Misleading Policy Messages from the Period TFR: Should We Stop Using It?

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Abstract

Public discussions about fertility trends and policies in developed countries refer almost exclusively to the period Total Fertility Rate (TFR), which is commonly misinterpreted as the ‘mean number of children per woman’ as if it were a cohort measure of fertility. We argue that the use of this indicator frequently leads to incorrect interpretations of period fertility levels and trends, resulting in distorted policy conclusions and, potentially, in misguided policies. We illustrate this point with four policy-relevant examples, drawn from contemporary Europe. These illustrations show that the TFR (a) inflates the presumed gap between fertility intentions and realised fertility, (b) erroneously suggests a significant fertility increase in many countries of Europe after the year 2000, (c) often exaggerates the level of immigrants’ fertility and (d) frequently suggests that family-related policies which led to shorter birth spacing in fact brought an upward swing in fertility level. We argue that there seems to be no policy-relevant question for which the period TFR would be the indicator of choice to be preferred over other existing measures, which range from measures related to future cohort size (total number of births) to sophisticated fertility indexes controlling for age, parity, duration since previous birth and tempo effect. Hence, there is a strong case for stopping the use of the period TFR as a one-fits-all fertility indicator which is now common practice.

European Demographic Research Papers are working papers that deal with all-European issues or with issues that are important to a large number of countries. All contributions have received limited review.

Editor: Maria Rita Testa

Head of the Research Group on Comparative European Demography: Dimiter Philipov

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1 INTRODUCTION

Demography has been in the headlines in Europe for many years and is being discussed in the highest policy circles. The European Commission has set up several bodies that discuss the “demographic challenge” which Commission President Barroso calls one of the three main challenges for Europe, and in 2006 it published an official communication on the topic that was presented to the media under the catching title “Five ways to defuse the demographic time bomb” (European Commission 2006). The main policy paradigm conveyed in this communication as well as in speeches by family ministers around Europe is that young people want to have significantly more children than they actually can afford to have and that the role of policy is to help them meet their family size desires. The resolution of the European Parliament on the demographic future of Europe (21 February 2008) proposes that “the average birth rate in the European Union, which at 1.5 is abnormally low, is not a reflection of women’s choice or of European citizens’ actual aspirations for creating a family.” As we will discuss below, this dominant and politically in many respects most convenient policy paradigm is largely based on an inappropriate use of the period Total Fertility Rate (TFR) which is compared with the cohort measure of desired family size as if it were itself a cohort measure of fertility. The same problem is found with another policy message that is being spread in Europe, namely the reversal of the declining fertility trends. Many politicians point at recent increases in the TFR as proof of their successful policies. In this paper we show that this trend often cannot be interpreted as a major turnaround in fertility because it is largely a consequence of the expected end of fertility postponement with government policies playing little role. Again, it is frequently the inappropriate use of the TFR that causes this misleading message.

Current public discussions about fertility trends and policies in developed countries almost exclusively refer to the period TFR which has become the ubiquitous fertility indicator of choice since the 1960s and is labelled as the ‘mean number of children per woman’ by many demographers and statistical offices and, in consequence, also by journalists and politicians. In the public discourse relatively few references are made to cohort fertility as the adequate measure of fertility or to other indicators of period fertility that may better reflect changes in fertility trends. Little reference is likewise made to trends in the absolute number of births, which after all directly determine the future size and age structure of the population. Although all demographers should be aware of the serious problems associated with calling the period TFR the ‘mean number of children per woman,’ a notion that only makes sense under a cohort perspective, there is hardly any public discussion about this. One important exception was a brief but heated public discussion in France in the early 1990s, initiated by Hervé Le Bras’ attack on what he perceived as the ‘lies of natalism’ fuelled by an excessive focus on period fertility measures, especially the TFR, by the French National Demographic Institute, INED (see an excellent account by Keyfitz 1993).[1] More recently the European Demographic Data Sheets (VID 2006 and 2008) have presented calculations of the TFRs adjusted for ‘tempo effect’ (i.e., the influence of changes in the timing of childbearing) along with traditional TFRs and cohort fertility measures in order to draw attention to this problem.

In discussing the use and usefulness of the period TFR this paper partly relates to a recent work by Ní Bhrolcháin (2007, 2008) who distinguishes between five purposes (‘reasons’) for which the TFR is being used and stresses that the choice of fertility indicator should be determined by the analyst’s objective. We go beyond this rather broad concept of

[1] Interestingly, this debate focused on the choice between period and cohort fertility measures and practically took for granted that the TFR represents the period fertility measure of choice. However, the journal *Population*, published by INED, soon took up the issue of period fertility measurement and the interpretation of the TFR in a series of research and discussion papers (published in English in *Population* 1994; see Rallu and Toulemon 1994 and subsequent commentaries and authors’ reply in the same issue).

measurement purposes and focus primarily on policy-relevant analysis of fertility trends and the questions surrounding it. We believe that demographers are expected to address specific questions that have societal or policy relevance and communicate their research to broader public. For some of these questions (such as, how many school-age children can we expect in ten years) the most appropriate demographic measure to be provided is the absolute number of births (adjusted for child mortality and actual or expected migration), while for others (e.g. whether women have on average more children as a consequence of economic or political changes) measures of fertility level would give the best answer. As we will discuss in the concluding section, the well-established TFR index does not give a satisfactory answer to such 'real world' questions beyond the narrow arena of demographic modelling.

In the following we will try to demonstrate that the period TFR is a very problematic measure for assessing both the need for and the impact of policy changes and, more generally, for studying fertility trends in conjunction with selected social and economic trends. The excessive use of this problematic indicator, motivated in part by its wide availability for different countries and periods, can lead to erroneous conclusions. We will also address two natural follow-up questions (a) "Can we offer a better indicator of fertility level based on period information?", and, if the answer is affirmative, (b) "Is there any role left for the traditional period TFR?" Most of the paper deals with the first question and compares the messages derived from the period TFR with those derived from three alternative measures of period fertility and from completed cohort fertility. The second question, which is more radical in its potential implications, is addressed in the concluding section.

The paper first reiterates the increasingly recognised fact that the period TFR can diverge considerably and systematically from the completed cohort TFR of women having children in a given period and this divergence can stretch over long periods of time. Timing effects and compositional factors affecting period TFR may be seen as undesired influences that confound the link between fertility and policy. We present four examples where the period TFR is typically used as a criterion for an evaluation of the 'underlying' level of fertility, often referred to as 'fertility quantum' (Bongaarts and Feeney 1998; van Imhoff 2001). We discuss whether the period TFR provides adequate and useful information about fertility levels and trends and whether this evaluation changes when other fertility indicators are used instead of the conventional period TFR. The first example concerns the presumed difference between the desired and actual fertility level in low-fertility countries. We show that this gap substantially diminishes if indicators other than the conventional period TFR, including the eventually achieved completed fertility, are used to assess fertility levels. Our second example focuses on a recent increase in the period TFR in many countries of Europe which has been often interpreted as a reversal of the previously declining trend. Using fertility indicators other than the ordinary TFR for two countries with a notable recent increase in the period TFR, the Czech Republic and Spain, we demonstrate that this trend is largely attributable to the slowing pace of fertility postponement, which had negatively affected the period TFR. This was particularly the case for first births, which accounted for most of the TFR increase. The third example discusses potential pitfalls of using the TFR as a measure of fertility of immigrant women and emphasises that it tends to exaggerate their level of fertility and thus also fertility differences between native and immigrant women. Finally, our fourth example brings the focus of our analysis to the policy effects. Drawing from the research on policy changes and fertility swings in Sweden, the Russian Federation and France, we conclude that policies which appear to give a boost to period fertility mostly lead to changes in the timing and spacing of births, but have only a limited durable effect on the quantum of fertility.

2 PROBLEMS WITH THE PERIOD TFR

An increasing number of studies have demonstrated that the period TFR is a questionable measure of the level (quantum) of period fertility. It controls neither for the parity distribution of women nor duration since the last birth, which are the key determining factors of reproductive behaviour (Rallu and Toulemon 1994a and Population 1994). Even more important, it is very sensitive to changes in the timing of childbearing, which inflate the TFR when women have children at progressively earlier ages and depress it when they postpone childbearing to later reproductive ages (e.g. Ryder 1990; Bongaarts and Feeney 1998; Bongaarts 2002; Sobotka 2004a). The latter situation has been typical for most developed countries since the early 1970s, when a long-term trend towards delayed parenthood started in western and northern Europe as well as in Canada, Japan and the United States (Kohler et al. 2002; Sobotka 2004b). Various estimates suggested that without this shift in the timing of childbearing period TFR in the European Union would have been by 0.2 to 0.3 higher in the late 1990s and early 2000s (Lutz et al. 2003; Sobotka 2004a; VID 2008), although this tempo effect was strongly regionally differentiated (Bongaarts 2002; Frejka and Sobotka 2008).

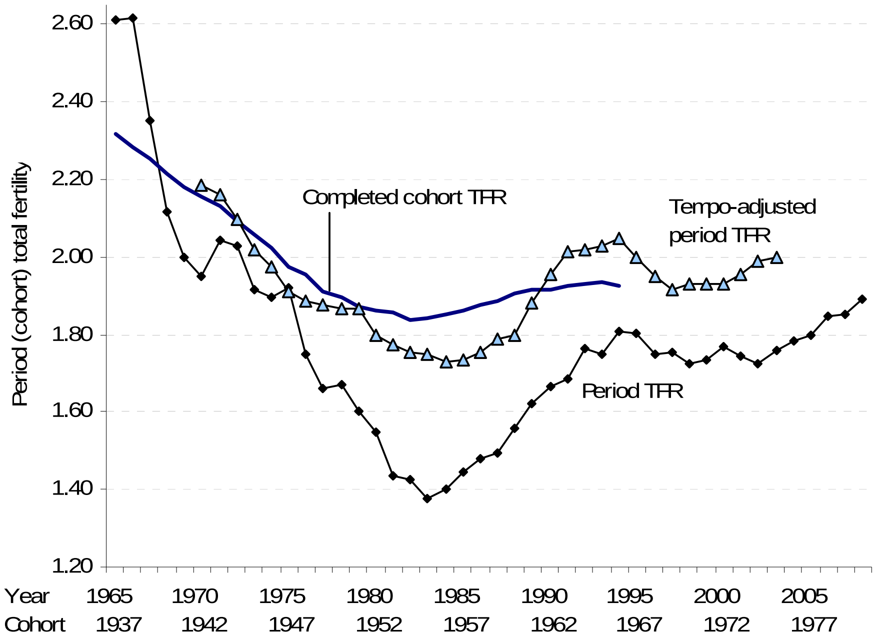
As a result, the period TFR considerably diverged from the completed cohort fertility of women who were in their prime childbearing ages in a given period. Such a mismatch is not problematic for short-term fluctuations, when period fertility measures should reflect actual ups and downs in birth rates that may not affect ultimate cohort fertility trends (Ní Bhrolcháin 1992). However, this disagreement becomes problematic once the period TFR differs systematically from the corresponding completed cohort TFR for two or three decades, as it has happened across much of the developed world. Figure 1 gives an illustration of this divergence for Denmark, where the gap between the period TFR and roughly corresponding cohort TFR averaged 0.26 in the period of 1970-1994 (the corresponding cohort TFR cannot be computed yet for the younger cohorts). Such a long-term divergence implies that the period TFR provides incorrect signals about the levels and trends of fertility and, by extension, also about the long-term prospects of population replacement and population growth in the absence of migration. As Figure 1 shows, much of this gap can be effectively removed in the long run with period indicators that aim to eliminate tempo effects, including the adjusted TFR.

As an alternative to the period TFR, we use the following range of indicators of period fertility:

- (a) adjusted period TFRs, proposed by Bongaarts and Feeney (1998), which are based on birth-order specific correction in the ordinary TFRs that reflect the changes in the mean ages of fertility schedule;
- (b) an age and parity-specific index of fertility, PATFR (e.g. Rallu and Toulemon 1994a) which is based on fertility table that controls for age and parity distribution of women of reproductive age
- (c) its variant adjusted for tempo and variance effects (Kohler and Ortega 2002).

We also employ completed cohort fertility. The choice of these indicators is driven in part by their suitability to address a given issue and in part by data availability. We are well aware of the shortcomings of the Bongaarts-Feeney adjustment, such as its simplified underlying assumption about the constant shape of fertility schedule, its lack of controlling for changes in the parity distribution of the female population and its relatively strong fluctuations over time (van Imhoff 2001; Schoen 2004). However, we use it alongside the adjusted PATFR for the reason of data availability and also because it gives in most cases very similar results to the other fertility adjustment methods. We do not dispose for a number of countries with potentially more appropriate indexes based on parity and duration since the last birth, which largely eliminate the need for tempo adjustment (Sobotka et al. 2005; Ní Bhrolcháin 2008). We provide a brief description of the indicators used in the Appendix.

Figure 1 Period TFR (1965-2008), adjusted period TFR (1970-2003) and completed cohort TFR (women born in 1937-1967) in Denmark.



Notes: Data on completed cohort TFR are based on two neighbouring cohort groups; e.g. cohort 1937 refers to a cohort born in 1937-38. A small fraction of the completed cohort TFR is estimated for women born in 1960-67. Period data are compared with the cohort data for women born 27-28 years earlier; this distance corresponds approximately to the mean age at childbearing in 1968-1994. Adjusted TFR is an average value for a 3-years period centred on a given year.

Sources: Council of Europe (2006) and Eurostat (2008, 2009) for the period TFR and adjusted TFR; Statistics Denmark 2007 (Tables 2.5 and 2.6) for the completed cohort TFR.

3 Example 1: The assumed gap between desired and actual fertility

Surveys on fertility ideals and intentions frequently indicate that despite the decline in fertility rates well below the replacement-level threshold, both mean ideal and desired family sizes in most countries of Europe remain at or above two children per woman (e.g. Testa 2007).[2] The period TFR has been repeatedly used to estimate this gap, suggesting a huge discrepancy between actual and intended fertility (see also Bongaarts 2008), often in the order of 0.5-0.8 children per woman.[3] A recent OECD analysis (OECD 2007: 36) posits that "the gaps between desired and actual fertility rates have increased over the past ten to twenty years" and suggests that these gaps are largest in countries where fertility rates are lowest. Several distinct explanations of this discrepancy have been proposed, among which institutional and structural constraints to childbearing and childrearing (McDonald 2006) are frequently taken as evidence of a need for a policy action (European Commission 2005; McDonald 2006).

The issue has been empirically illustrated by Lutz (2007); this illustration is further elaborated in Table 1. It combines four different fertility and family size indicators in major regions of the European Union (EU) and, separately, in Finland. The first column lists the personal ideal family size as collected in the Eurobarometer survey in 2006 for women aged 25-39 (Testa 2006). The second column, also based on Eurobarometer, gives the total intended family size for the same group of women. It combines the number of children already born with the number of children

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[2] Recent evidence for a number of European countries indicates, however, that young adult women increasingly express sub-replacement family size desires (Goldstein et al. 2003; Lutz et al. 2006; Sobotka 2009).

[3] For instance, Chesnais (2000: 133) stated: "…average ideal family size is around two (…), but the observed total fertility rate for the European Union is only 1.4. The difference between the number of children European women have and the number they would like is around 0.6 children per woman (or 6 children per 10 women)".

women intend to have in the future. This second measure constitutes a more realistic predictor of fertility than ideal family size, since it takes into account expected obstacles and difficulties in realising their fertility ideals and desires. However, a comparison between these two measures from the same survey shows that there is only a small difference between them, 0.15 children per woman for the whole EU.

Table 1 Ideal and intended family size and total fertility rate among women in various regions of the EU in 2006 and different ways to calculate the 'gap' between ideal (intended) and actual fertility.

	(1) Personal ideal family size	(2) Actual + intended family size	(3) TFR	(4) Tempo adjusted TFR	(5) Gap 1 (1)-(3)	(6) Gap 2 (1)–(4)	(7) Gap 3 (2)-(4)
Western Europe	2.44	2.36	1.88	2.00	0.56	0.44	0.36
Northern Europe	2.57	2.35	1.85	1.96	0.72	0.61	0.40
Southern Europe	2.08	1.81	1.37	1.47	0.71	0.61	0.34
Austria + Germany	2.07	1.88	1.34	1.59	0.74	0.48	0.28
Central-Eastern Europe	2.09	2.04	1.31	1.67	0.79	0.42	0.37
Finland	2.61	2.62	1.84	1.91	0.77	0.70	0.71
EU-27	**2.21**	**2.06**	**1.53**	**1.72**	**0.68**	**0.49**	**0.35**

Note: Data are weighted by population size of countries in given regions

Sources: Columns (1) and (2): Eurobarometer 2006 data analysed by Testa (2006). (3) and (4): VID 2008

The third and fourth columns in Table 1 list the TFR for 2006 and the Bongaarts-Feeney (1998) tempo-adjusted TFR for 2003-2005 as published in the European Demographic Data Sheet (VID 2008). The difference between the conventional TFR and the ideal family size (Gap 1 in Column 5) is indeed substantial—more than half a child in all regions—and reaches 0.7 children for the EU. But the two figures used to construct this gap are not comparable because they measure very different things, one cohort ideals and the other tempo-distorted period fertility. If one wishes to compare the ideal family size to a period fertility measure, then tempo-adjusted TFR would be more appropriate. And as Column 6 shows, the gap between those two indexes (Gap 2) becomes smaller and reaches 0.5 for the whole EU. The last column finally gives a third kind of gap, namely that between the intended family size and the adjusted TFR. This third gap is the smallest of all, ranging between 0.3 and 0.4 for different regions and reaching 0.35 for the EU; it represents about half of Gap 1.

These data make the population policy rationale based on trying to help couples reduce the presumed gap between desires and reality look much less convincing: Does this imply that governments have little reason to take action in countries like Austria and Germany that have a relatively small aggregate gap, but in the view of their governments undesirably low fertility rates? Probably not. On the other hand, high-fertility countries of northern Europe have a somewhat larger gap as measured this way. Should governments be more active in those countries which have a higher overall level of fertility? Probably not. In fact, Finland, which is listed in the table as an example of a country with very large Gaps 2 and 3, is often used as an example of what kind of policies governments in low-fertility countries should introduce in order to make it easier for couples to combine work and family. Hence the policy paradigm based on the presumed 'unmet need for children' is problematic on both counts; to some extent it reflects wishful thinking of policy makers and their implicit pronatalism.

While this analysis based on the most recent Eurobarometer data (Lutz 2007; Testa 2006) clearly illustrates the issue, there are some justified doubts about the validity and representativeness of this type of data from an opinion survey with limited sample size, which vastly increases the potential margin of error (Testa 2006).[4] Hence we also present a more in-depth analysis, using data from comparatively large surveys from three countries and focusing on the intended family size, which best reflects women's and couples' long-term childbearing plans.

First, we inspect period data on fertility intentions and fertility for women in the Czech Republic, where the difference between the period TFR and the mean intended family size (MIFS) widened rapidly when the period TFR plummeted in the 1990s (see Sobotka et al. 2008). With the mean intended family size remaining at 2.0 children per woman, the gap between MIFS and the period TFR reached as high as 0.8 in 1997 and still remained at 0.7 in 2005 (Table 2).[5] The tempo-adjusted fertility indicators suggest a much smaller gap at or below 0.3 (the Bongaarts-Feeney adjusted TFR is shown in Table 2; the adjusted PATFR shows similar results). Although this difference between fertility intentions and the actual level of fertility is not negligible either, it offers a much less dramatic interpretation than the gap measured with the ordinary TFR.

Such comparisons between intentions and period fertility rates are problematic, however. They compare the cohort intentions for children to be born in the future to the period measures of current fertility behaviour. A comparison of intended fertility among selected cohorts of women, expressed when they were in their prime reproductive years, with their final completed fertility is methodologically preferable. A usual drawback of cohort fertility analysis—the need to wait 15-20 years for given cohorts to complete their planned fertility—constitutes the main obstacle in such comparisons.

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[4] The small sample size for individual countries, typically around 130 female respondents aged 25-39, was the main reason why we decided to compute Table 1 for regions instead of giving examples for individual countries, which show a much larger variety in intentions and in the resulting intentions-fertility gaps.

[5] Note, however, that young adult women (below age 25) in the Czech Republic have adopted sub-replacement family size desires and their mean intended family size was estimated at 1.85 in 2005 (Sobotka et al. 2008).

Table 2 Gap between mean intended family size (MIFS) and period fertility measured with the TFR and with the alternative indicators of period fertility, Czech Republic, 1993-2005.

Year	**MIFS** (1)	**TFR** (2)	**Gap 1** (2)-(1)	**adjTFR** (3)	**Gap 2** (3)-(1)
1993	2.16	1.67	0.49	1.99	0.17
1997	2.00	1.17	0.82	1.70	0.30
2005	2.00	1.28	0.72	1.71	0.29
Average	2.05	1.37	0.68	1.80	0.25

Note: MIFS refers to the mean intended family size among women aged 18-35 (except in 1993, when the data refer to ages 18-44). Answers of undecided respondents were ignored. Adjusted TFR is an average value for a 3-years period centred on a given year.

Sources: MIFS was computed from the data of the 1993 RHS survey, 1997 FFS survey and 2005 GGS survey (see Sobotka et al. 2008, Table 7). Fertility indicators: our computations from Eurostat (2008).

Frequently, cohort analysis may lead to conclusions that are very similar to the comparison based on adjusted period measures discussed above. In England and Wales different cohorts of women who were interviewed at age 27-29 about their fertility plans expressed the MIFS by about 0.3-0.4 higher than the period TFR at that time (see Smallwood and Jefferies 2003 for trends in MIFS over time). However, the eventual gap between their intentions and the ultimately achieved fertility level was reduced by about a half and typically reached only 0.1-0.2 (Table 3).

Similarly, in Austria the period TFR also gives an exaggerated picture of the extent of unrealised fertility desires. At the time Austrian women reach their typical age at childbearing the gap between their mean reproductive desires and the contemporary level of TFR commonly widens to 0.4-0.5. However, a comparison of fertility intentions at younger ages with completed fertility shows that the intention-behaviour gap becomes substantially smaller, specifically, around 0.15 in the case of the cohorts 1955-60 and 1966-70 analysed in Figure 2. This finding is again surprisingly consistent with the conclusions based on period-based tempo-adjusted measures of fertility.

Table 3 Gap between the mean intended family size (MIFS), period TFR and completed cohort fertility in England and Wales (women aged 27-29, period 1979-96).

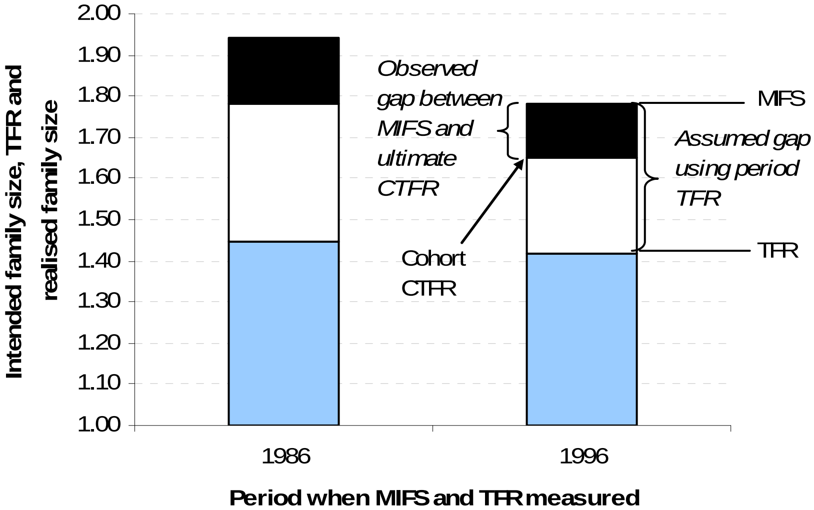
Years	Cohort	MIFS (1)	Period TFR (2)	Gap 1 (2)-(1)	Completed TFR (3)	Gap 2 (3)-(1)
1979-81	around 1952	2.12	1.84	0.28	2.05	0.07
1982-84	around 1955	2.16	1.76	0.40	2.02	0.14
1985-87	around 1958	2.16	1.79	0.37	1.99	0.17
1988-90	around 1961	2.20	1.82	0.38	1.96	0.24
1991-93	around 1964	2.09	1.79	0.30	*1.92 (est)*	0.17
1994-96	around 1967	2.14	1.74	0.40	*1.91 (est.)*	0.23
Average		2.15	1.79	0.36	1.98	0.17

Notes: MIFS refers to the mean intended family size among women aged 27-29; answers of undecided respondents were ignored (see Smallwood and Jefferies 2003 for alternative estimates of the MIFS based on different assumptions about uncertain respondents).

Data on the completed cohort TFR are partly estimated for cohorts born around 1964 and 1967.

Sources: MIFS: Smallwood and Jefferies 2003, Table 1. Completed TFR: ONS 2007, Table 10.2, pp. 56-57.

Figure 2 Differences between mean intended family size (MIFS), period TFR and completed cohort fertility (CTFR), Austrian women aged 25-30 (years 1986 and 1996, cohorts 1956-60 and 1966-70).



Notes: MIFS refers to the medium variant estimate of the mean desired family size among women aged 25-30 (see Sobotka 2009).

Data on the cohort CTFR are partly estimated for the cohorts born in 1966-70.

Sources: Sobotka's (2009) computation from Microcensus (1986 and 1996) data

All in all, period measures of fertility that are less distorted by changes in fertility timing than the period TFR as well as the ultimately achieved cohort fertility show that the gap between intended and realised fertility is grossly exaggerated when analysed with the period TFR. If the intentions data were further adjusted for some factors that are outside the reach of government policies, the presumed gap might become entirely erased. A French survey analysed by Toulemon and Leridon (1999) revealed that when women who had never lived with a partner were disregarded, the mean ideal family size at ages 25-35 (2.21) corresponded remarkably well with the eventually achieved mean family size (2.23) among women born in

1950-65. Caution needs to be taken when interpreting these findings: aggregate consistency does not mean that most individuals achieve their intended family size. Fertility intentions are often uncertain (Westoff and Ryder 1977; Morgan 1981; Sobotka 2009) and subject to changes and revisions during the life course (Quesnel-Vallée and Morgan 2004; Liefbroer 2009). The aggregate results represent an outcome of both under-achieving and over-achieving of the initial targets among individual women. Furthermore, the concepts of intended and ideal family size can both be criticised. The definition of intended fertility adds the number of children already born to those still intended, which makes any unplanned births in the past part of the total intended family size. This problem is avoided by the more hypothetical personal ideal family size which, on the other hand, is more detached from individual circumstances affecting reproductive behaviour, including infertility, and thus also harder to interpret.

4 EXAMPLE 2: RECENT INCREASE IN THE PERIOD TFR IN EUROPE

Since the late 1990s many countries of Europe have recorded a notable increase in the period total fertility rate. In Belgium, Bulgaria, the Czech Republic, Estonia, France, Latvia, Spain and Sweden, the TFR increased by more than 0.2 between 1998 and 2007. This has been generally interpreted as a welcome sign, indicating the much-needed reversal of the previous long-standing trend of declining period fertility rates, which in many countries of Europe had brought the TFR to 'lowest-low' levels of 1.3 or below (Kohler et al. 2002). Some governments have proudly attributed this trend to their policy action and a leading newspaper in Germany, *Die Zeit*, commented a tiny increase in the number of births in 2007 with the cheerful pronouncement "politics work!" (Gaschke 2009). However, an alternative explanation provides a different perspective on the recent rise in the period TFR. It is possible that much of the recent increase in the period TFR in European countries can be attributed to the slowing down or ending of fertility postponement. We look at fertility changes in two countries—the

Czech Republic and Spain—which experienced a substantial rise in the period TFR since the late 1990s and for which we could compute alternative indicators of period fertility that are less affected by the tempo effect. A systematic analysis of the role of tempo effects in the recent TFR increase is provided in a recent study by Goldstein et al. (2009).

Spain experienced a steep and continuous decline in the period TFR between 1976 and 1996, when it reached a record-low level of 1.17. At the same time the alternative tempo-adjusted indicators of period fertility also displayed an almost continuous fall, although at somewhat higher levels, suggesting that the fertility 'quantum' fell in parallel with the period TFR (Figure 3a). After 1996 the TFR first stabilised and then started rising, reaching 1.39 in 2007 (e.g. Delgado et al. 2008). However, the tempo-adjusted fertility indicators give another perspective on recent fertility 'reversal'. First, they suggest that fertility was declining until 2000, i.e. during the time when the TFR had stabilised and started to increase. Subsequently, these indicators essentially show a stabilisation, possibly a tiny increase, in period fertility. In effect, there was convergence between the period TFR and the adjusted period fertility measures around 2005 when the increase in the mean age at first birth stopped. This is a nice illustration of the expected consequence of the ending of the tempo effect.

A different story is depicted in Figure 3b for the Czech Republic. A massive postponement of childbearing after the collapse of the state-socialist system has taken place there since the early 1990s, bringing a pronounced rise in the mean age at first birth (Sobotka et al. 2008). In parallel, the TFR had fallen to the level of 1.13 in 1999 and then started a gradual recovery since the early 2000s, reaching 1.50 in 2008. The adjusted TFR as well as the age- and parity-specific index of fertility, the PATFR, adjusted for tempo effects (Kohler and Ortega's 2002 adjustment, see Appendix) fell much less precipitously over the 1990s to a level around 1.6 in 1998. This divergence between the ordinary TFR and the tempo-adjusted indicators indicates that a substantial part of the steep drop in the TFR could be attributed to the tempo effect. In contrast to Spain, a rise in the TFR in the early 2000s occurred in tandem with an increase in the adjusted TFR albeit a less intensive one. It is likely that the continuing rise in the ordinary TFR will bring a gradual convergence between different fertility measures in the future, in reaction to a slowing down of fertility postponement.

Figure 3a Period TFR, adjusted TFR, adjusted PATFR index and mean age at first birth in Spain, 1980-2007.

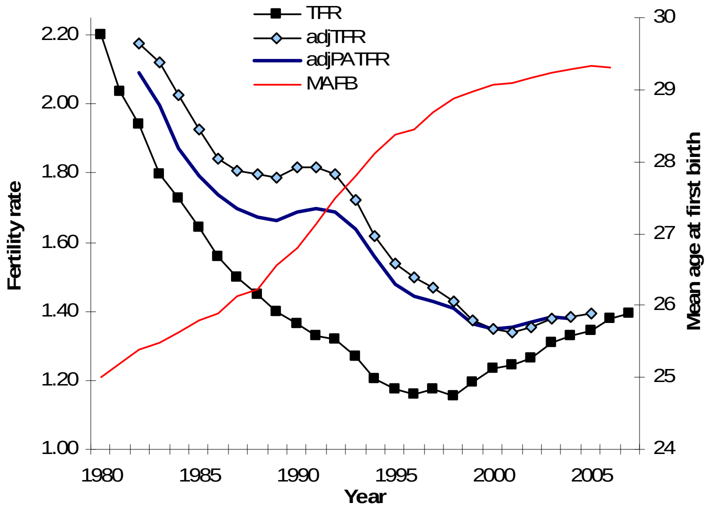
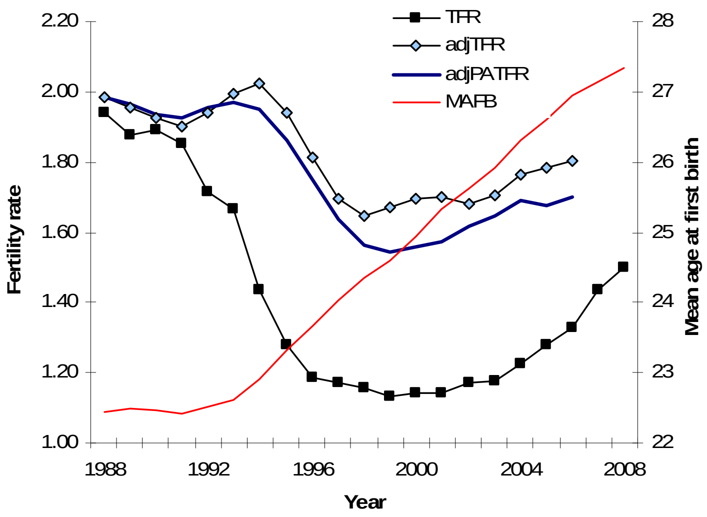


Figure 3b Period TFR, adjusted TFR, adjusted PATFR index and mean age at first birth in the Czech Republic, 1988-2008.



Notes: For adjusted TFR and PATFR average values for 3-year periods centred on a given year are shown.

Sources: Authors' computations based on Eurostat (2003 and 2008), INE (2008) and the data provided by the Czech Statistical Office.

In these two cases, and many others not discussed here (e.g. Goldstein et al. 2009), the adjusted indicators offer a different interpretation of recent fertility trends than the ordinary TFR. Whereas the TFR provides an impression of a substantial increase in fertility rates, the adjusted indicators often show that this increase was almost entirely (Spain) or largely (Czech Republic) driven by the diminishing tempo distortion.

This explanation is particularly pertinent for first births, for which the recent rise in the TFR was most clearly manifested. To illustrate this point, we compare the ordinary TFR for birth order 1 with the period fertility index based on age-specific probabilities of having first child computed for childless women (PATFR), which is markedly less affected by the tempo effect (Sobotka 2004b), and its adjusted variant (adjPATFR) computed using a simplified version (Sobotka 2004b: 94) of Kohler and Ortega's (2002) adjustment (see Appendix).

In the case of Spain, these three indexes provide contrasting impressions about the trends and levels of first-birth rates. Between 1980, when they stood at around 0.9 (suggesting 10% childlessness) and 2005, when they converged, although at a lower level below 0.8, the first-order TFR had dramatically fallen to 0.57 in 1996 and subsequently rose by a third during the next decade (Figure 4a). In contrast, the first-order PATFR depicts a gradual fall between 1980 and 1996 followed by a stabilisation. In other words, first-birth intensity did not rise after 1996 and almost all the increase in first-order TFR in Spain can be explained by a mechanical effect of a steep increase in the number of childless women at higher childbearing ages, when first-birth intensities remained relatively high and stable. This effect is not accounted for in order-specific TFR, which does not control for shifts in the parity distribution among women. Finally, when taking both tempo- and parity-composition effects into account the adjusted PATFR suggests that first-birth intensities actually declined between 1996 and 2004.

Likewise, in the Czech Republic, a substantial part of the dramatic fall in the first-order TFR, which took place between 1991 (0.91) and 1996 (0.52) could be attributed to the tempo effect (Figure 4b). Remarkably, the first-order adjPATFR only showed a modest decline to 0.86 in 1996-1999. Later, a rapid rise in the first-order TFR to 0.73 in 2008 was only weakly mirrored by a slow rise in first-order PATFR. Again, changing parity composition and diminishing tempo effect rather than a genuine increase in first-birth intensity provide the main explanation of the observed increase in the TFR.

Figure 4a Period TFR, adjusted TFR and adjusted PATFR index for first births, Spain 1980-2007.

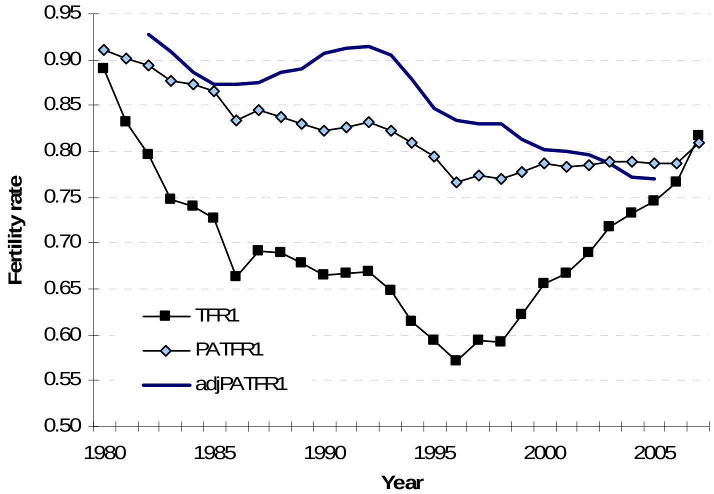
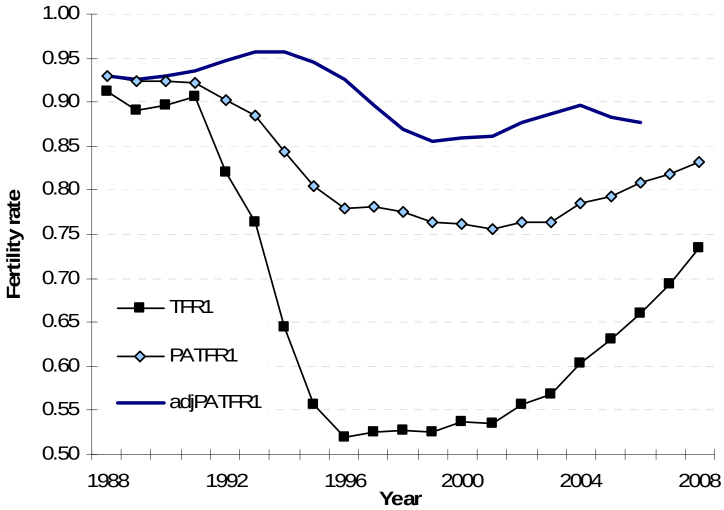


Figure 4b Period TFR, adjusted TFR and adjusted PATFR index for first births, the Czech Republic, 1988-2008.



Notes: For adjusted TFR and PATFR average values for 3-year periods centred on a given year are shown.

Sources: Authors' computations based on Eurostat (2003 and 2008), INE (2008) and the data provided by the Czech Statistical Office.

In sum, during the recent period the ordinary TFR usually indicates a larger magnitude of change, especially for first births, than fertility indicators which control for parity, duration, tempo effect, or at least some of these potentially distorting factors. Most of the TFR shifts can be explained by an increase in first-order TFR and, in turn, most of the increase in first-order TFR can be explained by a diminishing tempo effect coupled with an increase in the number of childless women at later childbearing ages. The often dramatic reversals in first-order TFR can be seen as a product of two distinct phases of first-birth postponement, when many cohorts of women first delayed their entry into motherhood, causing a decline in the TFR and later contributed to the recuperation of fertility rates at higher childbearing ages, which pushed the ordinary TFR upwards. The analysis of first-birth rates, where the cycle of fertility delay and subsequent recuperation is most apparent and fuels large shifts in the first-order TFR, best exposes the weaknesses of the conventional period total fertility rate when it is used as a measure of childbearing intensity or as a synthetic cohort indicator of the 'number of children per woman'.

5 EXAMPLE 3: TFR AS A PROBLEMATIC MEASURE OF THE FERTILITY OF IMMIGRANTS

Fertility of immigrants, when measured by the period TFR, is subject to yet another type of distortion linked to the endogeneity of migration for fertility. Immigrant women, especially when migration took place for the purpose of family formation, typically show elevated fertility rates during the first years after their arrival (e.g. Alders 2000; Østby 2002; Toulemon and Mazuy 2004; Andersson 2004). Consequently, their fertility rates are often more closely related to the duration of their stay rather than to their age. The total fertility rate, which takes age as the indexing variable of fertility, may therefore be strongly biased by the size of immigration streams: Even when fertility rates computed by the duration of stay in the country remain stable, increased migration would bring an inflated TFR by increasing the number of migrant women with short durations of stay, when their fertility rates are highest. Thus, the TFR computed for immigrants usually exaggerates their fertility quantum during periods of high immigration.

This distortion becomes yet more serious when the data on births are recorded for women with foreign nationality only, rather than for all women of immigrant origin. As many immigrants undergo a process of naturalisation when they stay in a country for many years and at some point become classified as nationals, foreigners frequently constitute a select group of migrants with relatively short duration of stay and thus also with elevated period total fertility rates. This may explain why several European countries record the TFR for foreign women as high as 3.0 and above (e.g. Sobotka 2008). For instance, the TFR for foreign women in France in 2005 was estimated at 3.29 as compared with 1.80 for women with French nationality (Héran and Pison 2007). For these reasons, some researchers have argued that the period TFR cannot serve as a reliable indicator of the level of immigrants' fertility (Andersson 2004; Toulemon 2004).

Not much research has been conducted yet to correct for this type of distortion in the TFR. Alternative estimates of migrant women's TFR for France controlling for age at entry and duration of stay (Toulemon and Mazuy 2004; Toulemon 2004) constitute the main exception. For 1991-1998 this alternative estimate reduced the TFR of immigrant women in France from 2.50 (estimated by using the conventional TFR) to 2.16. Thus, the 'excess' fertility of immigrant women in France as compared to native women, falls to about one half of its estimated level, from 0.85 to 0.46 when a more appropriate fertility indicator is used (Toulemon 2004: 4).

6 EXAMPLE 4: CHANGES IN FAMILY POLICIES AND SHIFTS IN TFR

So far our analysis has not referred explicitly to family policies. There is an increasing body of evidence that family-related policies can stimulate distinct swings in total fertility rates, which are often primarily induced by changes in fertility timing and spacing rather than by an increase in the underlying fertility quantum. Specifically, policies may stimulate earlier entry into parenthood or, which is more frequently the case, a faster progression to higher-order births.

The effects of changes in family policies on the timing of births have been documented for many European countries. For instance, Sweden constitutes a well-studied example of a sudden upswing in second- and third-birth rates at short durations since previous birth. This upswing followed two extensions of parental leave, which granted a continuous provision of paid parental leave benefit to women who had another child within 24 months from 1980 and 30 months from 1986 (e.g. Hoem 1990; Andersson et al. 2006; Neyer and Andersson 2008). This regulation, which became known as 'speed premium', has led to a shortening of birth intervals and contributed to a distinct upward swing in period TFR in the late 1980s, as many parents found it manageable to have children closely spaced to take advantage of the continuous benefit (Hoem 1990).[6]

Less well-known are the effects of policy changes introduced in Russia since 1982. These policies extended the period of maternity leave and, more importantly, they also extended the options for mothers to take child care leave until the child reached age 3 (see Zakharov 2006 and 2008).[7]

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[6] Leave compensation in Sweden is generous: parents on parental leave are entitled to receive 80% of their previous salary (90% until 1994; Andersson et al. 2006: 52, fn. 5), which is determined by income before the birth of the child. Thus parents who resume work before having another child risk receiving smaller parental leave benefit if they work part-time or lose their initial job. This creates an economic incentive for the couples to space their next child within the eligibility interval for the continuous parental leave (Hoem 1990).

[7] Unlike in Sweden, child care leave compensation was low in Russia and since 1982 amounted to around 20% of the average salary from the end of maternity leave to the time the child reached the age of 18 months (with the exception of mothers of sick children, who received their full salary) and it was unpaid thereafter (Zakharov 2008).

Following this new regulation, the TFR in Russia increased from 1.88 in 1981 to 2.09 in 1983 and, after a short pause, to 2.23 in 1987 (Council of Europe 2006). However, what looks like a successful policy intervention that brought about a desired increase in fertility was mostly an indirect effect of a change in the timing of childbearing, bringing a temporary boost to the period TFR. The mean age at first birth slightly declined, but the most pronounced effect was recorded for women with one child, who were giving birth to their second child at considerably shorter intervals. In a period perspective, this second-birth interval fell from around 5.5 to 3.5 years between the mid-1970s and the mid-1980s (Zakharov 2008, Figure 5). Although second children were born much ‘faster’ than before, especially for women born in the late 1950s and the early 1960s, Zakharov (2008) did not detect any increase in their cohort progression rate to second child. He concludes that “the demographic effect of the policy did not manifest itself in an increase in average family size in any major social groups.”

However, not only the period TFR is very sensitive to changes in the timing of childbearing. Changes in birth intervals, which are frequent by-products of family policy changes, also affect period parity progression rates (PPRs), computed on the basis of duration-specific fertility rates. Breton and Prioux’s (2005) detailed analysis of shifts in third-birth rates in France in the 1970s to 1990s reveal that third-birth PPRs have fluctuated in parallel with an introduction of family policies explicitly aimed at promoting third births (set up in 1978-1980 and again in 1985-87) as well as with the scaling-down of those measures in 1982. As in the previous two cases, these policies had primarily led to the temporary compression of birth intervals—in this case between the second and the third child—and had only a limited effect on cohort fertility rates[8] (Breton and Prioux 2005: 423).

[8] In the study of Breton and Prioux (2005) cohorts were defined as parity cohorts which measure progression rates to third birth among women having a second birth in a given year.

7 DISCUSSION AND CONCLUSIONS

This study has discussed four examples of different situations where the use of the period TFR results in erroneous readings of the levels and trends of period fertility, which in turn may or did lead to incorrect policy conclusions and, potentially, to misguided policies.

Our first example makes it clear that the popular and politically convenient policy rationale according to which governments should only try to help couples fill the gap between their desired and actual family size is ambiguous and not very significant in terms of quantity. We arrive at the same conclusion when using adjusted period measures as well as when using the more appropriate cohort comparison of fertility intentions among women of reproductive age and their later reproductive outcomes. A much smaller aggregate difference between intended and realised fertility can be more easily explained by biological and social obstacles to childbearing (Bongaarts 2008) that are largely outside the scope of policy influences, such as poor health, infertility, or an inability to find a suitable partner. By extension, our findings suggest that policies aimed at stimulating higher fertility preferences might be more effective in some of the low-fertility countries than the policies only focusing on this rather narrow gap. However, fertility policies that go beyond the rationale of trying to bridge the supposed gap between preferences and outcomes may turn out to be controversial.

Our second example reflects upon the most widely documented distortion in the period TFR—its sensitivity to changes in the timing of childbearing. We show that the period TFR may suggest a trend reversal and a substantial increase in fertility where other indicators show stagnation or even a slight downward trend (the example of first births in Spain) and that the difference between the period TFR and the more appropriate measures of period fertility level may be of major magnitude, potentially leading to a gross misinterpretation of fertility in a country (the example of the Czech Republic). Our analysis indicates that most of the recent increase in the period TFR has been driven by the rise in the TFR for first births, which can in turn be largely attributed to the diminishing first-birth postponement combined with a previous increase in the number of childless women at later childbearing ages (see also Goldstein et al. 2009). The positive impact of diminishing tempo distortion on the TFR had been foreseen in many analyses of fertility trends during the last decade (Bongaarts 2002; Lutz et al. 2003; Sobotka 2004a). This finding has an important policy corollary: while the rising TFR may be interpreted by some governments and politicians as proving the positive effects of their social or family policies on fertility, our findings leave much less space for such a cheerful interpretation.

Our third example draws on the existing research on fertility of immigrant women. The fact that the TFR often distorts the picture of immigrants' fertility may potentially lead to ill-informed policy efforts addressing the presumably high difference between fertility of migrant and native-born women. Our fourth example turns to policy effects themselves. Many fertility-related policies primarily affect the timing of childbearing and as a result they also bring a temporary shift in the period TFR without shaping cohort fertility trends. This shift, caused mostly by the tempo effect, may please policymakers who are likely to incorrectly interpret it as a welcome sign of the effectiveness of the new policy measures.

Let us now turn to the second question mentioned in the introduction, namely whether there is any role left for the traditional period TFR. We have presented clear evidence that it may grossly distort any policy-relevant analysis. Does this imply that the use of period TFR should be entirely abandoned? On a theoretical level the answer essentially depends on whether or not the period TFR adequately measures and describes some process that can be meaningfully interpreted and that other fertility indicators do not capture in the same way (see also Ní Bhrolcháin 2007 and 2008). In the spectrum of summary indicators of natality and period fertility that ranges from the absolute number of births per year (influenced by population size, age structure, parity and birth interval distribution of women, as well as tempo effects) at one end to parity, age and duration-specific indexes on the other, the period TFR occupies an odd in-between position. It adjusts for size and age structure but not for tempo, parity or birth intervals distribution. The decisive point then is whether there are any meaningful questions for which the answer would be provided by an indicator which only adjusts for age structure and not for other potentially important factors.[9]

We could not come up with a policy-relevant question for which the period TFR would be our indicator of choice. All questions that were considered in the end either related to age structure, cohort size or population growth for which the simple natality indicators provide the adequate answer or pertained to childbearing behaviour, such as the question whether a certain policy has led to a higher fertility rate. The latter question, in order to be adequately addressed, requires controlling for parity or duration composition and tempo effect or turning to a cohort fertility analysis. The only instances for which we could identify a role for the period TFR is the artificial realm of models of age-structured population dynamics constructed by demographers. And of course, in this realm the TFR still provides the best answer to the question "Did the TFR increase?" And since the TFR is such an established measure, a lot of people will keep asking this question.

The influence of the changed timing of childbearing on the period TFR is in our view particularly pertinent to current policy debates and proposals. Although the efforts to eliminate the tempo effect from period fertility measures remain by definition imperfect and subject to criticism, they are in our view worth undertaking. Policy-relevant questions are usually

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[9] By extension, this question also pertains to the issue of the factors that should be controlled for in an ideal fertility index of choice (see Population 1994). In theory, such a list can be extended to include factors like infertility, partnership status of women, or even their education status or fertility preferences (only women wishing to have a child in a given year would be included in the at-risk population). However, lack of data, measurement and computational problems as well as interpretation difficulties of such measures imply that the list of characteristics to be controlled for in any useful fertility index should be limited to the most essential ones.

concerned with the ‘quantum’ of fertility, including the issues of anticipating future period and cohort fertility levels and population prospects or explaining trends and reversals in fertility. The presumed mismatch between fertility intentions and behaviour is a prime example of an anticipatory use of period indicators used to show this mismatch, where the tempo effect strongly biases both the analysis and the resulting conclusions. Also from the perspective of shorter-term trends and reversals in fertility, most policies that have potential effects on fertility are arguably ‘quantum-oriented’: If, for instance, a new system of parental leave is established, few politicians hoping that it may have a positive influence on fertility would be content to learn that this influence may last for a couple of years only, because it would primarily operate through a tempo effect temporarily boosting the period TFR. What they are more likely to have on their mind is a long-term sustained boost to fertility level (‘quantum’).

These considerations seem to imply that there is indeed little use for the period TFR outside the models constructed by demographers. Still, these considerations have often been labelled as ‘theoretical’ because they are contingent on the availability of a broadly accepted better indicator of period quantum. While there are many useful indicators, we are unable to recommend any one as a ‘default’ indicator of choice, since they are based on different underlying models of behaviour that are not universally accepted (Population 1994) and that may not suit all types of measurement purposes (Ní Bhrolcháin 2007, 2008). Given this situation, a parallel use of several indicators, carefully selected on the basis of data availability and also of the research question asked, should be considered (Ní Bhrolcháin 2008). If the goal is to get information on the average childbearing intensity in a given year (the period quantum of fertility), we recommend choosing parity progression ratios, tempo-adjusted PATFRs or TFRs, or other indicators that at least partly reduce the distorting influences of age structure, parity distribution and the tempo effect. Especially the use of duration- and parity-specific fertility measures would provide a much better understanding of policy effects on fertility than the ordinary TFR can offer (Ní Bhrolcháin

1987, 1992, 2008). Recently initiated efforts to collect and compute detailed and unified sets of order-specific fertility indicators within the framework of the ‘Human Fertility Database’ should make a wider use of such indicators much easier in the future. Ultimately, cohort fertility data are best suited to analyse whether specific policies have had a lasting effect or whether there was a discontinuity in fertility trends among the cohorts that reacted most strongly to the policy changes. While ordinary cohort fertility data, specified by year-of-birth cohorts require a long ‘waiting time’ for each cohort to complete its reproductive history, data for parity cohorts, namely, fertility rates and parity progression ratios specified by duration since last previous birth can reduce this drawback (Breton and Prioux 2005 and Hosseini-Chavoshi et al. 2006 constitute nice recent examples of such analysis).

Our findings on the problematic use and interpretation of the period TFR, which should be avoided where possible, are in agreement with earlier arguments of prominent analysts like Norman Ryder (1990), Máire Ní Bhrolcháin (1992, 2008), Jean-Louis Rallu and Laurent Toulemon (1994b) and John Bongaarts and Griffith Feeney (1998). While we also generally agree with a recent conclusion offered by Neyer and Andersson (2007: 22) who proposed that crude measures of fertility, such as the TFR, cannot serve as appropriate measures of policy effects, we do not fully support their claim that an accurate information on fertility changes following the changes in family policies can only be derived from individual-level data (see also Neyer and Andersson 2008). While this may be true for the study of differential fertility behaviour, a carefully drawn interpretation of a wide range of aggregate level fertility indicators can provide crucial insights into the nature of fertility changes in response to specific new policies or other social and economic changes, frequently allowing researchers to draw valid and important causal inferences (Ní Bhrolcháin and Dyson 2007).

In conclusion, there is a strong case for stopping the use of the period TFR as a one-fits-all fertility indicator which is currently common practice. While demographers are increasingly aware of the pitfalls associated with the period TFR, their continuous reliance on this measure fuels large misperceptions of fertility levels and dynamics among policy makers, the media and the general public. As a minimum reporting standard, demographers who still choose to use the period TFR should stop referring to it as the 'mean number of children per woman', which it evidently is not. The choice of the most appropriate indicator must depend on the question asked. Since it is hard to think of a real-world question for which the TFR would be the indicator of choice there are good reasons for abandoning it altogether in communications with non-demographic audiences who almost inevitably will misinterpret it as a cohort measure. But such a radical solution may be premature as long as there is no widely accepted and easily available alternative. Hence, for pragmatic reasons, the TFR should still remain in use as part of a bouquet of fertility indicators. As the period TFR is most widely available and it often rises and falls in line with other indicators it is still worth being calculated and inspected. But its misleading 'cohort' interpretation should be avoided and, wherever possible, more appropriate indicators should be used.

Given that it has become so dear to many cohorts of demographers and data users it would take quite a while for the period TFR to lose its dominant position in fertility reporting and analysis even if the points made in this paper were readily accepted. We hope nevertheless that our study will stimulate a discourse about the best practice of fertility reporting and will contribute to the broader dissemination of different fertility measures which will more accurately inform policy makers and the public at large about the aspects of fertility change that matter for their questions.

Acknowledgements

A preliminary draft of this paper has been presented at the 2008 annual meeting of the Population Association of America in New Orleans, 17-19 April 2008. We are thankful to the conference participants and to Laurent Toulemon and Dimiter Philipov for their comments and suggestions. Many thanks to Werner Richter for language editing and to Ani Minassian for copy editing.

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Appendix

Fertility indicators used in this study

Besides the period and cohort total fertility rates, specified separately for first births and for total birth orders, this study utilises the following indicators of period fertility:

Tempo-adjusted total fertility rate (adjTFR), developed by Bongaarts and Feeney (1998), is computed a sum of order-specific adjusted TFRs, which take order-specific changes in the mean age of fertility schedule as an adjustment factor:

$adjTFR_i(t) = TFR_i(t) / (1-r_i(t))$,

where $r_i(t)$ is the estimated change in the mean age at childbearing of birth order i between the beginning and the end of year t. Following Bongaarts and Feeney (2000: 563, fn. 1), this is estimated as follows:

$r_i(t) = [MAB_i(t+1) – MAB_i(t-1)] / 2$,

where $MAB_i(t)$ is the mean age of fertility schedule of order i, calculated from age- and order-specific fertility rates of the second kind (incidence rates). Since the *adjTFR* displays considerable annual fluctuations, three-year moving averages are used in this study.

Fertility index controlling for age and parity (PATFR) is computed from a set of age and parity-specific birth probabilities, $q_i(a)$, which serve as an input of multistate fertility tables (e.g. Park 1976). Following Rallu and Toulemon (1994a: 66), order-specific birth probabilities are computed directly from the annual data on live births by age of mother (a) and birth order (i) combined with the parity and age structure of the female population at the beginning of a given year:

$q_i(a,t) = B_i(a,t) / P_{F,i-1}(a,T=January\ 1\ of\ t)$.

This equation expresses the probability that a woman aged a and having $i-1$ children at the beginning of a year t will give birth during the year. For more details of the computations used, see Sobotka (2004b, pp. 44-46 and 92-93).

For further information on age and parity-specific fertility index and its computation, see Park (1976), Rallu and Toulemon (1994a) and Barkalov and Dorbritz (1996).

Tempo and variance-adjusted period fertility index controlling for age and parity (adjPATFR).

This modification of the PATFR index was proposed by Kohler and Ortega (2002). Their method provides an estimation of period fertility that is free of three distortions present in the TFR, namely distortions caused by (1) changes in the parity distribution of women, (2) changes in fertility timing and (3) changes in the variance of the fertility schedule. It is an analogy of the method developed first by Kohler and Philipov (2001) for an adjustment of age- and order-specific fertility rates of the second kind (incidence rates). The authors employ a procedure that iteratively corrects the observed mean age and the inferred tempo for distortions caused by the variance effects (Kohler and Philipov, 2001: 10). We employ a simplified version of this adjustment, which is described in Sobotka (2004b: 94). As in the case of *adjTFR*, we use three-year moving averages of the adjPATFR to reduce random fluctuations in this index.