When a poor index becomes a good proxy: On the predictive value of individual fertility preferences at the cohort macro-level

Eva Beaujouan (eva.beaujouan@oeaw.ac.at), Wittgenstein Centre: Vienna Institute of Demography, Austrian Academy of Science

Laurent Toulemon (toulemon@ined.fr), Institut national d'études démographiques (Ined), Paris, France

Short abstract (300 words)

Establishing a link between fertility prospects and aggregate fertility has been a concern for many years, rarely explored in Europe to date. In particular, there appears to be a gap between ideal and actual family size, but little is known about whether this has varied over time. Likewise, whether ideals are more closely related to cohort fertility or to period fertility is a widely discussed question. Finally, highly educated women are generally less likely to reach within-cohort fertility expectations. We checked first whether the same holds true for ideals, for both men and women, and second, whether ideals have the same predictive power across cohorts in the three groups of low, medium and high educated.

Using an innovative approach, the correlation between aggregate preferences and actual number of children is explored in a period and in a cohort perspective. Long time-series on fertility preferences are scarce, and we use a very consistent French annual time-series of ideal family size (CREDOC, 1979-2012) in order to precisely model the correlation with cohort and period total fertility rates.

There is a persistent gap between ideal family size and fertility indicators. However, in terms of both trends and of year-on-year changes, ideals are not related to the period total fertility rate, but completed fertility and reported ideal family size are strongly linked at the population level, and especially so for men. The gap between ideal family size and cohort fertility is also growing across educational groups for men and women. However, the correlation across cohorts is weaker among lower educated, suggesting that their fertility behaviour is less well predicted by initial ideals than in the other educational groups.

A previous version of this text was presented at the IUSSP Conference, Busan, Korea, 26-31 August 2013. We thank the discussant of that session, Karel Neels, for his very useful discussion, and his comments which helped us preparing a new version of the paper. Errors remain ours. Eva Beaujouan's research was supported by the European Research Council under the European Union's Seventh Framework Programme (FP7/2007-2013) / ERC Grant agreement n° 284238 (EURREP, www.eurrep.org).

Introduction and research goal

Discussions are numerous on whether fertility intentions and preferences are good predictors of fertility (this wording covering the spectrum from short-term childbearing intentions to life-time ideal family size). Individual correlation between short-term intentions and fertility are widely explored, while studies on macro level correspondence between intended/preferred and actual family size are scarcer (Morgan and Rackin 2010; Smallwood and Jefferies 2003). Child planning declarations tend to be considered today as ambivalent and uncertain upstream (Bernardi et al. 2015; Ní Bhrolcháin and Beaujouan 2011), and limited by the strength of the desire and subject to unforeseen events downstream (Ajzen and Klobas 2013; Kapitány and Spéder 2012). The possibility to use them at all to predict fertility in forecasts has somewhat been abandoned. We propose here to come back on this old topic and to explore (1) whether changes over time and/or cohorts in fertility levels are related in some way to changes in the number of children one considers as ideal, and (2) how far aggregate family size preferences and total fertility are comparable in terms of level, across cohorts, sex and socio-economic groups.

Most studies of aggregate fit between fertility preferences and behaviour are based on the US (see e.g. Morgan and Rackin 2010), and some on the UK (Berrington and Pattaro 2014; Smallwood and Jefferies 2003). In the rest of Europe the results available mostly compare current preferences with current fertility (Noack and Østby 2002; OECD 2007; Testa 2012). In the European context, France shows a comparatively high fertility that has stabilised since the mid-1970s, after the baby boom: the total fertility rate has oscillated between 1.7 and 2.0 children per woman. Ideal family size also remains in the high range in Europe, without being exceedingly high (2.6 to 2.3 over the same period) (Sobotka and Beaujouan 2014). The CRÉDOC annual cross-sectional survey on French life circumstances includes a question on ideals, and this series, very consistent over time, provides us with an excellent opportunity to test the various dimensions of the link between ideal and actual fertility.

Predictability of fertility using answers on fertility intentions or ideal family size: not in terms of level but in terms of trends

At the individual level, evidence is frequent of a decent improvement of the models predicting fertility when introducing a fertility intention variable (e.g. Schoen et al., 1999). Research and theories exist that rely on the predictability of actual fertility from fertility intentions at the individual level (Ajzen and Klobas 2013; Philipov 2009; Spéder and Kapitány 2009). However, though usually significantly explicative of fertility outcomes, they are in absolute terms poor predictors, as major inconsistencies remain (Ní Bhrolcháin and Beaujouan 2011).

Originally, questions on fertility intentions were added to usual surveys in order to help predict future fertility in forecasting (Whelpton et al. 1966). In an assessment of the use of fertility expectations for projecting population, Long and Wetrogan (1981) found that they were performing very well. Nevertheless, while useful insights and inferences can be obtained from analysing aggregate changes in intentions across cohorts and over time, little direct use is actually done of them in forecasting (de Beer 1991; Van Hoorn and Keilman 1997). Indeed, completed fertility is often found to depart from family size preferences at an aggregate level (Freedman et al. 1980; Morgan and Rackin 2010; Smallwood and Jefferies 2003). On the other hand, Morgan (2001) notes that the predictive validity of aggregate intentions appears relatively high for recent cohorts' fertility, despite its substantial variability. The fit at the aggregate level remains nevertheless uneven (Bachrach and Morgan 2013), unwanted births and people not having the expected children offsetting each other, notably among women with lower educational background.

We propose to analyse the long term fit between macro family size preferences and actual number of children. Most comparable analyses have been done in times of decreasing cohort fertility (1960s to 1980s), and on very short time-spell, while our study covers a long time range in a period of fertility stabilization (1980s to 2000s). Moreover, most of the studies discussing a possible gap between fertility preferences and number of children are considering current fertility (TFR) to compare to life-time intentions (Noack and Østby 2002; OECD 2007; Testa 2012), which appears debatable (Morgan 2001). They also use intentions, which can be much more influenced by the perception of obstacles to childbearing than ideals (Edmonston et al. 2010; Hagewen and Morgan 2005; Sobotka and Lutz 2011). Our main hypothesis is that though there is always a gap between cohort ideal and actual family size, this gap might change little across cohorts in times of no large variation in fertility such as the baby boom. We also suggest that cohort fertility variation could be much better related to variation in life-time ideals than period total fertility. If the gap between ideal and actual family size would be relatively constant, then a careful monitoring of changes in childbearing perception could bring insights into the future changes of fertility and could inform fertility scenarios in forecasting models.

Ideals: a good marker of actual fertility?

After showing that life-time fertility *intentions* are causally prior to *ideal* parity, and also to *desired* parity, Ryder (1981) concluded that "questions concerning *ideal* and *desired* family size are pointless for the purpose of understanding or predicting fertility intentions". Yet, he did not look directly at the predictive validity of aggregate ideal family size. Ideal family size overstates actual family size because people do not consider its feasibility while stating it. But the way answers on ideal family size reflect trends in completed family size could be more satisfactory than answers on intentions. Indeed, we know that intentions change with age, time and family situation, that they are strongly affected by questions of timing and circumstances (Gray et al. 2013; Hayford 2009) and that in certain periods of life uncertainty is extremely large (Ní Bhrolcháin and Beaujouan 2011). By contrast, questions on ideals explicitly refer neither to individual experience, nor to current circumstances, which can be a good thing at the aggregate level (Toulemon and Leridon 1999). Coombs (1979) found notably that underlying preference among married women is a much better predictor of fertility over the entire reproductive cycle than expected family size. We thus argue that even if driven by norms (Trent 1980), ideal family size could reflect well the "cohort" context in which people constructed their position towards having a child, and that it could be a good predictor of final cohort fertility.

Cohort or period correlation?

Research generally suggests that short-term intentions are influenced by the current conditions of the individual. They could even reflect more the current conditions than the actual wish to have a child (Westoff and Ryder 1977). However, it is most likely that life-time family size preferences, and particularly ideals, will rather be good predictor of cohort completed fertility than of current total fertility rate. In their theory, Bachrach and Morgan suggest that childhood structures and surrounding are strong determinants of responses to family size preference questions (Bachrach and Morgan 2013), and that these schemes acquired early in life remain influential over the life-course. If these same structures influence fertility as well, as seems to be the case for instance for transmission of family size (Murphy 2013), then cohort preferences and fertility could be well correlated. Fertility ideals and current fertility could be however much less correlated, ideals changing less than intentions over the life-course while current fertility is strongly influenced by the current socio-economic situation (Sobotka et al. 2011).

Education, another predictor of the gap and the correlation?

Westoff and Ryder (1977) and Noack and Østby (2002) showed that the predictive power of preferences is much stronger within some subgroups. Notably, the macro predictive power of short and long term fertility preferences depends on the stage in the life-course, including parity, partnership status and age (Quesnel-vallée and Morgan 2003; Toulemon and Testa 2005; Westoff and Ryder 1977). Women with high school diploma are the closest to achieving their life-time fertility goals, while women with higher education are far from their stated cohort intentions (Berrington and Pattaro 2014; Morgan and Rackin 2010). This does not mean that the gap between lifetime ideal family size and completed fertility is more constant across cohorts for lower educated women than for highly educated women. Even the opposite, the fact that lower educated women control less well their fertility might imply that changes in their childbearing behaviour are less predictable. By contrast with women, men with at least some college have in general lower risks to overachieve than to achieve the predicted intention (Morgan and Rackin 2010). Men have in general somewhat lower ideals than women, thus their gap should be smaller (to the extent that their fertility is about the same). High educated men have lower opportunity costs to have children their female counterparts.

The correlation between ideal family size (IFS) and cohort Total fertility rate (CTFR) may be limited by three factors, which may vary by sex and level of education, and which may also vary over time. First, celibacy (defined here as the absence of any conjugal union before age 50) may limit CTFR, and time-trend in celibacy vary with sex and level of education: in France like in many other countries, the proportion of men and women who never lived as a couple recently increased, except for low educated women, but remained stable among highly educated women, so that the differentials by education reversed (Daguet and Niel 2010): in the year 2000s, among women aged 30-34, those with a low level of education are less often living as a couple than women with a medium or high level of education. A similar result is found by professional occupation: women with managerial occupation are more often living as a couple than workers or low-level employees (Buisson and Daguet 2012). Second, the relation between ideal family size and actual fertility may be weakened by other constraints. Opportunity costs of children are higher for women with good professional prospects, while income effect makes children easier to afford for men and women who earn most. Other investments and interests than children may also explain that highly educated women have lower fertility, even if their answers on Ideal family size is similar to the ones given by women with a lower level of education. Third, fertility includes unplanned births, and the relation between answers on ideal family size and actual fertility would not only depend on rational and economic factors but also on birth limitation practice, themselves very linked to the educational background (Musick et al. 2009). Though highly educated women fulfil better their short-term intentions, on the long term they are more often revising their intentions downward (Iacovou and Patricio Tavares 2011). Overall the general link between aggregate initial intentions and eventual fertility is supposed to be rather less good among higher educated and best for lower educated. We assume the correlation to be larger among respondents with higher education, as they control their fertility better, but the gap to be larger.

Researcb questions and hypotheses

In this paper, we explore whether the difference between preferred (intentions/ideals/situated ideals) and realised fertility is systematic over time and cohorts. In a first part we expose together early life-time declaration regarding these indicators and life-time fertility of the same cohort, as well as contemporaneous fertility rates. We then test the robustness of fertility prospects to predict cohort/period fertility, focussing on ideals. We finally focus on the change in the correlation and in the gap across cohorts, by sex and level of education.

From our exploration we deduced four hypotheses that we will test here:

(1) An aggregate link between ideal total family size and total number of children might exist at the cohort level, but is unlikely to exist for period, as life-time ideal might be more influenced by cohort-constant feature than by current situation.
(2) Whether for periods or for cohorts, and whatever the indicator of intentions and preferences, there is a gap between mean preferred and actual family size.
(3) This gap might be more or less constant over time or across cohorts.
(4) We expect a smaller gap between ideal and actual family size (cohort wise) for lower than for higher educated women, but this gap might be less constant over time for the former.

Data and method

I – Data

Ined-Insee surveys

A collection of surveys including questions on fertility intentions or ideal family size has been made. This work is thus based on a range of French surveys that took place between 1955 and 2011. The content of the questionnaires differs depending on the survey, as shown in Table 1.

Table 1 French surveys used for the exploration of fertility preferences and intentions

Survey	Question on ideal and societal ideal	Question on fertility intentions
INED, Enquêtes conjoncture: 1955, 1967, 1976, 1978, 1982, 1987	X	
INED, Enquête fécondité: 1988		X
INED, Enquête sur la famille et l'emploi (French FFS): 1994		X
INED, Enquête intentions de fécondité: 1998	X	X
Enquête sur les relations familiales et intergénérationnelles (French GGS): 2005		X
INED-INSERM, Enquête Fecond 2010	X (only ideal)	X
CRÉDOC, Conditions de vie et aspirations des Français, 1979-2012	X (only ideal)	

The questions on ideal and societal ideal number of children do not vary much over time, the formulation being:

(1) D'après vous, quel est le nombre idéal d'enfants dans une famille ? [What is in your view the ideal number of children in a family?]
(2) Et en pensant spécialement aux personnes du même milieu que vous, et disposant des mêmes ressources, quel est le nombre idéal d'enfants dans une famille ? [And thinking especially to persons of your background, and with equivalent resources, what is the ideal number of children in a family?]

Ideal (1) thus relates to a family in general, while "situated" ideal (2) indicates the number of children the respondent thinks ideal in a family from the same *milieu*, with the same standard of living as him.

While questions on ideals refer to norms, questions on intentions are supposed to refer to actual future behaviour. The formulation of the question on number of children intended has not changed much per se:

(3) Combien souhaitez-vous avoir d'enfants en tout, y compris ceux que vous avez déjà, et éventuellement celui que vous attendez ? [How many children do you wish to have overall, including the ones you already have, and if relevant the one you are currently expecting]

But the way to arrive the final question on number of children is almost never the same from one survey to the other. The selection of the respondents asked questions on intentions and then the filters between intentions and question on intended family size create some discrepancies, changing from one survey to the other (restriction to people living as a couple, not infecund, etc.). Notably, preliminary questions on duration, immediate projects, long-term projects, can be used as filter.

CRÉDOC surveys

We mainly use a repeated survey on *« les Conditions de vie et les Aspirations des Français »,* conducted every year by the CRÉDOC. At the beginning of each year, 2000 persons representative of the French population are interviewed on their living conditions and their main aspirations. It entails a number of socio-demographic variables like sex, age, marital status, diplomas and income. The question regarding ideals has not changed over the 35 years, and is the following:

(4) Quel est le nombre d'enfants que vous considérez actuellement comme idéal pour une famille en général ? [Which number of children do you currently consider as ideal for a family in general?]

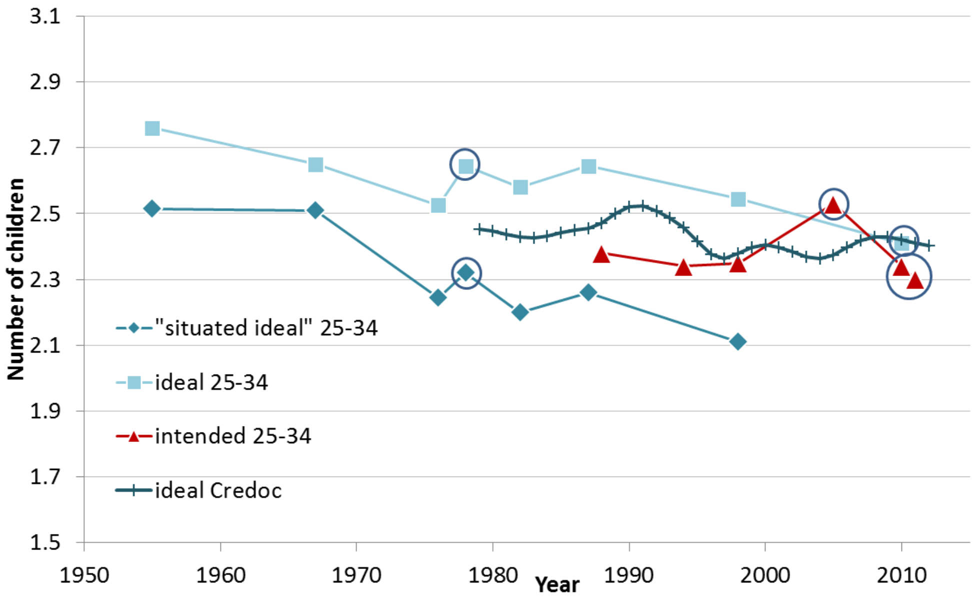
The only change over time in the series holds to a change in the mode of interview, doing of it a very reliable series (see appendix %%%). Paper questionnaires have been replaced by Computer-assisted personal interviews (CAPI) on laptops in 1998, the interviews remaining however face-to-face. The questions asked before are general demographical questions and three questions on marriage and women's work and have not changed over time. Method of sampling (quotas), weighting and controls are unchanged. 1998 appears in a good continuity with the other years, which suggests that the change in the mode of collect has not affected the variables we are studying. This is of utmost importance in the study of series data (Ní Bhrolcháin et al. 2011).

Ideals and intentions from the various surveys

Figure 1 shows the time series extracted from the various surveys described above. We can see that the number of points for each series is not very high. Moreover, the heterogeneity between the surveys and the low quality of some indicators show up here: for instance we know from further exploration that the points 1978 and 2010 of the situated ideal and ideal series are not reliable (the former survey was focussing on family policy with a pronatalist flavour, the later included some constraints on fertility in the wording), while the 2005 set of questions on intentions was an incentive to declare at least one more children. Subsequently, these points should be suppressed in case of further studies, letting only very little data points for comparing preferences and actual fertility. The filters, (who is answering the question, who is considered as not concerned) are the main reason for these inconsistencies.

Due to the small sample size (around 240 women aged 25-34 each year), the CRÉDOC series suffers from random errors. A five-year moving average is thus plotted in Figure 1 (see detail in Appendix 1). We notice that until the recent years, the CRÉDOC ideal number of children was positioned somewhere between the situated ideal and the ideal collected from other surveys. Question wording could be a reason for such observations, but also the survey design (quota) that differs from usual large sample surveys. Overall, the regularity in the surveys makes of this series a powerful tool, despite their small sample size and quota sampling procedure.

Figure 1 Mean ideal family size CRÉDOC and mean contextual ideal, ideal and intended family size by year of survey for other French surveys, age 25-34, women



Sources: CRÉDOC annual Survey; INED, Enquêtes conjoncture 1955, 1967, 1976, 1978, 1982, 1987; INED, Enquête intentions de fécondité 1998; INED, Enquête fécondité 1988; INED, French FFS 1994 ; Ined-Insee French GGS 2005; INED-INSERM, Enquête Fecond 2010
Note: doubtful estimates and outliers are circled (see text)

Cohort total fertility rate (CTFR)

Cohort fertility rates from 1945 to 1972 are recovered from Prioux (vital registrations), Insee, and Toulemon and Mazuy (2001). The CTFR has been estimated and extrapolated from the 1973 up to the 1985 cohort (see details in appendix). We also estimated men's fertility, in order to use men's answer as a check for our assumptions, which mainly deal with women (see details in appendix). Data on male fertility are less accurate: in France recognition by the father is not compulsory for children born out of marriage, and some men may not quote their children if they never recognized them or if they do not see them anymore after a couple disruption with the mother. Civil registration data for men are imputed (Insee, 2015), but differentials by education are estimated from retrospective survey data, where under-registration of children is large, likely to be correlated with level of education and changing with birth cohort.

II – Methodology

Is there any macro-level relation between period fertility (as measured by the Period Total Fertility Rate, PTFR), cohort fertility (Cohort Total Fertility Rate, CTFR), and answers on intended or ideal number of children? This question is treated using time-series and looking at their correlation over time. This time-series analysis could be performed for the CRÉDOC series, rich of 34 points in time.

The models consist of simple linear regressions, focusing on the correlation between answers on Ideal family size (IFS), and CTFR. Predictive power is assessed at a macro scale, because we are interested in the context and in the effects at population scale.

The CRÉDOC surveys cover the 1979-2012 period. The cohorts born before 1945 (baby boom cohorts) and the cohorts born after 1985 (for which no forecast of CTFR was estimated) are excluded (see Lexis Diagram in appendix %%%). For the description we study the 25-34 age group, and in the models we concentrate on the persons most likely to still have children (men and women aged 20-34). The older ones are likely to adjust their ideal to the number of children they actually had, and their answers may not be very useful for the estimation of future fertility. Ideal Family Size is estimated from the answers to the CRÉDOC series of surveys, while CTFR and PTFR are attributed to the respondents according to their year of birth and to the survey year. IFS is estimated at the individual level, which allows to disentangle the answers not only by year and age (and thus by cohort), but also by level of education, and partnership status.

Concretely, we analyse the aggregate link between ideal family size at various ages in each cohort and completed family size by cohort. We do the same for the aggregate link between IFS at various ages in each year and period TFR. We then estimate partial correlations between ideal family size on the one hand, CTFR and PTFR on the other hand. Our research strategy was made of four items.

We first studied the macro time-series, elaborating IFS series as overall means of answers over periods, and compare them to the PTFR and CTFR. We decomposed the main question into three sub-questions:

a) Are ideals related to CTFR?
b) Are ideals related to PTFR?
c) Are ideals more correlated with PTFR or with CTFR?

We checked that the results did not change when changing the age range of respondents to IFS (20-49, and 25-34) and that using CTFR of women for men, some lags (especially a 2-year lag, 2 years being the mean age difference between partners) did not change our conclusions. We also tried to use estimates of men's fertility, but men's series were very similar to women's, and uncertainties on men's fertility prevented us to go further in that direction. The same holds for couples' cohort fertility, an index more consistent with IFS than CTFR, as answers on the ideal number of children in a family usually refer to couples, and not to men or women who never lived as a couple (Toulemon and Leridon 1999). Overall, the trends for couples' fertility and CTFR are very close. As a second check, we used another period fertility index, the tempo-adjusted Total fertility rate (AdjPTFR, see Appendix %%% for details) and checked whether the correlation between IFS and the CTFR changed when we controlled for the AdjPTFR instead of for the PTFR. The AjdPTFR is assumed to be more correlated with CTFR than PTFR, the latter being subject to "tempo-distortion" in case of change in the mean age at childbirth. The AdjPTFR is then a better estimate of the "period quantum" (Bongaarts and Feeney 1998), a good proxy for the CTFR under some simple assumptions (Calot et al. 1994; Ryder 1980). As a third check, we detrended all variables in order to verify whether our correlations were robust to the removal of time trends. We consider that fertility in France has been quite stable since the end of the 1970s, so that the correlation between IFS and CTFR may not be linked to a common trend such as an overall fertility decline or increase. We expect the relation to be robust to detrending the series.

Second, we ran linear regressions with ideal family size as the dependent variable *y*, CTFR and PTFR, estimated as independent variables *x* constant for each cohort and each year respectively. This allowed us to use the whole sample for all survey years, each respondent aged *x* in *t* being related to birth cohort *t-x*. We restricted our analyses to respondents aged 20 to 34 in the survey years 1979-2012, and belonging to cohorts 1945-1985, so that periods and cohorts are treated in a similar way (see Lexis diagram in appendix %%%). It also allowed us to easily test the statistical significance of our results. The regression coefficients β were transformed into correlation coefficients *r* using the relation:

$$r = \beta\ (\sigma_x / \sigma_y)$$

σ_x and σ_y being the standard deviations of *x* and *y*, respectively. This allowed us to easily estimate partial correlations with adding other covariates in our models, in order to check the robustness of our results, as well as to test the nullity of the correlations. We also estimated partial correlations from the changes in the coefficient of determination R^2, and we checked that the estimate was the same than the one given by a direct computation based on the correlations between covariates (see appendix %%%).

We performed the same checks than for the macro-level series: we replaced the PTFR by the AdjPTFR; we detrended all time variables in order to check whether our correlations were robust to the removal of time trends; we estimated cohort couples' IFS. Finally, we ran models for men, using male IFS and female PTFR and CTFR, with or without a 2-year lag.

Third, we looked at the gaps between IFS and CTFR, and between IFS and PTFR, to see how they change with age and whether they are stable between periods or between cohorts, so as to understand what is behind the correlations found from the correlation analyses.

Finally, we ran separate analyses by level of education, in order to check our fourth hypothesis that the relation between ideal family size and cohort total fertility is stronger for highly educated women. We first estimated cohort fertility and ideal family size by sex and level of education, and run separate analyses by level of education. Educational levels groups were created according to the Isced 7 scale, so that low educated corresponds to Isced 0-2 (no diploma to lower secondary), medium to Isced 3-4 (upper secondary to above secondary non-tertiary) and high to Isced 5-6 (tertiary).

Results

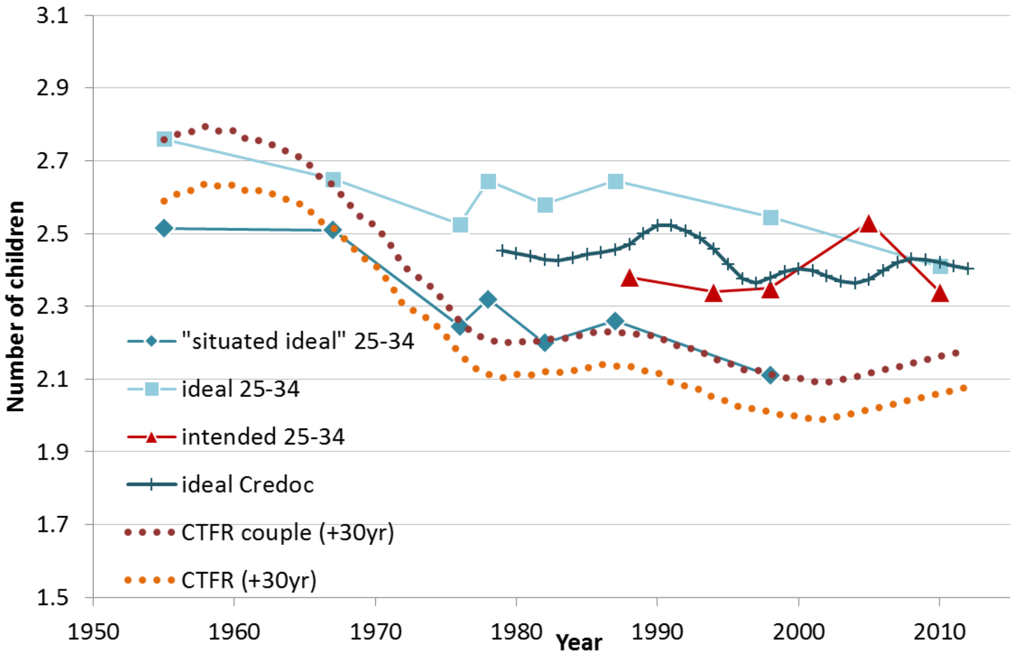
Trends over time

Figure 2 allows comparing the preferences of women when they are 25-34 with the cohort fertility of the same cohort. E.g. for year 2010, we look at CTFR of cohort 1980 which is actually 30 at that time:

since these women are not yet 40, on these recent years we show the projected CTFR. The CTFR is in general below any preference indicator over time. It is also below intended fertility (0.2 to 0.4 children), which is consistent with other findings that systematically find that women tend to underestimate their future number of children. Only when fertility was still dropping, completed fertility was closer from the situated ideal and still below the ideal number of children. Intentions are not available in that period, so the comparison is not possible. We only know that in the period of fertility decrease, cohort fertility intentions and completed fertility were quite close in the US (Freedman et al. 1980).

The gap between situated ideal and ideal family size (from Ined/Insee surveys) has increased at the end of the 1970s, but overall the trends have been rather similar. However from that time, in terms of level, completed fertility for women in a couple has been very close from the ideal reported for people of similar life-standards. A new point in this series would be necessary, to see whether the situated ideal family size tends to increase like the CRÉDOC time-series or to decrease like the series of the other (more doubtful) surveys.

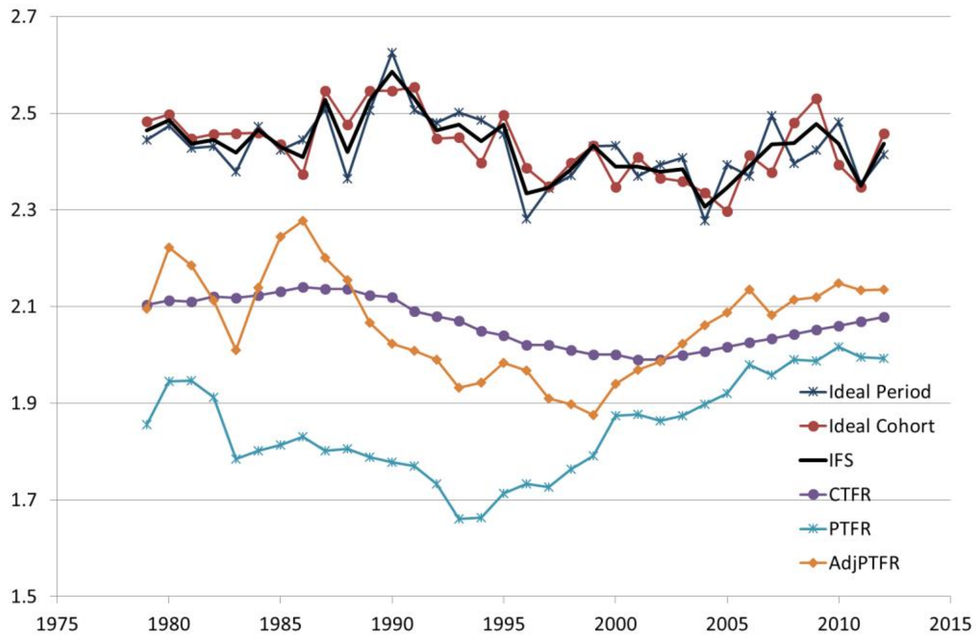
Figure 2 Mean ideal family size CRÉDOC and mean contextual ideal, ideal and intended family size by year of survey for other surveys, age 25-34; Cohort total fertility rate (for all women and for women ever in a couple)



Sources: See Figure 1; CTFR from vital registrations data and author estimates (see appendix %%%).

The answers on ideal family size include a non-negligible random component, as the sample size is around 240 women aged 25-34 each year. Nevertheless, Figure 2 shows that IFS is increasing during the 1980s, then decreasing between 1990 and 1995 and increasing again after 2005. This trend may also be related to Cohort fertility: In France, CTFR is increasing from cohort 1950 to 1960, then decreasing between cohorts 1960 to 1970, and increasing again in most recent cohorts.

Figure 3 Several indices compared, 1979-2012: IFS, PTFR, AdjPTFR and CTFR



Sources: CRÉDOC annual Survey; CTFR from vital registrations data and author estimates.

Note. Indices for a survey year t. IFS: Ideal Family Size, unsmoothed answers from women 25-34, periodwise, cohortwise (surveys t-5 to t+4 for cohort t-30 aged 25 to 34 in t-5 to t+4) and average; CTFR: cohort Total Fertility Rate – cohort aged 30 in t); PTFR: Period TFR; AdjPTFR: Adjusted Period TFR.

The macro-level correlations are presented in Table 1. Three estimates of ISF are used in this table: for a year *t*, the first estimate of ISF is based on the answers of women aged 25-34 each year; the second is based on the answers of women born in *t*-30, from survey years *t*-5 to *t*+4; the mixed estimate is the mean of the period and cohort estimates. According to these three measures, the correlation with the PTFR is small and negative (-0.20 to -0.16); when we replace PTFR by AdjPTFR, the correlation becomes positive, though still small. By contrast, the correlation between IFS and CTFR is always large and positive (0.47 to 0.61).

From these time series, the correlation between PTFR and CTFR is slightly negative (-0.09), while the AdjPTFR is positively correlated with both PTFR (0.55) and CTFR (0.65). When we estimate partial correlations between ISF and CTFR, controlled for the PTFR or the AdjPTFR, the partial correlation remains high and positive (0.60 to 0.66); the partial correlation between IFS and PTFR does not change much when it is controlled for the CTFR (-0.18), while the partial correlation between ISF and AdjPTFR becomes negative (-0.37), when controlled for CTFR. When PTFR and AdjPTFR are considered together in correlation with the IFS, the partial correlation between PTFR and IFS is more negative (-0.37), while the partial correlation between the AdjPTFR and IFS becomes positive (0.34). Nevertheless, this last correlation is difficult to interpret: what does the trends in the AdjPTFR measure, when "controlled for the PTFR"? We concluded that it would be a "cohort-like component" of fertility level, so that it appeared more consistent to look only at partial correlations of AdjPTFR and PTFR with IFS, controlled for CTFR, and vice versa, and we did not pursue the analysis of partial correlations of PTFR and AdjPTFR with IFS, controlled one for the other.

Results are consistent for men and women, though PTFR is even more negatively correlated to IFS, and CTFR even more positive. Tests shifting the CTFR and TFR by two years give equivalent results.

Table 1. Macro-level correlations between IFS, PTFR and CTFR, women and men

Women — Macro-level correlations with the…

Crude time series	PTFR	AdjPTFR	CTFR
ISF, Period, 25-34	-0,19	-0,12	0,47
ISF, cohort, 25-34	-0,16	-0,06	0,61
ISF, Mixed 25-34	-0,20	-0,10	0,61
ISF, Mixed 25-34, partial	-0,18		0,60
ISF, Mixed 25-34, partial		-0,18	0,62
ISF, Mixed 25-34, partial	-0,62	0,60	
Detrended time-series	**PTFR**	**AdjPTFR**	**CTFR**
ISF, Period, 25-34	-0,06	-0,01	0,36
ISF, cohort, 25-34	0,06	0,12	0,47
ISF, Mixed 25-34	0,00	0,06	0,47
ISF, Mixed 25-34, partial	-0,22		0,51
ISF, Mixed 25-34, partial		-0,22	0,51
ISF, Mixed 25-34, partial	-0,50	0,51	

Men — Macro-level correlations with the…

Crude time series	PTFR	AdjPTFR	CTFR
ISF, Period, 25-34	-0,21	0,27	0,64
ISF, cohort, 25-34	-0,48	-0,09	0,41
ISF, Mixed 25-34	-0,42	0,13	0,66
ISF, Mixed 25-34, partial	-0,62		0,76
ISF, Mixed 25-34, partial		-0,54	0,77
ISF, Mixed 25-34, partial	-0,66	0,58	
Detrended time-series	**PTFR**	**AdjPTFR**	**CTFR**
ISF, Period, 25-34	0,00	0,18	0,40
ISF, cohort, 25-34	-0,36	-0,25	0,05
ISF, Mixed 25-34	-0,25	-0,03	0,33
ISF, Mixed 25-34, partial	-0,50		0,53
ISF, Mixed 25-34, partial		-0,42	0,52
ISF, Mixed 25-34, partial	-0,37	0,29	

Sources: Ideal family size (IFS): CRÉDOC annual surveys; Period Total Fertility Rate (PTFR), Tempo-adjusted PTFR (AdjPTFR), Cohort TFR (CTFR): Civil registration data, authors' estimates (see appendix %%%)

Our main result is thus that IFS is positively correlated with CTFR, and not correlated or slightly negatively correlated with PTFR and AdjPTFR. Detrending the time series does not lead to any change: our result is robust to removing time trends during the period (Table 1, bottom). We ran additional checks, but our result was stable to all of them: looking at first differences, using ages 20-49, and using couple ISF instead of overall ISF (results not shown).

Results from linear regressions: a small but stable correlation between Ideal family size and Cohort TFR is confirmed

We ran a series of linear regression with IFS as the dependent variable y, and fertility index or indices as the covariates (Table 2). Female respondents aged 20 to 34, born between 1945 and 1985, for all survey years 1979-2012, were included. As the answers on Ideal family size are very diverse (from 0 to 7, a standard error around 0.76, see appendix %%%), the estimated correlation coefficients are much smaller than their macro-level counterparts (the order of magnitude is typically from 10 to 1). The linear regression allows us estimating the statistical significance of the regression parameters, and thus the significance of the correlations.

The correlation between IFS and CTFR is positive (0.05) and highly significant ($p < 0.001$), while the correlation between IFS and PTFR is 10 times smaller, negative and not significantly different from zero (Table 2, left part). When PTFR and CTFR are put together in the regression, in order to estimate partial correlations, results do not change. From this analysis, the correlation between AdjPFR and IFS is large (0.03) and significant ($p = 0.001$) but, when AdjPTFR and CTFR are considered together, the partial correlation between IFS and CTFR remains, while the correlation between IFS and AdjPTFR vanishes. This comes from the fact that CTFR shares a slightly negative trend with AdjPTFR, while the trend is positive for PTFR; when the detrended series are considered, CTFR is correlated in a similar way with PTFR and AdjPTFR. The regressions run with the detrended variables (Table 2, right part) confirm these conclusions: a robust and significant correlation between IFS and CTFR, no relation between IFS and PTFR, a correlation between IFS and AdjPTFR which vanishes when controlled for CTFR.

Table 2. Correlation coefficients between IFS and several fertility indices, based on individual data (women)

Raw variables			Detrended variables		
	Correlation coefficient r	**Pr>|t|**		Correlation coefficient r	**Pr>|t|**
One variable (correlations)			*One variable (correlations)*		
PTFR->IFS	-0,004	0,657	PTFR->IFS	0,011	0,255
CTFR->IFS	0,051	<.0001	CTFR->IFS	0,035	0,000
AdjPTFR->IFS	0,030	0,001	AdjPTFR->IFS	0,016	0,081
Two variables (partial correlations)			*Two variables (partial correlations)*		
PTFR->IFS	-0,009	0,336	PTFR->IFS	-0,005	0,653
CTFR->IFS	0,052	<.0001	CTFR->IFS	0,036	0,001
AdjPTFR->IFS	0,001	0,904	AdjPTFR->IFS	0,001	0,963
CTFR->IFS	0,050	<.0001	CTFR->IFS	0,034	0,002

Sources: See Table 1

Considering couples' CTFR did not have any impact on the results, and estimating IFS from men's answers led to consistent results (Table 3): the (small and negative) correlation between male IFS and female PTFR was non significantly different from zero, but the correlations between male IFS and (female) CTFR was larger: 0.07 instead of 0.05. Anyway, the difference between these two coefficients was not significant, and including a two-year lag in the times series, in order to take into account the age difference between spouses, did not lead to an increase in the correlations. Men's answers on IFS are closely related to female CTFR for the same birth cohorts, but our estimates of male fertility are too close to female's to allow showing any further differences.

Table 3. Correlation coefficients between IFS and several fertility indices, based on individual data (men)

Raw variables			Detrended variables		
	Correlation coefficient r	**Pr>|t|**		Correlation coefficient r	**Pr>|t|**
One variable (correlations)			One variable (correlations)		
PTFR->IFS	0,003	0,799	PTFR->IFS	0,018	0,080
CTFR->IFS	0,073	<.0001	CTFR->IFS	0,044	<.0001
Two variables (partial correlations)			Two variables (partial correlations)		
PTFR->IFS	-0,014	0,174	PTFR->IFS	-0,001	0,901
CTFR->IFS	0,076	<.0001	CTFR->IFS	0,042	0,000

Sources: See Table 1

Further evaluation of the correlation

We took benefit of the CRÉDOC dataset to evaluate the correlation between IFS and fertility at different ages. In the CRÉDOC surveys, answers on IFS do not vary with age: the mean IFS is 2.40 among the respondents for all surveys 1979-2012, ages 20-49 (see Figure %%% in appendix %%% for a precise description of the set of respondents by age, year, and cohort). At all ages between 20 and 39, the IFS is between 2.38 and 2.42.

Age-specific Ideal Family Size series may be presented by year (Figure 4) and by Birth cohort (Figure 5). The age-specific IFS are highly correlated, especially when observed by period: answers on Ideal family size increase at all ages during the beginning of the 1990s, then decrease during the 1990s and remain constant during the 2000s. The mean answers do not vary much with respondents ages, and the overall trend does not seem to be correlated with the Period TFR.

The Figures are quite different when data are plotted not by period but by birth cohort: the age variability appears larger than period-wise, but the overall trend looks very much like the one of the Cohort TFR: overall stability for cohorts 1945-60, then decline for cohorts 1960-70 and increase for the most recent cohorts.

This better fit of answers on IFS with Cohort TFR than with period TFR is summarized in Figure 6, where we plotted the correlation coefficients: at all ages the correlation between IFS and CTR appears positive, while the correlation between IFS and PTFR heavily depends on age: at young ages the correlation is positive, and it turns negative at older ages. The positive correlation between IFS at young ages and PTFR is mostly due to an increase in IFS among young women since 2000, which may be related to the increase of CTFR as well as to period effects.

Figure 4. Coefficients of correlation based on the models estimating ideal family size against total fertility rate and final cohort completed fertility; Models for women, normal and detrended, and for men, normal and with a shift of two years for CTFR

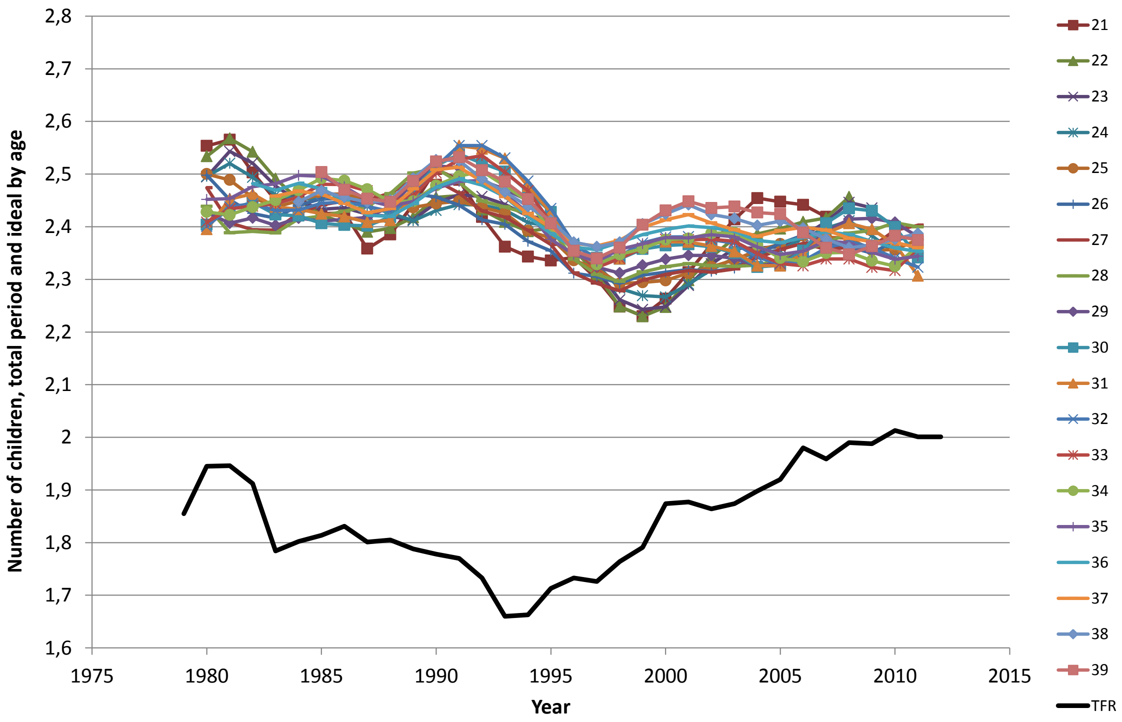
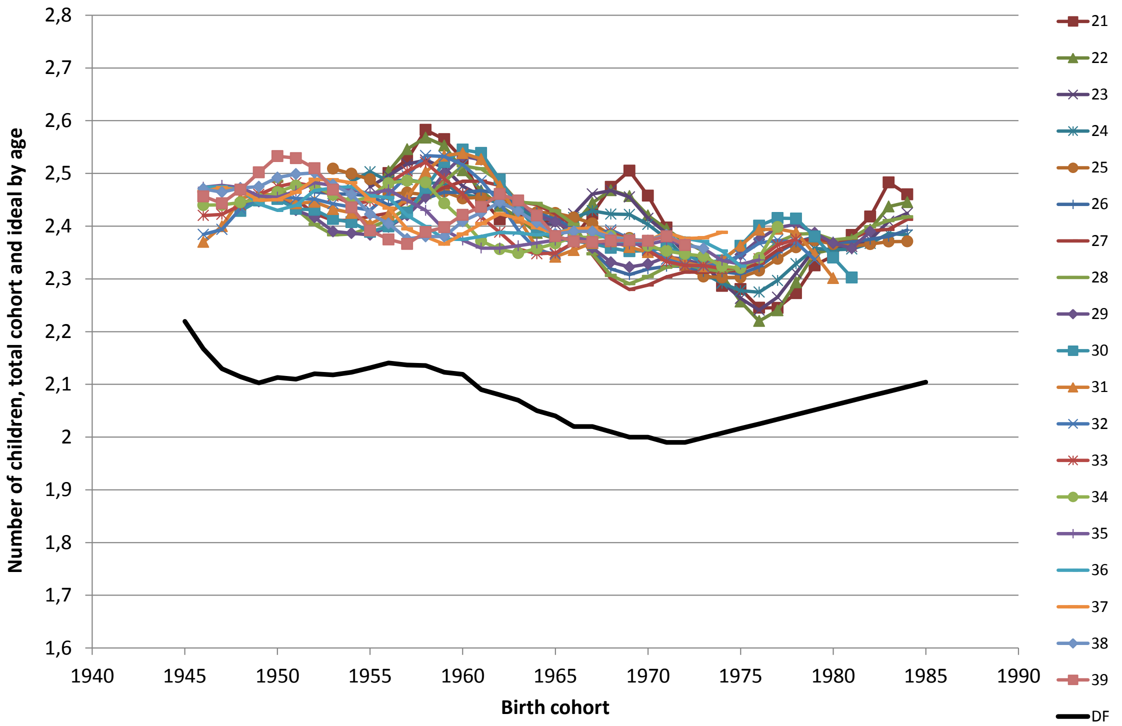
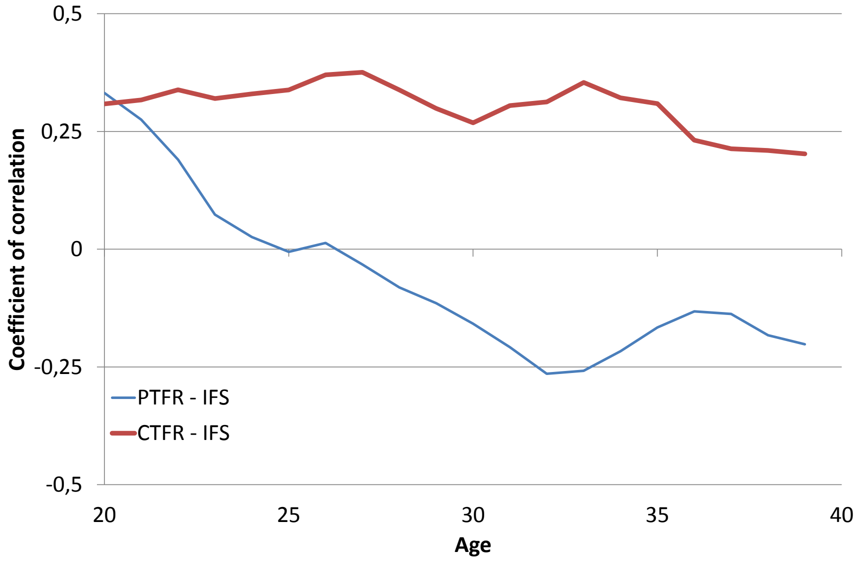


Figure 5 Coefficients of correlation based on the models estimating ideal family size against total fertility rate and final cohort completed fertility; Models for women, normal and detrended, and for men, normal and with a shift of two years for CTFR



Note: The age-specific coefficients are smoothed twice in MA3.

Figure 6. Correlation coefficients estimating ideal family size for each age against (1) total fertility rate and (2) final cohort completed fertility; Models for women



Note: The correlations are estimated on unsmoothed series. The curves of correlation coefficients have been smoothed for less graphical variability (moving average ages x-1 to x+1, run twice).

Age effects: gap between ideal number of children and cohort final completed fertility

Based on our correlation results, we are confident that answers on IFS may be useful to predict cohort fertility in the French post-baby boom context. For answers on IFS to be useful for cohort fertility projection, the gap between IFS and fertility must remain stable. To simplify, we present the gap with cohort fertility, which is our main topic of interest, but checked and found that the gap between IFS and PTFR is strongly unstable (not shown). We estimated the gap between IFS and female CTFR for each woman, and tested models with interactions between age and birth cohort, as well as between age and period. We used linear regressions with age, cohort, and period as continuous covariates, and added non-linear changes with age, period or cohort by including squared variables[1]; non-linear trends allows checking the assumption of a decreasing gap during the 20s, and non-linear time trends could be linked with the non-linear trends in CTFR during this period. The parameters of the models, as well as their significance level, are shown in Table appendix %%%. We plotted in Figure 7 the estimated gap by age (20 to 40), for years 1980, 1995 and 2010, and birth cohorts 1945, 1965, and 1985.

For female respondents, the gap remains stable, with no significant main effect of age and birth cohort, no interaction between birth cohort and age (Figure 7, top left). The results for men are very different: the gap is highly unstable, with significant linear effects of age and cohort (the gap

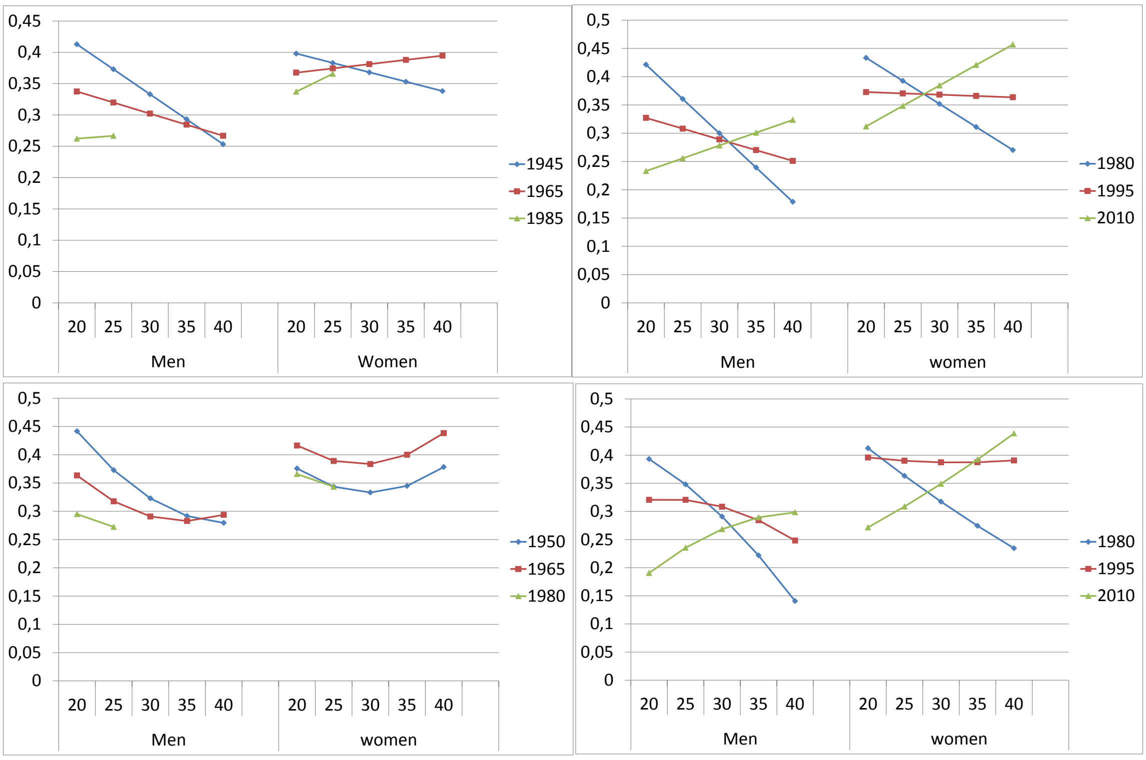
[1] Our continuous variables for year is computed as [(year-1995) / 10]; for birth cohort [(Cohort - 1965) / 10]; for age [(age - 30) / 10]. The covariates thus vary within the range [-1.5;+1.5] for year, [-2;+2] for cohort and [-1;+1] for age, so that their squared values are not too large, and the parameters can be accurately estimated.

decreasing with age and with birth cohort). Period models show a dramatic change in the age effect with time: in 1980 the gap is much larger among young men and women, while in 2010 the gap is larger among older respondents (Figure 7, top right).

Adding squared age and squared cohort as covariates, we found for women an effect of birth cohort squared, linked to the fact that answers on IFS are more stable than CTFR: among cohorts with lower fertility, the gap is larger than among cohorts with higher CTFR. We also find a nearly significant effect of age squared: the gap is larger among young and old women than among women aged around 30[2]. By comparison, the gap appears very unstable for men, age and cohort effects remaining significant when squared covariates are introduced. Period effects do not change much when squared effects are included.

All in all, the only model where the gap remains constant is the one where the gap is estimated for women, against birth cohort, which confirms that the set of women's answers on IFS is a good proxy for their complete fertility, while men's answer are less stable. The gap between IFS and CTFR is not stable with age, when time is controlled for and measured by the survey year.

Figure 7 Estimates of the gap between answers on Ideal family size and Cohort total fertility, by birth cohort (left) and by period (right). Models including linear effects (top) and squared effects (bottom)



² This result is almost significant (p = 0.0502) but may be partly due to the sample scheme: we miss young respondents among older cohorts, and old respondents among the most recent cohorts, which fertility is higher. The U-shpaed variations with age may thus be partly artifactual.

Education… levels, gap, interactions

The mean gap between Ideal family size and cohort fertility is lower for men than for women (0.30 vs. 0.37): mean cohort fertility is identical for men and women, while mean Ideal family size is larger for women than for men (2.44 vs. 2.37). For men, IFS and CTFR slightly increase with education level, and the gap is almost constant. Among women, mean fertility is higher among low educated women, while IFS moderately increases with education, so that the gap between IFS and CTFR is positive and increasing with education, from 0.18 to 0.56 (Table 4).

Table 4. IFS, CTFR and gap by level of education and sex

	Low	Middle	High	All
IFS, Men	2,34	2,40	2,47	2,37
CTFR, Men	2,07	2,02	2,11	2,08
Gap, Men	0,27	0,38	0,35	0,30
IFS, Women	2,43	2,42	2,49	2,44
CTFR, Women	2,26	1,93	1,93	2,07
Gap, Women	0,18	0,50	0,56	0,37

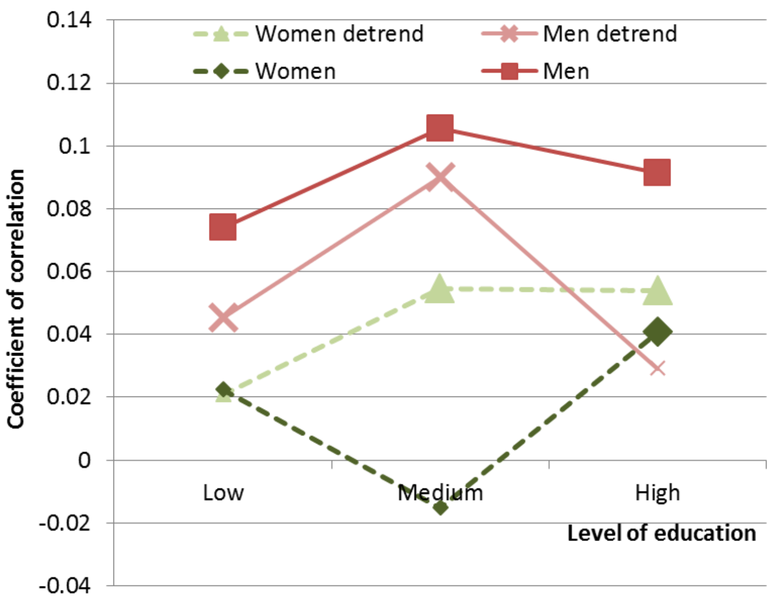
Regarding time trend in IFS and CTFR by level of education, compositional effects render the analysis difficult (Figure 8): the overall level of education changed dramatically among these cohorts, so that the proportion of women with a low level of education decreased from 70% in cohort 1945 to 36% in cohort 1975, while the proportion of highly educated women increased from 21% to 35% (the trend is slowing for more recent cohorts, which are still young in our sample). Similar trends prevail for men. Correlations within subgroups must thus be taken with much caution. Notably, the stability of the gap for the whole population of men and of women is related to a decline of the gap for women with a middle or high education and for men with high education (Figure 8).

Figure 8 Estimates of the correlation between answers on Ideal family size and Cohort total fertility, by sex, birth cohort and level of education

Note: results smoothed with a moving average (MA3)

For women, the correlation between IFS and CTFR appears significant only for the most educated (Figure 9), which confirms our last hypothesis. When the trend (partly due to compositional effects) is removed, the correlation increases and becomes significant also for women with middle education. These results strongly confirm our assumption on the usefulness of answers on IFS to forecast CTFR.

Figure 9 Coefficients of correlation based on the models estimating ideal family size against final cohort completed fertility by sex and level of education



Men’s answers are less easy to interpret. On the one hand, the correlation between IFS and CTFR is larger than for women, and this is still the case for detrended series. We find here the same result than for the whole group, irrespective of level of education (see Tables 1 and 2). On the other hand, the correlation is not increasing with educational level, and even becomes non-significant for highly educated men when detrended series are correlated. We do not want to interpret these results more in detail, because of the shortcomings of male fertility data. Detailed data on time trends by sex and level of education are presented in appendix %%%.

Conclusion and discussion

Ideal family size appears to be a good proxy for cohort total fertility rate (CTFR) in post-baby boom situations. Answers on Ideal number of children seem also more strongly related to CTFR than to PTFR among cohorts born after 1945 in France. The interest to study these links in the post-baby boom cohorts is twofold: these cohorts have grown in large families and so their future fertility might be quite over-estimated; in terms of modelling, the small variations in the trends can be linked to each other without being attributed to the strong downfall. In counterparty models are more difficult to identify as fertility is almost (a bit “too”) stable in France.

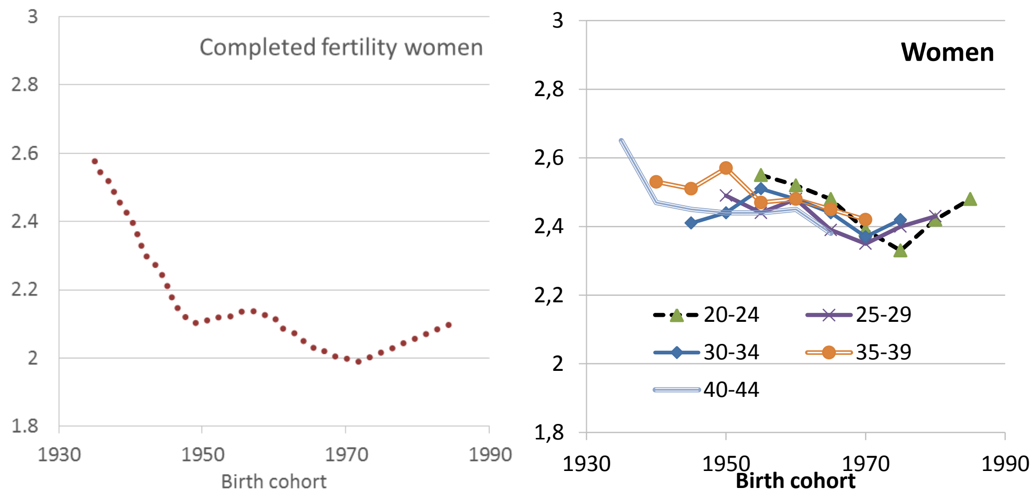
This study links long-term trends in fertility and in fertility prospects for the first time, and shows some potential in this direction. However, consistent series are scarce, and thus other such comparisons unlikely. It would notably be very useful to do the same with all the “preference” indicators – notably fertility intentions – in order to compare their efficiency in predicting fertility.

Despite the fact that post-baby boom fertility is mainly period-driven (Ní Bhrolcháin 1992), we found that consistent time series on ideal family size are correlated with cohort fertility, and not with period fertility. One major reason for answers on fertility intentions or ideal family size to be bad predictors of cohort fertility could be a strong downward trend in CTFR, or inconsistent time series on IFS. This reopens the debate on the usefulness of these questions in order to predict cohort fertility (Morgan 2001).

Regarding future improvements, we would like to test other indicators of fertility such as duration specific period fertility. Also, for forecasting aims, other authors show that partial-adjustments are possible that improve the consistency and predictive power of fertility expectations to predict fertility. Models can notably account for the decrease of expectations with age and its variation with marital status, parity, etc. So it would be interesting to proceed to some interactions and test the differences between groups (e.g. educational groups). This necessitates however to decompose completed fertility in subgroup, and to estimate and project it for the subgroups.

There are great prospects for the future of these previsions. We remind that the cohorts aged 20-29 in the very recent years had to be dropped because our projection of completed fertility was not going so far and/or for symmetry reasons. And we observe in Figure 10 that the mean ideal family size for these recent cohorts has increased recently, as has (and might continue) the CTFR. It appears thus possible that in a continuation of the time-series, models would get a stronger predictive power. This observation also cross-validates, in some way, the increase in completed fertility projected here.

Figure 10 Projection of CTFR for recent cohorts (left hand side) and ideal number of children by age (right hand side)



Acknowledgments

The authors wish to thank Regis Bigot and Emilie Daudey for their help with the data processing. Eva Beaujouan’s contribution was supported by the European Research Council under the European Union’s Seventh Framework Programme (FP7/2007-2013) / ERC Grant agreement n° 284238 (EURREP).

References

Ajzen, I., & Klobas, J. E. (2013). Fertility intentions: An approach based on the theory of planned behavior. *Demographic Research*, *29*(8), 203–232. doi:10.4054/DemRes.2013.29.8

Bachrach, C. A., & Morgan, S. P. (2013). A Cognitive–Social Model of Fertility Intentions. *Population and Development Review*, *39*(3), 459–485. http://onlinelibrary.wiley.com/doi/10.1111/j.1728-4457.2013.00612.x/abstract. Accessed 9 October 2013

Bernardi, L., Mynarska, M., & Rossier, C. (2015). Uncertain, Changing and Situated Fertility Intentions. In D. Philipov, A. C. Liefbroer, & J. E. Klobas (Eds.), *Reproductive Decision-Making in a Macro-Micro perspective* (pp. 113–139). Springer Netherlands. http://link.springer.com/chapter/10.1007/978-94-017-9401-5_5. Accessed 19 February 2015

Berrington, A., & Pattaro, S. (2014). Educational differences in fertility desires, intentions and behaviour: A life course perspective. *Advances in Life Course Research*, *21*, 10–27. doi:10.1016/j.alcr.2013.12.003

Bongaarts, J., & Feeney, G. (1998). On the Quantum and Tempo of Fertility. *Population and Development Review*, *24*(2), 271–291. doi:10.2307/2807974

Buisson, G., & Daguet, F. (2012). Qui vit seul dans son logement ? Qui vit en couple ? *INSEE première*, *1392*.

Calot, G., Sardon, J.-P., Desplanques, G., Keilman, N., Bhrolchain, M. N., Festy, P., et al. (1994). Period Fertility Measures: Reflective Commentaries. *Population: An English Selection*, *6*, 95–130. http://www.jstor.org/stable/2949145\nhttp://www.jstor.org/stable/pdfplus/2949145.pdf?acceptTC=true

Coombs, L. C. (1979). Underlying family-size preferences and reproductive behavior. *Studies in family planning*, *10*(1), 25–36. http://www.ncbi.nlm.nih.gov/pubmed/442149

Daguet, F., & Niel, X. (2010). Vivre en couple La proportion de jeunes en couple se stabilise. *INSEE première*, *1281*.

De Beer, J. (1991). From birth expectations to birth forecasts: a partial-adjustment approach. *Mathematical population studies*, *3*(2), 127–144. doi:10.1080/08898489109525330

Edmonston, B., Lee, S. M., & Wu, Z. (2010). Fertility Intentions in Canada: Change or No Change? *Canadian Studies in Population*, *37*(3-4), 297–337. http://socialiststudies.com/index.php/csp/article/viewFile/16041/12846. Accessed 13 July 2015

Freedman, R., Freedman, D. S., & Thornton, A. D. (1980). Changes in fertility expectations and preferences between 1962 and 1977: Their relation to final parity. *Demography*, *17*(4), 365–378. http://www.springerlink.com/index/962WM185415242PR.pdf. Accessed 6 July 2012

Gray, E., Evans, A., & Reimondos, A. (2013). Childbearing desires of childless men and women: When are goals adjusted? *Advances in Life Course Research*, *18*(2), 141–149. doi:10.1016/j.alcr.2012.09.003

Hagewen, K. J., & Morgan, S. P. (2005). Intended and ideal family size in the United States, 1970-2002. *Population and Development Review*, *31*(3), 507–527. doi:10.1111/j.1728-4457.2005.00081.x

Hayford, S. R. (2009). The evolution of fertility expectations over the life course. *Demography*, *46*(4), 765–783. <Go to ISI>://WOS:000272312800006

Iacovou, M., & Patricio Tavares, L. (2011). Yearning, learning and conceding: Reasons Men and Women Change Their Childbearing Intentions. *Population and Development Review*, *37*(1), 89–123.

Insee, 2015, "2,1 enfants par femme pour les générations nées entre 1947 et 1963" http://www.insee.fr/fr/themes/document.asp?ref_id=if25

Kapitány, B., & Spéder, Z. (2012). Realization, postponement or abandonment of childbearing intentions in four European countries. *Population (English Edition), 67*(4), 599–629. http://www.cairn.info/resume.php?ID_ARTICLE=POPE_1204_0599. Accessed 26 March 2014

Long, J. F., & Wetrogan, S. I. (1981). The utility of birth expectations in population projections. In G. E. Hendershot & P. J. Placek (Eds.), *Predicting fertility* (pp. 29–50). Lexington, Massachussets/Toronto: Lexington Books, D.C. Heath and Company. http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:The+utility+of+birth+expectations+in+population+projections#0. Accessed 21 August 2013

Morgan, S. P. (2001). Should fertility intentions inform fertility forecasts? In *The Direction of Fertility in the United States* (pp. 153–178). Alexandria, Virginia: US Census Bureau Conference.

Morgan, S. P., & Rackin, H. M. (2010). The correspondence between fertility intentions and behavior in the United States. *Population and Development Review*, *36*(1), 91–118. http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2857728&tool=pmcentrez&rendertype=abstract

Murphy, M. (2013). Cross-national patterns of intergenerational continuities in childbearing in developed countries. *Biodemography and social biology*, *59*(2), 101–26. doi:10.1080/19485565.2013.833779

Musick, K., England, P., Edgington, S., & Kangas, N. (2009). Education differences in intended and unintended fertility. *Social Forces*, *88*(2), 543–572. http://sf.oxfordjournals.org/cgi/doi/10.1353/sof.0.0278. Accessed 10 June 2012

Ní Bhrolcháin, M. (1992). Period paramount? A critique of the cohort approach to fertility. *Population and Development Review*, *18*(4), 599–629.

Ní Bhrolcháin, M., & Beaujouan, É. (2011). Uncertainty in fertility intentions in Britain, 1979-2007. *Vienna Yearbook of Population Research*, *9*, 99–129. http://www.oeaw.ac.at/vid/publications/VYPR2011/VYPR2011.shtml. Accessed 23 July 2013

Ní Bhrolcháin, M., Beaujouan, É., & Murphy, M. (2011). Sources of error in reported childlessness in a continuous British household survey. *Population Studies*, *65*(3), 305–318. doi:10.1080/00324728.2011.607901

Noack, T., & Østby, L. (2002). Free to choose - but unable to stick to it? Norwegian fertility expectations and subsequent behaviour in the following 20 years. In E. Klijzing & M. Corijn (Eds.), *Dynamics of fertility and partnership in Europe : insights and lessons from comparative research* (pp. 103–116). New York and Geneva: United Nations.

OECD. (2007). *Babies and Bosses - Reconciling Work and Family Life: A Synthesis of Findings for OECD Countries*. Paris. http://www.oecd.org/els/familiesandchildren/babiesandbosses-reconcilingworkandfamilylifeasynthesisoffindingsforoecdcountries.htm

Philipov, D. (2009). Fertility Intentions and Outcomes: The Role of Policies to Close the Gap. *European Journal of Population - Revue Européenne de Démographie*, *25*(4), 355–361. doi:10.1007/s10680-009-9202-1

Prioux, F., & Barbieri, M. (2012). L'évolution démographique récente en France: une mortalité relativement faible aux grands âges. *Population*, *67*(4), 597–656. http://www.cairn.info/resume.php?ID_ARTICLE=POPU_1204_0597. Accessed 9 May 2013

Quesnel-vallée, A., & Morgan, S. P. (2003). Missing the target? Correspondence of fertility intentions and behavior in the US. *Population Research and Policy Review*, *22*(5-6), 497–525.

Ryder, N. B. (1980). *The Cohort Approach: Essays in the Measurement of Temporal Variations in Demographic Behavior*. Ayer Publishing.

Ryder, N. B. (1981). Changes in parity orientation from 1970 to 1975. In G. E. Hendershot & P. J. Placek (Eds.), *Predicting Fertility* (pp. 101–128). Lexington, Massachussets/Toronto: Lexington Books, D.C. Heath and Company. http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Changes+in+parity+orientation+from+1970+to+1975#0. Accessed 21 August 2013

Schoen, R., Astone, N. M., Kim, Y. J., Nathanson, C. A., & Fields, J. M. (1999). Do fertility intentions affect fertility behavior? *Journal of Marriage and the Family*, *61*(3), 790–799. <Go to ISI>://000082552600019

Smallwood, S., & Jefferies, J. (2003). Family building intentions in England and Wales: trends, outcomes and interpretations. *Population Trends*, *112*, 15–28.

Sobotka, T., & Beaujouan, É. (2014). Two is best? The persistence of a two-child family ideal in Europe. *Population and Development Review*, *40*(3), 391–419. http://onlinelibrary.wiley.com/doi/10.1111/j.1728-4457.2014.00691.x/abstract. Accessed 16 September 2014

Sobotka, T., & Lutz, W. (2011). Misleading policy messages derived from the period TFR: Should we stop using it? *Comparative Population Studies*, *35*(3), 637–664. doi:10.4232/10.CPoS-2010-15en

Sobotka, T., Skirbekk, V., & Philipov, D. (2011). Economic recession and fertility in the developed world. *Population and Development Review*. doi:10.1111/j.1728-4457.2011.00411.x

Spéder, Z., & Kapitány, B. (2009). How are Time-Dependent Childbearing Intentions Realized? Realization, Postponement, Abandonment, Bringing Forward. *European*

Journal of Population - Revue Européenne de Démographie, *25*(4), 503–523. doi:10.1007/s10680-009-9189-7

Testa, M. R. (2012). *Family Sizes in Europe: Evidence from the 2011 Eurobarometer Survey* (No. 2). *iffd.org*. Vienna. http://iffd.org/wp-content/uploads/2012/05/documento-de-interes-maria-rita-testa.pdf. Accessed 25 October 2012

Toulemon, L., & Leridon, H. (1999). La famille idéale : combien d'enfants, à quel âge ? *INSEE première*, (652).

Toulemon, L., & Mazuy, M. (2001). Les naissances sont retardées mais la fécondité est stable. *Population (French Edition)*, *56*(4), 611–644.

Toulemon, L., & Testa, M. R. (2005). Fertility intentions and actual fertility: A complex relationship. *Population and Societies*, (415), 2003–2006.

Trent, R. B. (1980). Evidence bearing on the construct validity of "ideal family size." *Population and Environment*, *3*(3), 309–327. http://link.springer.com/article/10.1007/BF01255345. Accessed 16 May 2013

Van Hoorn, W., & Keilman, N. (1997). Births expectations and their use in fertility forecasting. *Eurostat Working Papers (Population and social conditions)*, (E4/1997-4). http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Births+expectations+and+their+use+in+fertility+forecasting#0. Accessed 11 February 2013

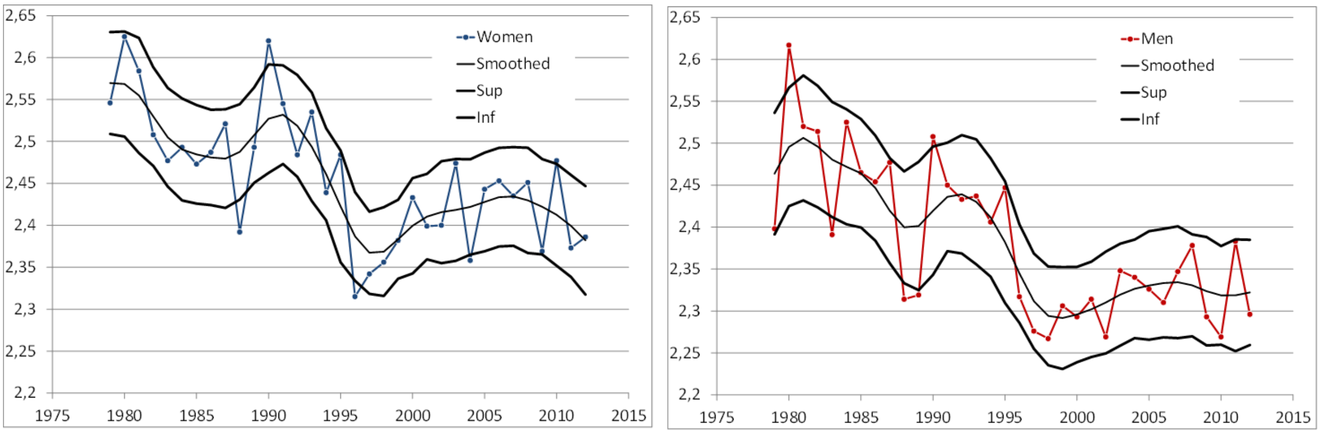
Westoff, C. F., & Ryder, N. B. (1977). The predictive validity of reproductive intentions. *Demography*, *14*(4), 431–453.

Whelpton, P. K., Campbell, A. A., & Paterson, J. (1966). *Fertility and Family Planning in the United States*. Princeton University Press.

Appendix 1: CRÉDOC series: variability and selection

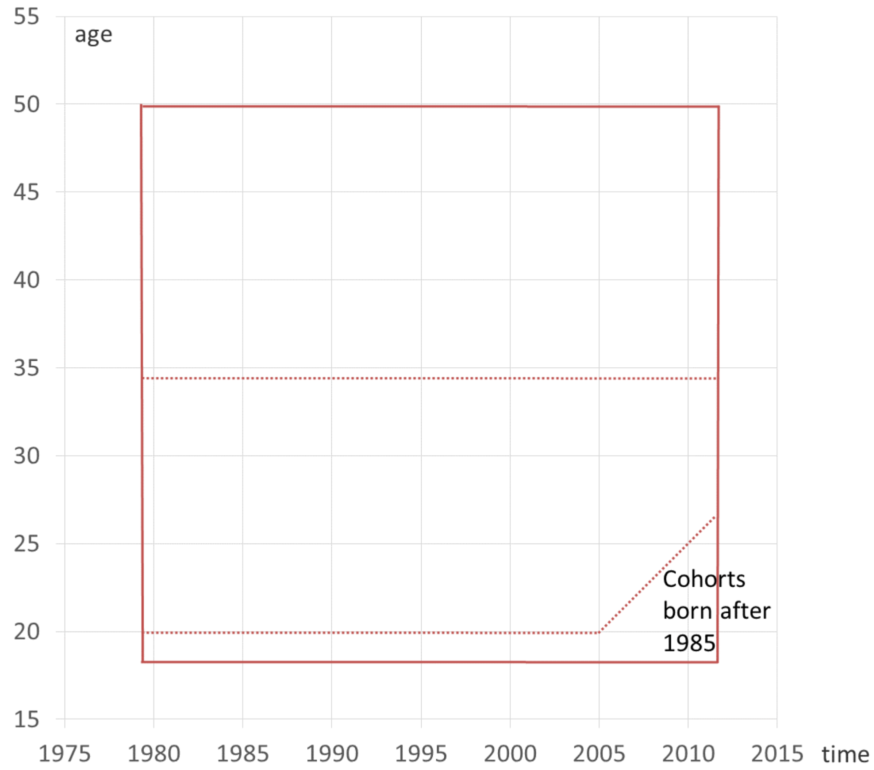
CRÉDOC yearly time series is very homogeneous, comprised in a 5% confidence interval around a smoothed curve (Figure 11). The smoothed curve is plotted here only in order to show the confidence intervals and to better represent the shape, but we use the actual data in our estimations.

Figure 11 Mean ideal number of children from CRÉDOC surveys, at age 18-49. Smoothed estimates and yearly 5% confidence intervals. Left: men, right: women.



Source: CRÉDOC, « les Conditions de vie et les Aspirations des Français » annual Survey
The smoothed estimate is based on 5-year moving average (Hoem %%% tails in moving average); the 95% confidence intervals are estimated independently for each year.

Figure 12 Lexis Diagram

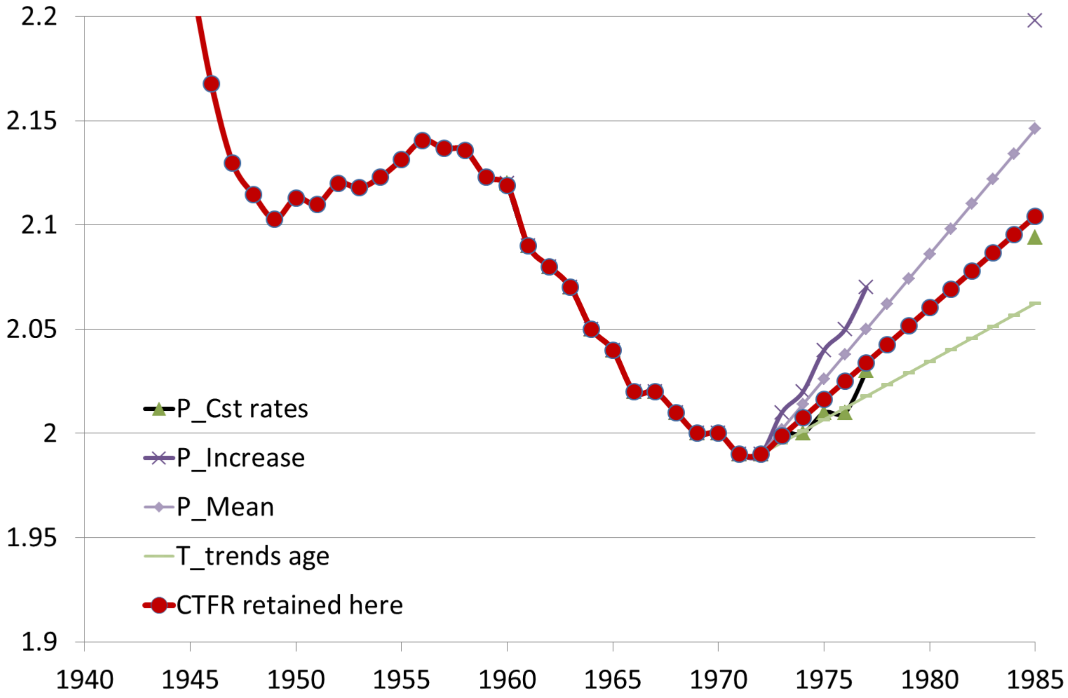


Cohorts born in 1945 are 34-year old in 1979; cohorts born in 1985 are 27-year old in 2012, as the surveys took place at the end of the year %%% true if the surveys took place at the end of the year. Check

Appendix: Projection of cohort completed fertility

The estimation is based on several projections: an extrapolation up to 1985 of Prioux' projections in table A.5 p. 641 (Prioux and Barbieri 2012), called here P_Cst rates (rates freeze) and P_increase (tendency); and Toulemon's projections in Figure 16 p. 635. In this case, the increase in the age specific rate (DF4), closest from the subsequent CTFR, has been extrapolated and applied from 1972 to obtain T_trends age. From this, a conservative increase in the cohort total fertility has been calculated (CTFR retained here, which is the average of T_trends age and P_Cst rates), and P_mean (the average of P_Cst rates and P_increase) is also retained for the high fertility scenario.

Figure 13 Forecast of cohort total fertility rates (CTFR), adapted from Prioux (P) and Toulemon (T)

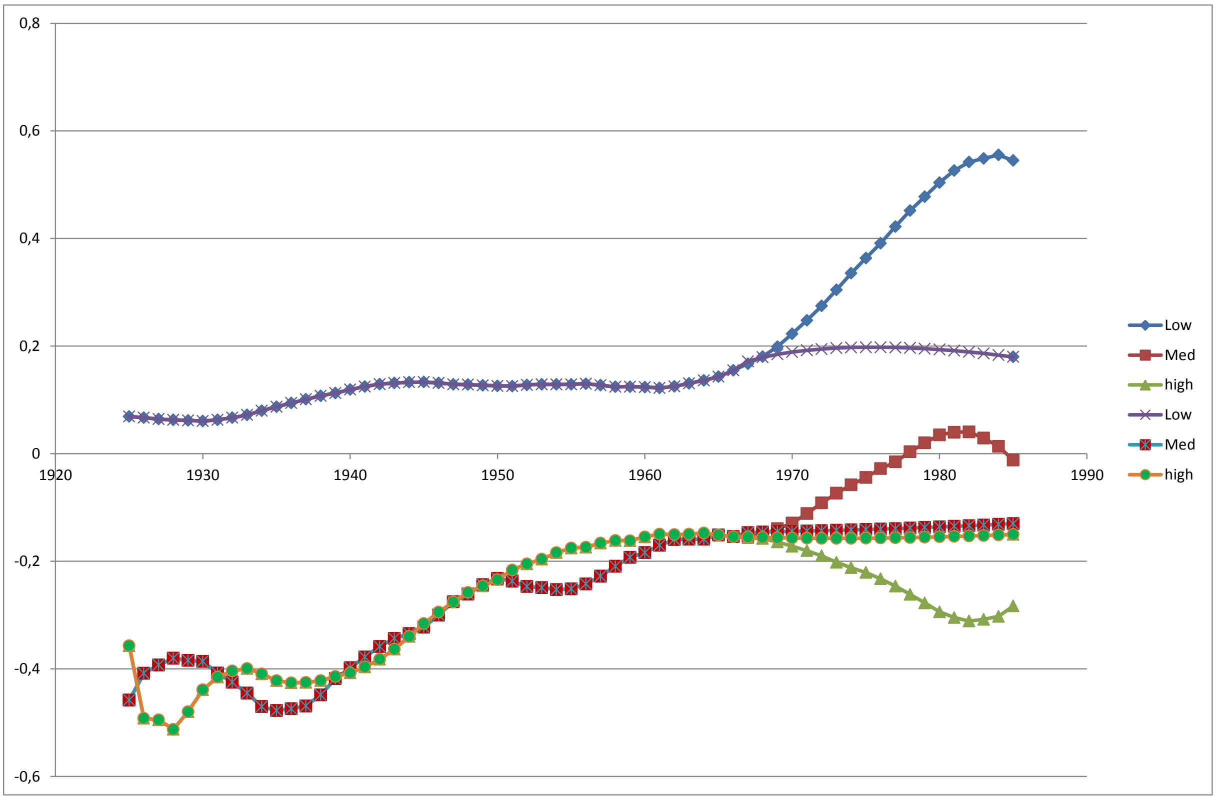


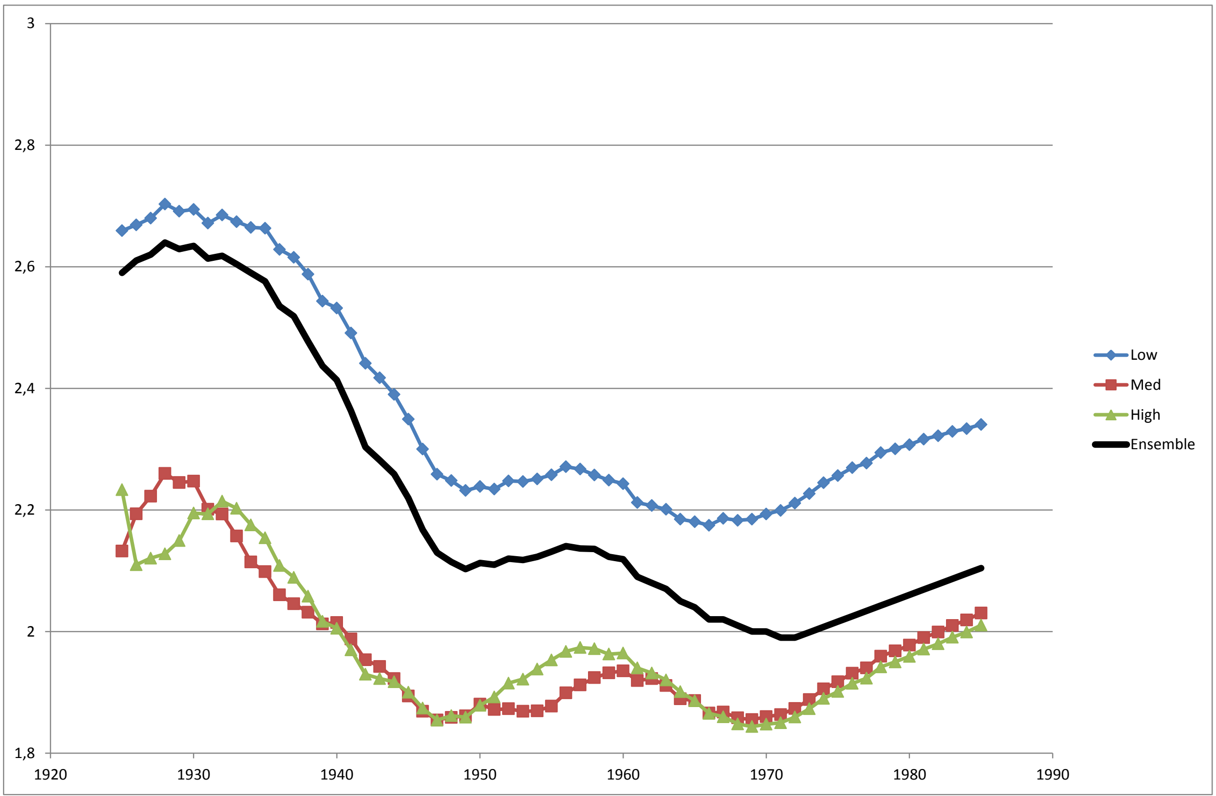
Sources: Prioux and Barbieri (2012) and Toulemon and Mazuy (2001)

Additionally, final completed fertility has been calculated among women who have lived in a couple only, as the question on ideals asks about family size, underlying being at least in a couple. The curves are presented further on. They were deduced from the preceding curve by applying a coefficient of the proportion ever in a couple in each cohort calculated in the large-sample EFL survey (Family Survey 2011). In the most recent generations, 1975+, the proportion was considered as constant.

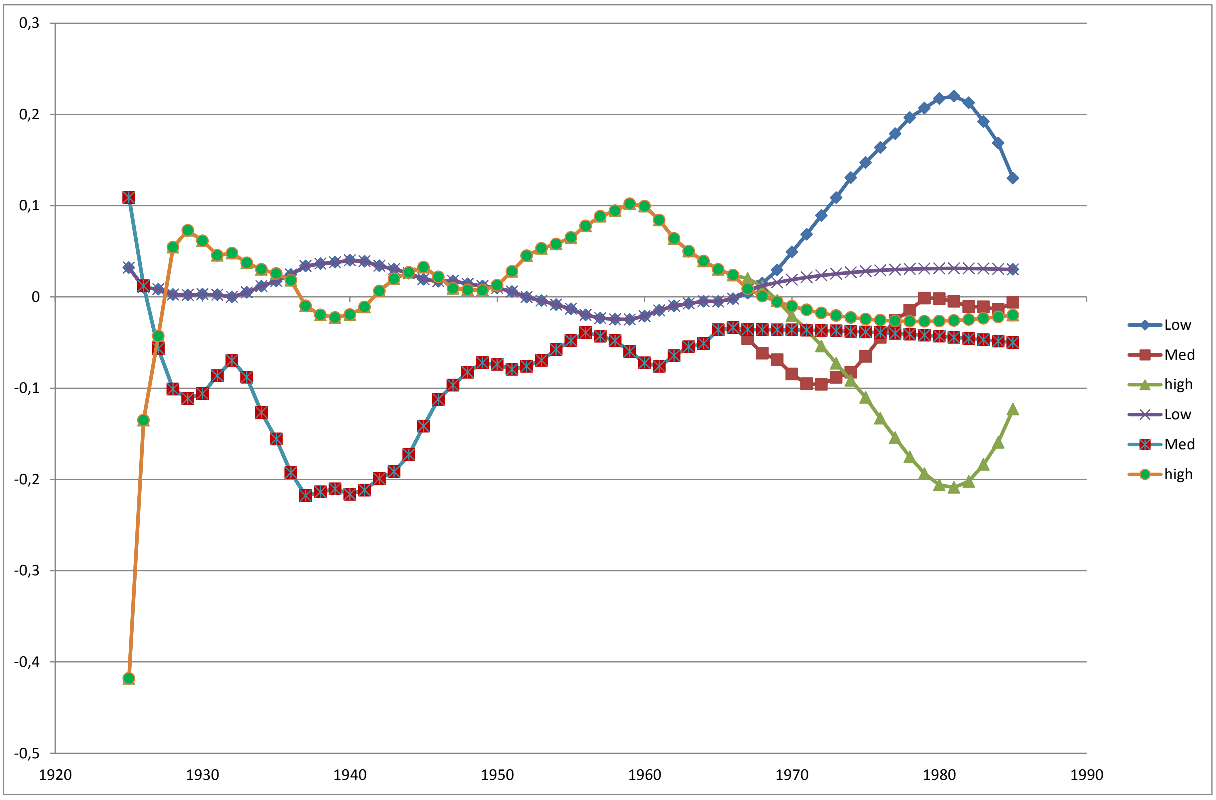
Fertility by education

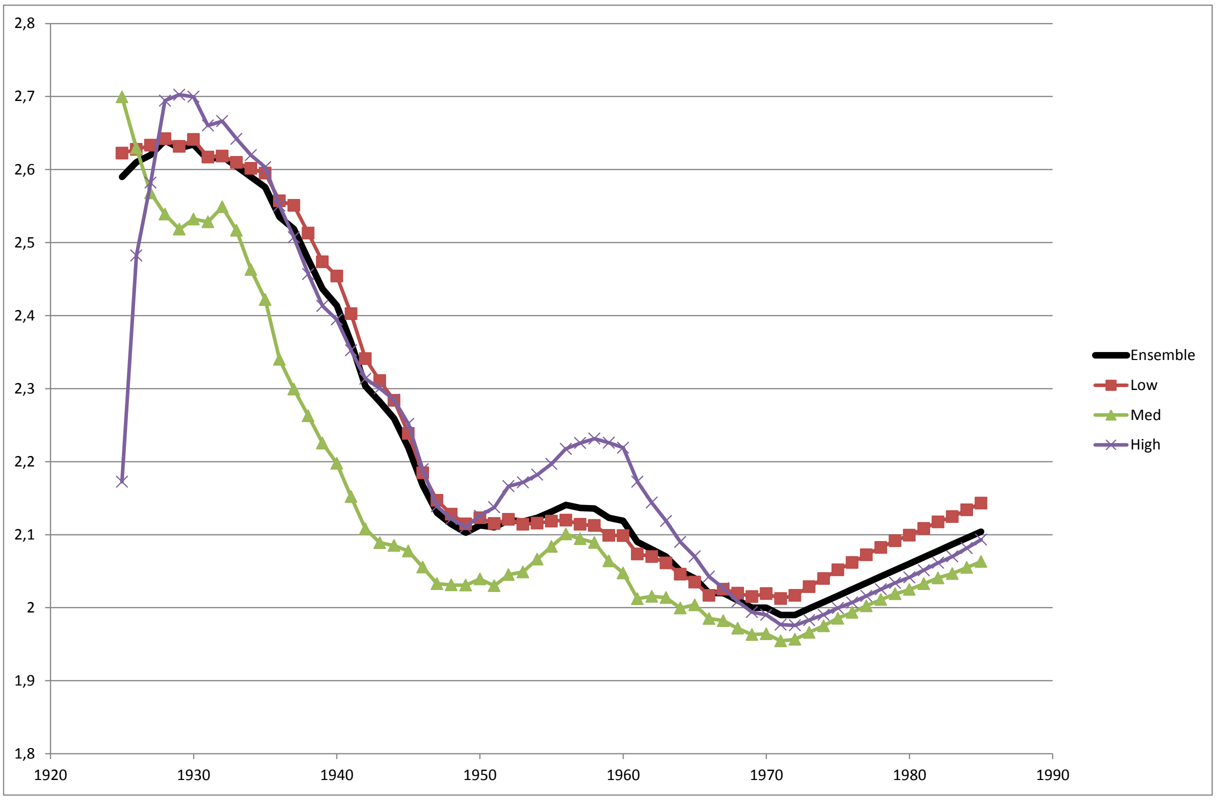
Women





Men

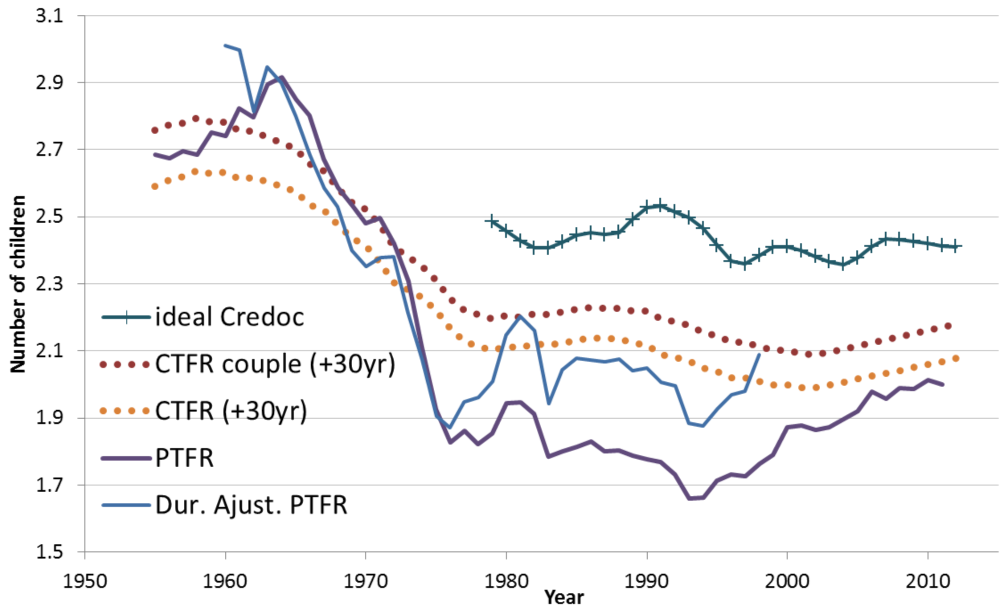

0,3
0,2
0,1
0
-0,1
-0,2
-0,3
-0,4
-0,5
1920
1930
1940
1950
1960
1970
1980
1990
Low
Med
high
Low
Med
high


2,8
2,7
2,6
2,5
2,4
2,3
2,2
2,1
2
1,9
1,8
1920
1930
1940
1950
1960
1970
1980
1990
Ensemble
Low
Med
High

Appendix:

This figure shows together the CRÉDOC time-series of ideal family size, together with the completed fertility of the same cohort and with the period fertility rate. In terms of level, cohort fertility rate is overall closer than period fertility rate. The correlation between the curves (which is then studied with the models at a more global level) is less obvious to observe. It seems however that the CTFR curves and the ideal curve tend to move together, while the TFR sees bumps and trough that do not appear on the ideals curve. The duration adjusted TFR shows in fact a shape very close from the one of the TFR, not letting expect a much better fit.

Figure 14 Mean ideal family size CRÉDOC, age 25-34; cohort total fertility rate (for all women and for women ever in a couple); period total fertility rate (PTFR) and duration specific PTFR.



Sources: smoothed CRÉDOC annual Survey; CTFR including forecast; PTFR and duration specific PTFR

Appendix: Detail regarding the correlations shown in the figures

Table 2 Correlation coefficients based on the coefficients of the models

	Correlation coefficient r	**Pr>|t|**	Regression corefficient a	Standard error of the covariate Sx	Standard error of IFS Sy
PTFR->INC	-0.005	0.630	-0.036	0.096	0.758
CTFR->INC	0.051	<.0001	0.753	0.051	0.758
PTFR->INC	-0.009	0.319	-0.074	0.096	0.758
CTFR->INC	0.052	<.0001	0.766	0.051	0.758
AdjPTFR->INC	0.030	0.001	0.220	0.104	0.758
CTFR->INC	0.051	<.0001	0.753	0.051	0.758
AdjPTFR->INC	0.001	0.945	0.006	0.104	0.758
CTFR->INC	0.051	<.0001	0.747	0.051	0.758
CouCTFR->INC	0.053	<.0001	0.848	0.048	0.758

Sources: smoothed CRÉDOC annual Survey; CTFR including forecast; PTFR and duration specific PTFR

Table 3 Correlation coefficients based on the coefficients of the models

	r	**Pr>|t|**	a	Sx	Sy
Detrended variables					
PTFR->INC	0.011	0.259	0.090	0.090	0.757
CTFR->INC	0.035	0.000	0.668	0.040	0.757
PTFR->INC	-0.005	0.628	-0.043	0.090	0.757
CTFR->INC	0.036	0.001	0.689	0.040	0.757
AdjPTFR->INC	0.016	0.083	0.128	0.096	0.757
AdjPTFR->INC	0.000	0.992	0.001	0.096	0.757
CTFR->INC	0.034	0.002	0.646	0.040	0.757
Men					
PTFR->INC	-0.009	0.371	-0.079	0.095	0.798
CTFR->INC	0.070	<.0001	1.077	0.052	0.798
PTFR->INC	-0.017	0.100	-0.145	0.095	0.798
CTFR->INC	0.072	<.0001	1.106	0.052	0.798
Men age shifted by two years					
PTFR->INC	-0.017	0.096	-0.142	0.095	0.789
CTFR->INC	0.069	<.0001	1.024	0.053	0.789
PTFR->INC	-0.012	0.225	-0.103	0.095	0.789
CTFR->INC	0.068	<.0001	1.011	0.053	0.789

Sources: CRÉDOC annual Survey; CTFR including forecast; PTFR and Adjusted PTFR

Table 4 Correlation coefficients based on the coefficients of the models

Corrélation d'après les coefficients des régressions	r	**Pr>|t|**	a	Sx	Sy
Women					
Low	0.022	0.089	0.401	0.041	0.741
Medium	-0.015	0.460	-0.240	0.048	0.763
High	0.041	0.021	0.683	0.047	0.781
Men					
Low	0.066	<.0001	1.173	0.044	0.773
Medium	0.096	<.0001	1.937	0.041	0.832
High	0.104	<.0001	1.013	0.085	0.825

Sources: CRÉDOC annual Survey; CTFR including forecast; PTFR and Adjusted PTFR

Appendix : Estimating adjusted PTFR

Let us write for a year t, x(t) = PTFR(t) the Period total Fertility Rate and a(t) the mean age at childbearing, and a'(t) its change over t. The Bongaarts-Feeney Adjusted Period Total Fertility Rate is defined as

$$AdjPTFR(t) = PTFR(t)\frac{1}{1 - a'(t)}$$

In order to avoid too much instability in the estimate of the the trend in the mean age at childbearing, we used a 3-year moving average of the half-differences b(t) = a(t+1) - a(t-1):

$$b(t) = \frac{1}{2}\,(a(t+1) - a(t-1))$$

$$a'(t) = \frac{1}{3}\sum_{u=t-1}^{t+1} b(u) = \frac{1}{6}\left(\sum_{u=t-1}^{t+1} a(u+1) - a(u-1)\right)$$

$$a'(t) = \frac{1}{6}\left(\sum_{u=t-1}^{t+2} a(u) - a(u-1) + \sum_{u=t}^{t+1} a(u) - a(u-1)\right)$$

$$a'(t) = \frac{1}{6}\Big(\big(a(t+2) - a(t+1)\big) + 2\big(a(t+1) - a(t)\big) + 2\big(a(t) - a(t-1)\big) + \big(a(t-1) - a(t-2)\big)\Big)$$

$$a'(t) = \frac{1}{6}\Big(\big(a(t+2) - a(t)\big) + \big(a(t+1) - a(t-1)\big) + \big(a(t) - a(t-2)\big)\Big)$$

We checked that further smoothing of the time trend in the mean age at childbearing did not change the estimation of the AdjPTFR in a significant manner. This is sensible as the mean age at childbirth increased around 0.1 year by year during the period (Insee, 2015: T44)

Appendix: estimating partial correlations

All correlations were estimated from the coefficients of linear regressions of Ideal number of children against CTFR and other variables, at the individual level. This allowed us to easily run significance tests on the parameters, as well as to add control variables in order to estimate easily partial correlations. We estimated the partial correlations $r_{XY.A}$ between variables $\underline{X}$ and Y, controlled for A, from the change in the coefficient of determination of the linear regressions. Calling R_X and R_{XA} the coefficients of determination of the linear regression of Y against X and against X and A:

$$r_{XY.A} = \frac{(R_{XA})^2 - (R_X)^2}{1 - (R_X)^2}$$

We checked that a direct estimation gave the same result than an estimate based on the pairwise correlation coefficients:

$$r_{XY.A} = \frac{r_{XY} - r_{AX} r_{AY}}{\sqrt{(1 - r_{AX}^2)(1 - r_{AY}^2)}}$$

Appendix : detrending time series

We detrended the macro-level time series by replacing them with the residuals from linear regressions against time.

If t is the time and x(t) is a time series, we estimated a linear equation x(t) = a t + b + u(t), the residuals u(t) being as small as possible (least-square estimates). The important feature is that u(t) is uncorrelated with time (no time trend.

At the macro-level, we also used first differences as a detrending method. The first difference of a time series x(t) is defined by y(t) = x(t) – x(t-1). From the previous linear equation, we have y(t) = a + u(t) – u(t-1), so that the series y(t) is also uncorrelated with time.

When we estimate the correlation for regressions of IFS against PTFR or CTFR, we detrended the PTFR or CTFR using a macro-level regression (as above), and introduced time (cohort or period) as an additional continuous covariate, so that the regression parameter of IFS against the fertility index is “controlled for the time trend”, thus reflecting the correlation between the detrended fertility index and the detrended IFS. We estimated the variance of detrended series from the residuals in linear regressions with time as a continuous covariate.

Appendix

Regressions on the gap. Models with and without interactions

Cohort models					Period models				
	Parameters		Significance			Parameters		Significance	
	Women	Men	Women	Men		Women	Men	Women	Men
Intercept	0,38	0,30	<,0001	<.0001	**Intercept**	0,37	0,29	<,0001	<.0001
Age	0,01	-0,03	0,256	0,010	**Age**	0,00	-0,03	0,668	0,018
Cohort	0,01	-0,02	0,334	0,021	**Year**	0,01	-0,01	0,094	0,068
Age*Cohort	0,02	0,02	0,059	0,144	**Age*Year**	0,05	0,04	<,0001	0,001

Cohort models					Period models				
	Parameters		Significance			Parameters		Significance	
	Women	Men	Women	Men		Women	Men	Women	Men
Intercept	0,38	0,29	<,0001	<.0001	**Intercept**	0,39	0,30	<,0001	<.0001
Age	0,01	-0,03	0,361	0,010	**Age**	0,00	-0,03	0,804	0,022
Cohort	0,00	-0,02	0,644	0,020	**Year**	0,01	-0,01	0,105	0,066
Age²	0,04	0,04	0,050	0,140	**Age²**	0,01	-0,01	0,752	0,706
Cohort²	-0,02	0,00	0,012	0,810	**Year²**	-0,02	0,00	0,001	0,573
Age*Cohort	0,01	0,03	0,710	0,119	**Age*Year**	0,06	0,04	<,0001	0,001

Appendix:

Educated men and women have a larger gap, but a better correlation between IFS and CTFR.

Figure 15 Ideal family size and final cohort completed fertility by sex and level of education