB, Statistiska Centralbyrån.

Appendixes

Appendix 1

I used truncated cohorts to study their evolution toward the whole age line, from 15 to 49 years old, with the help of R-programming. The results are estimated values of missing data, not available from ASFR schedules. These values have then been interpolated according to Schmertmann's (2003) quadratic spline model.

Even though the available ASFR schedules provided data from 15 up to 49 years old, I have assumed each cohort to give "births" also at 50 years old with an ASFR equal to the minimum reached by all cohorts, that is to say 0. Fertility in truncated data must decrease down to the minimum reached by each cohort; this minimum is reached at 50 years old: this is the main and unique assumption. I have then defined what would be a "covariate": the x axes, that is to say the age line from 15 to 49 years old, and a variable xx, that is to say x plus 50 years old. My "response variable" is the ASFR, which must necessarily be positive: to avoid negative results I work with logarithms. This variable is yy0, where in addition to the original data there are also "not available" data (NA), which stand in the position where I want to extrapolate values. I then add the variable yy: I insert into yy0, the logarithm of the minimum of initial data as last value. To predict the missing values I have used functions already implemented in the R library which interpolate all data, omitting not available data. In particular I am using B-Splines, which have the advantage that they minimize the necessary support. It is better to use a B-Spline, since a simple polynomial may degenerate. What I get are results nested in the predict function, which lays on the interSpline function, and "predicts" not available data, NAs. In other words, the predict function uses the coefficients estimated by the B-Spline to cover the gap produced by the NAs.

The limitations of this procedure are clear; the forecast of cohorts truncated before PAF suffer from index underestimation. On the other hand, it is unlikely that this procedure accounts for a rise in fertility postponement. To come to this conclusion I chose eight "control cohorts"[19] and subsequently truncated them to understand whether the output would have been reliable, that is to say up to which age[20] I can cut a cohort and still obtain reliable indexes and see if there is a common threshold above which output must be considered unreliable. Indexes considered to study the impact of truncation are alpha, P, H plus D and S.

Table A1 provides an overview of the simulation results for Sweden. From this simulation we notice that indexes react differently to progressive truncation. This depends on how the considered index is constructed and where it is located, that is to say how fertility is distributed on the age axis. The second column reports index values obtained with complete ASFR schedules. From the third column on, ASFR schedules are truncated by one year of age, down to 41 years old.

From table A1, it is clear that truncating cohorts up to 46 years old produces no significant variation, <0.01, while truncating ASFR schedules further produces higher deviations from original values (column "49"). Reliable output from truncation matches perfectly the output from the fertility ASFR forecast; this is the reason why I decided to use only the latter, which provides a broader sample of cases, up to the 1961 and 1968 cohort for Italy and Sweden respectively.

[19] Cohorts considered are 1930, 1935, 1940, 1945, 1950, 1953, 1954 and 1955 from Sweden.
[20] Truncation starts at 49 years old and continues down to 41 years old.

Table A1. Variation of Alpha, PAF, H, D, S and CCFR at progressive truncation of the ASFR schedule, from 49 to 41 years old for selected birth cohorts. Sweden.

ALPHA	**49**	**48**	**47**	**46**	**45**	**44**	**43**	**42**	**41**
1955	12.445	12.445	12.446	12.451	12.463	12.489	12.536	12.617	12.738
1954	13.031	13.032	13.032	13.036	13.046	13.067	13.106	13.174	13.272
1953	13.626	13.626	13.627	13.630	13.638	13.655	13.687	13.740	–
1950	13.909	13.909	13.909	13.911	13.914	13.921	13.933	13.949	13.971
1945	14.040	14.041	14.041	14.041	14.044	14.049	14.058	14.071	14.087
1940	14.435	14.435	14.435	14.436	14.436	14.438	14.440	14.442	14.443
1935	–	13.369	13.370	13.370	13.374	13.381	13.394	13.413	13.444
1930	14.154	–	14.154	14.156	14.162	14.173	14.195	14.229	14.281
PAF	**49**	**48**	**47**	**46**	**45**	**44**	**43**	**42**	**41**
1955	27.177	27.177	27.176	27.172	27.161	27.138	27.095	27.020	26.907
1954	26.469	26.469	26.468	26.465	26.455	26.434	26.396	26.328	26.227
1953	25.850	25.850	25.849	25.846	25.837	25.819	25.786	25.729	–
1950	25.341	25.341	25.341	25.339	25.335	25.327	25.314	25.295	25.270
1945	24.741	24.741	24.741	24.740	24.737	24.731	24.722	24.709	24.692
1940	25.552	25.552	25.551	25.551	25.550	25.549	25.546	25.544	25.542
1935	–	26.193	26.192	26.192	26.188	26.182	26.170	26.152	26.122
1930	25.499	–	25.499	25.497	25.491	25.479	25.455	25.418	**25.361**
H	**49**	**48**	**47**	**46**	**45**	**44**	**43**	**42**	**41**
1955	35.299	35.299	35.300	35.305	35.318	35.347	35.402	35.501	35.666
1954	35.094	35.094	35.096	35.101	35.114	35.144	35.200	35.303	35.468
1953	34.737	34.737	34.738	34.743	34.755	34.783	34.835	34.925	–
1950	33.479	33.479	33.480	33.482	33.488	33.501	33.523	33.555	33.599
1945	32.070	32.071	32.071	32.072	32.074	32.079	32.087	32.099	32.114
1940	31.764	31.764	31.764	31.764	31.765	31.767	31.769	31.771	31.772
1935	–	32.659	32.660	32.660	32.662	32.666	32.674	32.687	32.707
1930	33.573	–	33.573	33.575	33.582	33.598	33.626	**33.674**	**33.749**
DELAY	**49**	**48**	**47**	**46**	**45**	**44**	**43**	**42**	**41**
1955	7.2	7.2	7.2	7.2	7.2	7.1	7.1	7.0	6.9
1954	6.5	6.5	6.5	6.5	6.5	6.4	6.4	6.3	6.2
1953	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.7	–
1950	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
1945	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
1940	5.6	5.6	5.6	5.6	5.6	5.5	5.5	5.5	5.5
1935	–	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.1
1930	5.5	–	5.5	5.5	5.5	5.5	5.5	5.4	5.4
STOPPING	**49**	**48**	**47**	**46**	**45**	**44**	**43**	**42**	**41**
1955	3.3	3.3	3.3	3.3	3.3	3.2	3.1	3	2.8
1954	3.1	3.1	3.1	3.1	3.1	3.1	3	2.9	2.6
1953	3.2	3.2	3.2	3.2	3.2	3.1	3.1	2.9	–
1950	4.2	4.2	4.2	4.2	4.2	4.2	4.1	4.1	4
1945	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.2
1940	6	6	6	6	6	6	6	6	6
1935	–	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4
1930	4.2	–	4.2	4.2	4.2	4.1	4.1	**4**	**3.9**
CCFR	**49**	**48**	**47**	**46**	**45**	**44**	**43**	**42**	**41**
1955	2.081	2.081	2.081	2.082	2.083	2.085	2.088	2.095	2.106
1954	2.074	2.074	2.074	2.074	2.075	2.077	2.081	2.088	2.098
1953	2.061	2.061	2.061	2.062	2.062	2.064	2.068	2.074	–
1950	2.025	2.025	2.025	2.025	2.025	2.027	2.028	2.031	2.035
1945	2.000	2.000	2.000	2.000	2.000	2.001	2.002	2.003	2.005
1940	2.053	2.053	2.053	2.053	2.053	2.053	2.054	2.054	2.054
1935	–	2.177	2.177	2.177	2.177	2.178	2.179	2.181	2.185
1930	2.168	–	2.168	2.168	2.169	2.170	2.173	2.177	2.184

Appendix 2

The tables in this appendix contain the data used to produce figures 15 to 22.

Table A2.1. Cumulated fertility Italy

Cohort	20	25	30	35	40	45	50
1942-1947	*0.159*	*1.103*	*1.544*	*1.864*	*1.974*	*1.995*	*1.996*
1948	0.158	0.835	1.458	1.758	1.868	1.890	1.891
1949	0.160	0.832	1.429	1.730	1.844	1.866	1.868
1950	0.164	0.830	1.407	1.711	1.829	1.852	1.854
1951	0.172	0.828	1.387	1.689	1.812	1.836	1.837
1952	0.183	0.825	1.371	1.675	1.803	1.827	1.828
1953	0.192	0.812	1.347	1.655	1.785	1.811	1.812
1954	0.199	0.795	1.322	1.635	1.769	1.795	1.796
1955	0.203	0.771	1.288	1.609	1.745	1.771	1.773
1956	0.200	0.739	1.248	1.578	1.717	1.744	1.745
1957	0.193	0.706	1.208	1.546	1.686	1.712	1.714
1958	0.181	0.673	1.173	1.518	1.662	1.688	1.689
1959	0.166	0.638	1.137	1.487	1.634	1.657	1.659
1960	0.149	0.596	1.094	1.448	1.595	1.618	1.619
1961	0.134	0.552	1.049	1.408	1.547	1.568	1.569

Table A2.2. Cohort deficit from benchmark cohort, Italy[21]

Cohort	20	25	*30*	35	40	45	50
1943-1947	0	0	*0*	0	0	0	0
1948	-0.001	-0.268	*-0.085*	-0.106	-0.106	-0.105	-0.105
1949	0.001	-0.271	*-0.114*	-0.134	-0.130	-0.128	-0.129
1950	0.005	-0.273	*-0.136*	-0.154	-0.145	-0.142	-0.143
1951	0.013	-0.275	*-0.157*	-0.176	-0.162	-0.159	-0.159
1952	0.024	-0.279	*-0.173*	-0.189	-0.171	-0.168	-0.168
1953	0.033	-0.291	*-0.196*	-0.209	-0.189	-0.184	-0.184
1954	0.040	-0.308	*-0.222*	-0.229	-0.205	-0.200	-0.200
1955	0.044	-0.332	*-0.255*	-0.256	-0.229	-0.224	-0.224
1956	0.041	-0.364	*-0.296*	-0.286	-0.257	-0.251	-0.251
1957	0.034	-0.397	*-0.336*	-0.319	-0.288	-0.282	-0.282
1958	0.022	-0.430	*-0.370*	-0.347	-0.312	-0.307	-0.307
1959	0.007	-0.466	*-0.407*	-0.378	-0.340	-0.338	-0.338
1960	-0.011	-0.507	*-0.450*	-0.416	-0.379	-0.377	-0.377
1961	-0.026	-0.551	*-0.495*	-0.457	-0.427	-0.427	-0.427
Average	0.016	-0.358	-0.264	-0.261	-0.239	-0.235	-0.235

[21] Values obtained by subtracting the cumulated age specific fertility of the cohort from the benchmark cohort.

Table A2.3. Cumulated fertility, Sweden

Cohort	20	25	30	35	40	45	50
1943-1946	*0.208*	*0.871*	*1.595*	*1.853*	*1.956*	*1.983*	*1.984*
1947	0.234	0.853	1.476	1.817	1.958	1.990	1.992
1948	0.227	0.835	1.453	1.807	1.958	1.992	1.993
1949	0.210	0.815	1.431	1.799	1.961	1.997	1.999
1950	0.187	0.794	1.408	1.789	1.962	2.000	2.001
1951	0.174	0.770	1.385	1.778	1.961	2.000	2.001
1952	0.166	0.742	1.357	1.773	1.966	2.004	2.006
1953	0.164	0.717	1.335	1.772	1.978	2.015	2.017
1954	0.162	0.692	1.312	1.772	1.986	2.022	2.024
1955	0.158	0.670	1.291	1.774	1.990	2.027	2.028
1956	0.148	0.641	1.277	1.785	2.001	2.038	2.039
1957	0.132	0.607	1.263	1.795	2.009	2.046	2.048
1958	0.115	0.570	1.250	1.801	2.009	2.048	2.050
1959	0.103	0.544	1.245	1.805	2.008	2.049	2.052
1960	0.092	0.521	1.242	1.797	1.996	2.040	2.042
1961	0.086	0.511	1.247	1.787	1.986	2.032	2.035
1962	0.077	0.496	1.250	1.766	1.973	2.021	2.024
1963	0.071	0.494	1.255	1.752	1.965	2.017	2.020
1964	0.061	0.495	1.254	1.730	1.955	2.011	2.013
1965	0.056	0.499	1.235	1.704	1.946	1.999	2.001
1966	0.054	0.507	1.210	1.683	1.928	1.972	1.974
1967	0.053	0.510	1.172	1.659	1.908	1.946	1.948
1968	0.054	0.511	1.132	1.638	1.889	1.925	1.927
1969	0.036	0.448	1.074	1.595	1.879	1.925	1.927

Table A2.4. Cohort deficit from benchmark cohort, Sweden

Cohort	20	25	*30*	35	40	45	50
1943-1946	0	0	*0*	0	0	0	0
1947	0.026	-0.018	*-0.119*	-0.036	0.002	0.007	0.008
1948	0.019	-0.036	*-0.143*	-0.046	0.002	0.009	0.009
1949	0.002	-0.056	*-0.164*	-0.054	0.006	0.015	0.014
1950	-0.021	-0.077	*-0.187*	-0.064	0.007	0.017	0.017
1951	-0.034	-0.102	*-0.210*	-0.076	0.006	0.017	0.017
1952	-0.041	-0.130	*-0.238*	-0.081	0.011	0.022	0.022
1953	-0.044	-0.154	*-0.261*	-0.081	0.022	0.032	0.032
1954	-0.045	-0.180	*-0.283*	-0.081	0.031	0.040	0.040
1955	-0.050	-0.201	*-0.304*	-0.079	0.034	0.044	0.044
1956	-0.060	-0.230	*-0.318*	-0.068	0.045	0.055	0.055
1957	-0.076	-0.264	*-0.332*	-0.058	0.053	0.063	0.064
1958	-0.093	-0.301	*-0.345*	-0.052	0.053	0.065	0.066
1959	-0.105	-0.327	*-0.350*	-0.048	0.052	0.066	0.068
1960	-0.116	-0.350	*-0.353*	-0.056	0.040	0.057	0.058
1961	-0.122	-0.360	*-0.348*	-0.066	0.030	0.049	0.051
1962	-0.131	-0.375	*-0.345*	-0.087	0.017	0.038	0.040
1963	-0.137	-0.377	*-0.340*	-0.101	0.009	0.034	0.036
1964	-0.147	-0.376	*-0.341*	-0.123	-0.001	0.028	0.029
1965	-0.152	-0.372	*-0.360*	-0.149	-0.010	0.016	0.017
1966	-0.154	-0.364	*-0.385*	-0.170	-0.028	-0.011	-0.010
1967	-0.155	-0.361	*-0.423*	-0.194	-0.048	-0.037	-0.036
1968	-0.154	-0.360	*-0.463*	-0.215	-0.067	-0.058	-0.057
1969	-0.172	-0.423	-0.521	-0.258	-0.077	-0.058	-0.057
Average	-0.085	-0.252	-0.310	-0.097	0.008	0.022	0.023