Comparison of Retrospective Fertility Data from Censuses in Belgium and Family Surveys in France

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Several data sources can be used to describe fertility behaviour. Data on births recorded in the civil registers can be linked with population data from censuses to provide annual estimates of fertility. Additionally, censuses in Belgium and Family surveys in France contain retrospective questions about the number of children already born to the respondents. Looking at cohorts of women born in the first half of the twentieth century, Sandra Brée, Thierry Eggerickx, Jean-Paul Sanderson *and* Rafael Costa *compare the data from civil registration with the retrospective data obtained via these questions at the national and sub-national levels in France and Belgium. The authors find strong consistency between the data, with only a few exceptions. Combining these different data sources thus provides opportunities to study the fertility of cohorts of women over long periods.*

This article examines whether individual retrospective data from population censuses in Belgium and Family surveys in France can usefully be employed to study the fertility of cohorts of women born between the turn of the twentieth century and the early 1960s. This research was prompted by the lack of knowledge about fertility behaviour in the first half of the twentieth century, especially in Belgium. There are two main explanations for this knowledge gap. First, use of individual administrative data that are less than 100 years old is prohibited in Belgium(1) and in France. Second, the aggregate data available for census years offer limited opportunities for detailed studies of fertility behaviour.

(1) In Belgium, population registers that are less than 100 years old cannot be consulted or used, except with special permission from the Privacy Commission. The nineteenth-century registers are available in electronic form but are not centralized, so in practice only studies of small municipalities or, at best, small towns can be undertaken, owing to the amount of work involved in sorting and coding the data.

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The solution we propose is to use individual data from recent surveys and censuses, specifically the questions that women are usually asked about their fertility.[2] This approach, which makes it possible to reconstitute the reproductive lives of the cohorts of women covered by a survey or a census, is potentially promising for researchers. Aside from the diachronic dimension, which involves studying changes in fertility over time, the approach can be used to calculate detailed, diversified indicators – including completed fertility, birth intervals, mean age at the birth of each child, completed parity, and age-specific fertility – which for older cohorts can usually only be obtained through methods of family reconstitution on a very small scale (villages or small towns). Fertility parameters can also be examined alongside other variables extracted from censuses and surveys, such as marital status, educational level or place of birth. This approach also allows the spatial dimension of fertility to be taken into account: at the regional level in France, and at *arrondissement* and even municipal levels in Belgium.

However, the use of retrospective data raises problems linked to the respondents' memory or the non-response rate, and may also be hampered by selection effects, since we cannot include the behaviour of women lost to observation because of death or emigration. The survey results also depend on the sampling method and any weighting variables applied by the survey administrators. The aim here is to assess the impact of these biases and to test the validity of using these retrospective data for longitudinal studies of fertility. While a small number of studies have already performed this type of exercise (Andersson and Sobolev, 2013; Neels, 2006; Van Bavel, 2014), our research makes three additional contributions: first, we verify the consistency of the data for older cohorts born at the beginning of the twentieth century, and examine how biases may have evolved over the cohorts; second, we consider two countries, Belgium and France, and two different data sources – censuses and surveys, respectively – which may raise different problems; and third, we measure the biases when indicators are calculated on the scale of the regions in France, and the *arrondissements* and municipalities in Belgium.

The first section, consisting of a literature review, is followed by a second section that presents the tests used to validate the data at national level for both countries. The third section concerns the validation of these retrospective data for analyses at more detailed geographical levels.

I. State of the art

In the case of Belgium, there are no studies of twentieth-century fertility based on individual civil registration data, owing mainly to the 100-year confidentiality period that applies to personal data. Lesthaeghe (1977) and most other studies of fertility in the twentieth century are therefore based on

(2) Namely, their total number of children and their respective dates of birth.

cross-sectional data and concern inter-censal periods (Damas et al., 1988; Masuy-Stroobant, 1976, 1977). Other studies draw on fertility surveys conducted in 1966, 1971, 1976, 1983 and 1991.[3] Although these surveys allow for a detailed analysis of fertility behaviour, the results have little temporal depth and their spatial representativeness is limited to the country's three regions.[4]

Electronic individual data from more recent population censuses offer new opportunities for studying twentieth-century fertility. Based on the questions that female respondents are asked about their number of liveborn children and their dates of birth, it is possible to reconstitute the fertility of several cohorts of women. The research by Neels (2006, 2010), Van Bavel (2014) and, to a lesser extent, the 1991 census monograph on fertility (Schoenmaeckers et al., 2002) are the only studies to have used these data longitudinally.

In the case of France, there are many studies of fertility, particularly in the second half of the twentieth century (see, in particular, INSEE and INED). A comprehensive study entitled *Un siècle de fécondité en France* (Daguet, 2002) examines fertility in the twentieth century through cross-sectional and longitudinal indicators, but only at the national level and mainly using census and civil registration data. The results of the Family surveys (Enquêtes Famille) conducted in 1982 (Desplanques, 1985), 1990 (Lavertu, 1997) and 1999 (Barre and Vanderschelden, 2004) offer detailed data tables on various themes, including fertility, with some data provided by cohort. Research has also been conducted on cohort fertility using these data (Desplanques, 1993; Daguet, 2000; Toulemon, 1996, 2001). In France, fewer data are available at the sub-national level. Since 1954, INSEE has published regional population data, derived from a comparison of census and civil registration data (Daguet 2005; Le Bras, 1995; Todd and Le Bras, 2014). To our knowledge, however, there has been no longitudinal analysis of French fertility at the sub-national level.

Unlike in Belgium, a retrospective, longitudinal approach to fertility in France cannot be based directly on the censuses for the cohorts born after the First World War because the question on the number of children was not asked after the 1946 census.[5] From 1954 onwards, it was included in the Family survey attached to the census.[6] The Family survey, conducted on a sample of the total population, is designed to monitor the development of new family configurations through an event history questionnaire (Table 1). The first Family survey was conducted jointly with the 1954 census, and was

(3) Numerous articles on these surveys (especially the 1966 survey) have been published in the journal *Population et Famille*. See also the report by Lodewijckx (1999) and the review by Oris (2009).

(4) The 1983 and 1991 surveys were conducted only in the Flanders and Brussels regions.

(5) The question on the number of liveborn children was first included in the French census of 1886 (only for legitimate children in 1891). The summary tables give the number of children by duration of marriage or age of the household head but not by the mother's year of birth. However, in the family statistics from the censuses of 1931 and 1946, data on the number of children per woman by the mother's birth year are available.

(6) The individuals selected for the sample receive a specific questionnaire to fill out and return to the enumerator alongside the census questionnaire.

followed by the Family surveys of 1962,[7] 1975, 1982, 1990, 1999 (Desplanques, 2005) and 2011. The first three surveys only concerned ever-married women, so they are excluded from our analysis.

Table 1. Characteristics of the Family surveys in France

Survey year	Cohort	Marital status	Total	
			Women	Men
1954	1899-1908	Ever-married	52,474	Not surveyed
1962	*Not available*			
1975	1910-1960	Ever-married	247,000	Not surveyed
1982	1917-1963	All statuses [a]	310,000	Not surveyed
1990	1921-1971	All statuses [a]	340,000	Not surveyed
1999	-1981	All statuses [a]	278,000	167,000
2011	-1993	All statuses [a]	238,000	121,000

(a) Never-married, widowed, married or separated.
Source: Family surveys, France.

The first two useable surveys (1982 and 1990) comprised only women aged 18-64, and therefore yield information about the 1917-1938 cohorts and the 1921-1946 cohorts, respectively (i.e. the cohorts of women aged 45 and over). The 1999 and 2011 surveys covered men and women aged 18 and over, which makes it possible to reconstitute the reproductive lives of older cohorts (the oldest woman in the 1999 survey was born in 1893 and the oldest woman in the 2011 survey was born in 1907). These data were adjusted and post-stratified by the researchers in charge of the surveys to account for differences between the population surveyed in the enumerators' sectors and the total population, especially on the regional scale, since the sample was concentrated in certain geographical areas (Barre and Vanderschelden, 2004). In the 1999 and 2011 surveys, the recommended weightings were applied.[8]

For the 1982 and 1990 surveys, the samples were constructed by randomly drawing geographical areas to obtain a representative sample at regional level covering 1/50th of the population. All the women in those areas were then surveyed. For the 1999 and 2011 surveys, a representative sample of districts[9] was drawn randomly in each region after a classification of neighbourhoods[10] by socio-demographic characteristics.

Several problems may be encountered when using retrospective data for fertility analysis:

- Recall errors concerning the number of events reported and their timing (date, age). These are more likely to affect the oldest women at the time

(7) The 1962 survey is not made available by INSEE for data quality reasons: the file was improperly archived and approximately one-third of the records are missing.

(8) The weightings applied are those recommended in the technical documentation, namely "poidsm5" for the analyses at national level, "poidsm7" for the regional level for 1999, and "poids_ind" for 2011.

(9) Enumerators' data collection areas (INSEE's definition).

(10) Groupings of adjacent census zones within the same municipality (INSEE's definition).

of the census or survey (Neels, 2006; Van Bavel, 2014). It is difficult to quantify the impact of this bias, but we assume it is small, given the importance of the birth of a child in a mother's life (Anderson and Sobolev, 2013). However, as infant mortality was still high before 1940,[11] the oldest women may omit births of children who died in infancy, which would lead to an under-estimation of the number of births (Van Bavel, 2014).

- Non-response, which may exclude births from the observation even though the mothers are included, thus causing a numerator/denominator bias and a potential under-estimation of fertility (Neels, 2006). To avoid this bias, we can exclude the women who did not answer these questions, but in doing so we are assuming that the non-respondents have the same fertility behaviour as the respondents, and that there is no selection effect. But non-response rates increase with age (INSEE, 1982, 1990, 2002, 2014; Neels, 2006; Van Bavel, 2014), and they are higher for foreigners, in the most urbanized areas (Neels, 2006), and among single people, people living alone or without children, the unemployed and the least educated (INSEE, 1982, 1990, 2002, 2014). Furthermore, non-response rates vary by region of residence (INSEE, 1982, 1990, 2002, 2014).
- Biases related to selection effects resulting from mortality and international emigration (Andersson and Sobolev, 2013; Wunsch, 2001). These would lead to an over-estimation of fertility calculated on the basis of retrospective data. Indeed, most studies of the fertility of emigrants suggest that they have slightly lower pre-migration fertility than non-emigrants (Anderson and Sobolev, 2013; Eggerickx et al., 2014). Moreover, it has been demonstrated that single and childless women have a higher risk of mortality than women in unions and mothers (Doblhammer, 2000). Lastly, in a sub-national study of fertility, both internal and international migration can produce a selection bias because women may have spent their reproductive years elsewhere than in their place of residence at the time of the survey or census. The fertility of migrant women nevertheless appears to be closer to that of women in the host region than to that of women in the region of origin (Eggerickx et al., 2014).

II. Use of retrospective fertility data at the national level

The United Nations 1958 report *Recent Trends in Fertility in Industrialized Countries* asserts that "(…) in most respects, the limitations observed in the censuses under consideration will not seriously affect the interpretation of the data presented, but they should be borne in mind".[12] According to Neels

(11) In Belgium and France, the probability of dying before age 1 was approximately 150 per 1,000 live births in 1900 and 65-75 per 1,000 live births in 1940 (Caselli et al., 1999).

(12) *Recent Trends in Fertility in Industrialized Countries*, p. 59. The quote appears in Chapter V, "The fertility of married women according to census data".

(2006, 2010), who used the Belgian census of 1991, the biases inherent in the use of retrospective data are extremely small. To demonstrate this, he presents a series of tests comparing cross-sectional indicators[13] and longitudinal indicators[14] based on census and civil registration data. For all the indicators extracted from the two data sources, the match between the series by year of observation or by cohort was very good or "excellent" (p. 278). In sum, "measures of general fertility calculated retrospectively from the 1991 census data are fully robust in the period domain as far back as 1960 and for cohorts of women born between 1918 and 1951" (Neels, 2006, p. 301).

Van Bavel (2014) compared the data from the Belgian census of 1981 with civil registration data, but only for completed fertility by cohort. For the cohorts born between 1921 and 1944, the differences are negligible, usually less than 0.03 children. For the older cohorts born between 1901 and 1920, the indices calculated on the basis of the census are always lower than those estimated from civil registration, but the differences are still small, between 0.05 and 0.08 children. In the censuses, these differences may be due to higher under-reporting of children by older women, who tend to be more affected by memory problems, and to a rate of non-response to the question on the number of liveborn children that increases with age. Civil registers may give an over-estimation because they record all births, sometimes including births to mothers who are not resident in the municipality, the region or the country (Davie and Mazuy, 2010).

Andersson and Sobolev (2013) measured the selection effects related to emigration and mortality in retrospective studies. In Sweden, for the years 1961-1999, the authors compared two databases, one prospective and the other retrospective, extracted from the population registers. The first was used to measure the fertility of the total population from 1961 onwards, including that of women who died or emigrated during the observation period. The second comprised only women who were present in 1999 and excluded all the women who disappear from observation. Their results show that the impact of excluding the women who died or emigrated when using retrospective data has negligible effects on measures of fertility, even if fertility is slightly over-estimated for the oldest cohorts.

These three studies validate the use of retrospective data for the longitudinal measurement of fertility at the national level. What about the Belgian censuses and the French Family surveys? Are the same biases observed at the national and sub-national levels? And what happens when we refine the analysis to look at age-specific fertility rates? The analyses below seek to test the data quality by comparing the fertility of the same cohorts[15] in Belgium (censuses of 1961, 1981 and 2001) and France (Family surveys from 1982, 1990, 1999

(13) These are the age-specific fertility rate, the total fertility rate, the mean age at childbearing, and the mean age at childbearing by birth order.

(14) These are completed fertility, mean age at childbearing and parity progression ratios.

(15) The 1917-1922 cohorts in Belgium and the 1926-1930 cohorts in France are the first cohorts for which the census or survey data are useable.

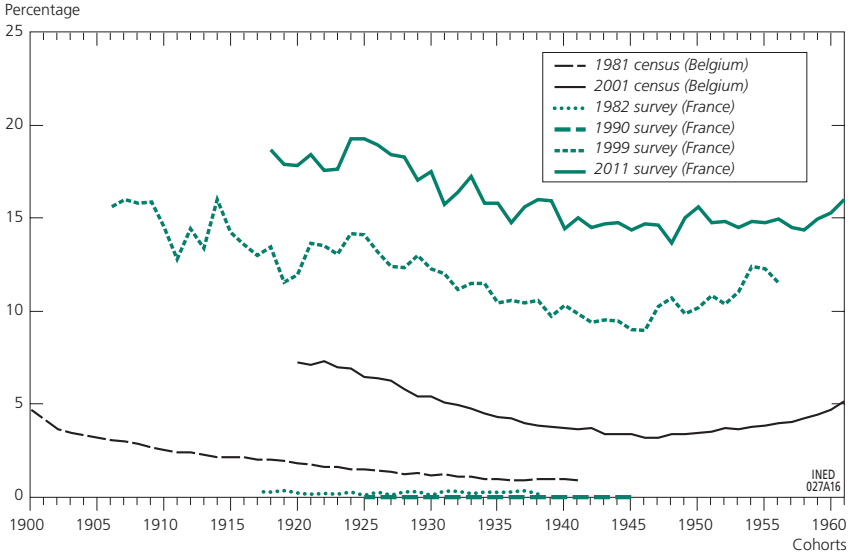
and 2011).[16] The comparison is also performed on existing longitudinal series based on other data sources. If the differences found are small, these tests will validate the use of retrospective data.

1. Levels of non-response by birth cohort

One of the first problems that may invalidate the use of retrospective data from censuses and Family surveys is the non-response rate. Non-response can produce a numerator/denominator bias if mothers who did not answer the question on the number of liveborn children are included for calculation of the indices, or a selection bias if we exclude these mothers, who may have specific fertility behaviours.

Figure 1 shows the non-response rates to the question about the number of liveborn children in the Belgian censuses and the French Family surveys. In the Belgian census of 1981, the non-response rate falls from 4.7% for the 1900 cohort to less than 1% for the 1941 cohort, confirming Neels (2006) and Van Bavel's (2013) finding that the missing responses can mainly be attributed to the oldest women. The 2001 census presents a similar profile, but only for the cohorts born up to 1947, while the more recent cohorts exhibit a rising non-response rate: from 3.2% for the 1948 cohort to 5.2% for the 1961 cohort. This increase may be due to trends in international immigration, which, for these cohorts, mainly took the form of

Figure 1. Rates of non-response to the question on the number of liveborn children, by cohort and census date (Belgium) or survey date (France)



Sources: 1981 and 2011 censuses, Belgium; 1982, 1990, 1999 and 2011 Family surveys, France.

(16) The Belgian census data were obtained from Statistics Belgium and the French survey data from the Quetelet network.

family reunion, and hence long-term settlement of immigrant families in Belgium. Neels (2006) demonstrated that rates of non-response to the question on the number of liveborn children were much higher among foreigners.

Furthermore, non-response rates in the 2001 census are higher than in the 1981 census for all cohorts, indicating that the data are of lower quality. This is probably linked to the collection method used in 2001, when the census questionnaires were sent out and returned by post, without the support or supervision of enumerators (Deboosere et al., 2006), as had been the case in 1981. For the cohorts born before 1940, it is therefore preferable to use the data from the 1981 census.

The French Family surveys exhibit a sharp contrast in non-response rates. In the surveys of 1982 and 1990, the non-response rate to the question on the number of liveborn children is negligible,[17] but fluctuates between 9% and 16% for the 1999 survey, and between 14% and 19% for the 2011 survey. The difference between the latter two surveys should, however, take account of the overall non-response rate: 21% for the 1999 survey and 17% for the 2011 survey. These rates are comparable to those of other non-compulsory surveys, but much higher than in the 1982 and 1990 Family surveys, whose non-response rates were around 3% (INSEE, 2002). The Family survey was compulsory until 1990, but in 1999, the length of the retrospective section prompted the survey designers to make it optional (Héran, 2005). That change is the most likely explanation for the significant difference in non-response rates between the 1982 and 1990 surveys and the more recent surveys from 1999 and 2011.

Beyond those differences, the pattern of non-response by cohort in the 1999 and 2001 French surveys is similar to that of the 2001 Belgian census. For the cohorts born before 1946-1947, the rates increase with age, while the increase among the more recent cohorts could, as in the Belgian case, be attributable to international immigration (Neels, 2006).

2. Completed fertility and age-specific fertility from different sources

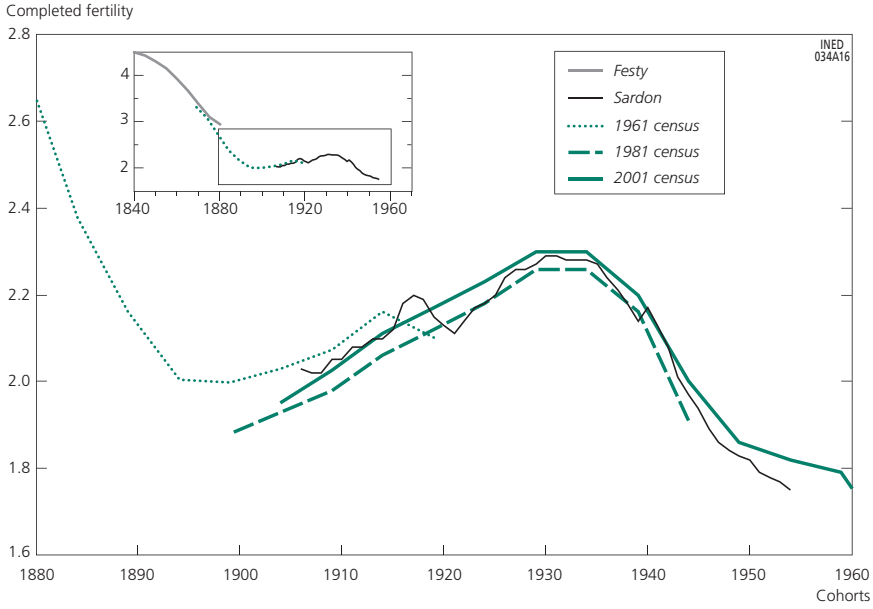
Figures 2 and 3 compare completed fertility (at age 50) by five-year cohort extracted from the Belgian population censuses of 1961, 1981 and 2001[18] and the French Family surveys of 1982, 1990, 1999 and 2011. Two series of longitudinal indicators are presented: the estimates proposed by Festy (1979) for the cohorts of women born between 1816 and 1880[19] in Belgium and between 1831 and 1945 in France, and the annual figures supplied by Sardon (1990, 1991) for the cohorts born between 1906 and 1954 in Belgium, and

(17) It is not specified in the file whether the corresponding variable was previously adjusted.

(18) In Belgium, the 2001 population census is called the General Socio-Economic Survey (SEE 2001).

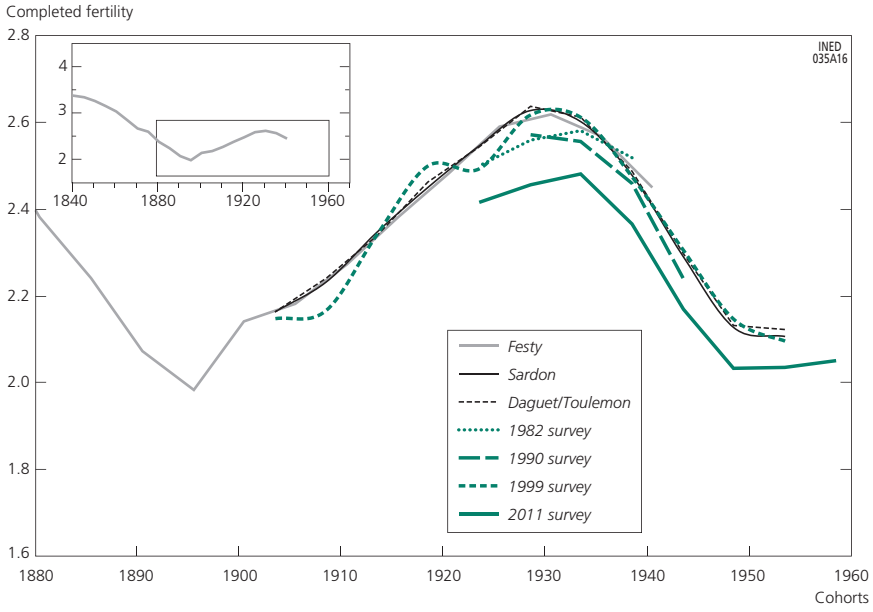
(19) This is a snapshot of the five-year total fertility rates calculated on the basis of civil registration data for the periods 1846-1850 to 1896-1900. These estimates are based on an indirect method explained in Festy (1979) pp. 209-211 for Belgium and p. 335 for France.

Figure 2. Comparison of completed fertility in Belgium estimated from different data sources



Sources: Festy 1979, Sardon 1990 and 1991, Belgian censuses.

Figure 3. Comparison of completed fertility in France estimated from different data sources



Sources: Festy 1979, Sardon 1990, 1991, Daguet 2002, Toulemon 2001, Family surveys.

between 1901 and 1956 in France. The two series are based on a longitudinal transposition of the cross-sectional age-specific (or age-group-specific) fertility rates constructed using indirect methods (Festy, 1979) and civil registration data (Sardon, 1990, 1991). Toulemon (2001) and Daguet (2002) have already estimated French cohort fertility using data from the 1946 census and Family surveys, after adjusting for non-response.[20]

This comparison confirms the validity of the indicators calculated on the basis of census data. For Belgium, completed fertility derived from the 1961 census are extended by the curve of Festy's estimates, and the curves of the 1961, 1981 and 2001 census data overlap with Sardon's calculations. The differences between completed fertility based on civil registration data and completed fertility based on census data are small, not exceeding 3%. The same applies for France (Figure 3). The results of the first three surveys are very close to those of Sardon and Festy, especially the 1999 survey results, even for the oldest cohorts (1900-1904). It is Toulemon and Daguet's reconstitution of completed fertility from the 1946 census and the various Family surveys that yields results closest to those of Sardon and Festy. The 2011 survey underestimates fertility. There seems to be under-reporting of children born in unions no longer current at the time of the survey, especially when those children do not live with the current couple (Mazuy and Toulemon, 2013). Analysis of parities (distribution of women by number of children) shows, in particular, that childlessness is overestimated and that parities of four or more children are overestimated.

The exercise can be refined by comparing, for some cohorts, fertility rates by five-year age groups derived from censuses and surveys with the series proposed by Sardon (1991) based on civil registration figures. For Belgium,[21] the curves overlap almost exactly (Figure 4), which confirms the excellent match, at the national level, between longitudinal fertility indicators extracted from census data and civil registration statistics. For the oldest cohorts born between 1922 and 1936, the fertility rates derived from the 1981 census correspond more closely to those proposed by Sardon (1991). But the differences with the rates calculated from the 2001 census are small, not exceeding 4% for the 30-34 age group from the 1922-1926 cohorts. For France (Figure 5), the rates match Sardon's estimates, particularly for the 20-24 age group (differences of 6% if all the surveys are taken into account, but 3% if the 2011 survey is excluded) and for the oldest cohorts at the time of the survey. The results of the 1999 survey are the closest to Festy and Sardon's calculations[22] of completed fertility[23] and especially

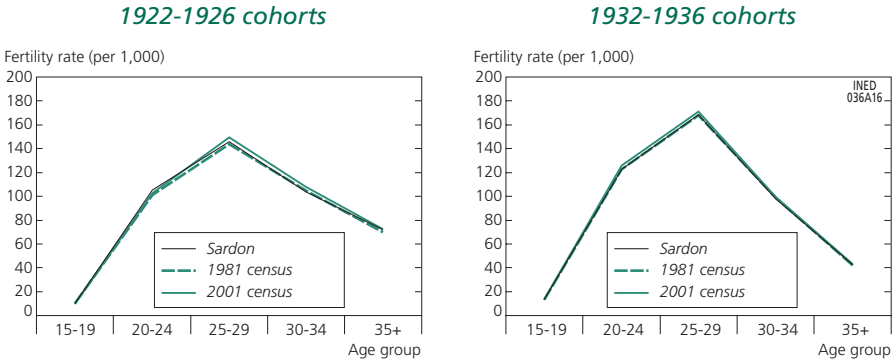
(20) Toulemon (2001) and Daguet (2002) estimated completed fertility and parities. The aim of future research will be to explore other indicators, and above all to use these sources for individual analyses, after having validated them at the aggregate level, which is the purpose of this article.

(21) Daguet's results are very close to Sardon's for France and are not shown here.

(22) The differences between the surveys are 2.5% on average for completed fertility (2.7% for Festy, 2.3% for Sardon) and 1.6% for age-specific fertility derived from the surveys and Sardon's results.

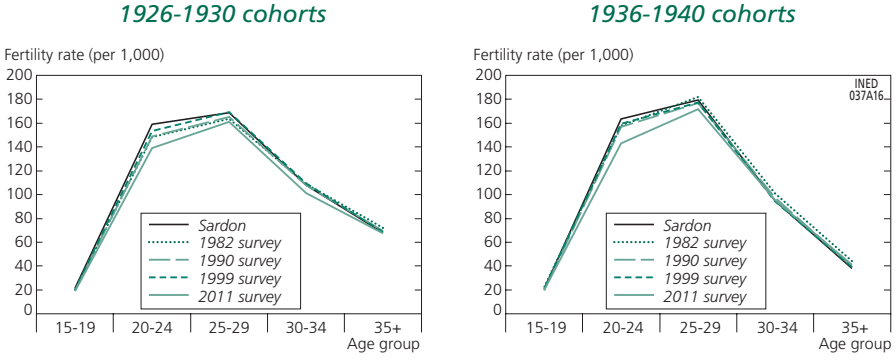
(23) For completed fertility, the differences with respect to Festy are on average 3.7% for the 1982 and 1990 surveys, 1% for the 1999 survey and 6% for the 2011 survey; and 4.2%, 6.7%, 0.9% and 5.1%, respectively, with respect to Sardon's data.

Figure 4. Comparison of fertility rates (births per 1,000 women) by five-year age group and data source, Belgium



Sources: Sardon (1991) and censuses.

Figure 5. Comparison of fertility rates (births per 1,000 women) by five-year age group and data source, France



Sources: Sardon (1990b) and Family surveys.

age-specific fertility,[24] despite the advanced age of the oldest cohorts. The differences between the surveys are also small: 1%-2% for the 20-29 age group if we exclude the 2011 survey, and 3%-5% if we include it.

3. Estimating selection biases in retrospective data

The use of retrospective data extracted from population censuses and surveys raises the problem of selection biases. The data only describe the fertility behaviour of women from a given cohort who are present at the time of the census. But what about the behaviour of women from the same cohort who disappear from observation because they have died or emigrated? Since it is extremely difficult to answer that question, we generally assume that the

(24) For the age-specific fertility rates, the differences are less than 4% between age-specific rates derived from the 1999 survey and those of Sardon for the 1926-1930 cohort, and less than 8% for the 1931-1935 cohort (except for the 35+ age group).

phenomena are independent, i.e. that neither mortality nor migration influence fertility, which implies that the women who have died and emigrated had the same fertility behaviour as the women surveyed at the time of the census. Otherwise, the fertility rates calculated on the basis of census data would provide a distorted view of the behaviour of the cohorts. Andersson and Sobolev (2013) have shown, in the case of retrospective surveys based on Swedish population registers, that the effect of omitting information about individuals who have migrated or died is negligible, except in the case of immigrant women (slight over-estimation of actual first-order fertility in this population).

For Belgium, we can estimate the scale or impact of these selection biases by comparing, for the same cohort of women, completed fertility derived from the 1981 and the 2001 censuses. Let us take the example of the cohort born between 1917 and 1921 (Table 2). In 1981, the 235,000 women in that cohort were aged 60-64. By 2001, the cohort had shrunk to 138,000 women, aged 80-84. In other words, any significant discrepancies in the fertility of this cohort calculated on the basis of the two censuses would indicate biases attributable either to memory – which we assume to be less reliable among the oldest women – or to a selection effect, since by 2001 the cohort consisted solely of women who had not died or emigrated.(25) Table 2 shows that the differences are not large and tend towards a slight over-estimation of fertility in 2001. We would expect memory bias to produce an under-estimation. We might therefore find a small selection effect due to emigration and mortality, i.e. that the women who survived and who did not emigrate were slightly more fertile than the others.

If we extend the analysis to age-specific fertility, the result is similar. The curves overlap almost exactly (Figure 6) and the relative differences between

Table 2. Numbers of women and completed fertility of the same cohorts, observed in the Belgian censuses of 1981 and 2001

Cohort	Age in		Number of women		Difference (2001-1981)	Completed fertility 1981	Completed fertility 2001
	1981	2001	1981	2001			
1917-1921	60-64	80-84	234,793	137,527	−97,266	2.12	2.17
1922-1926	55-59	75-79	308,689	226,985	−81,704	2.18	2.23
1927-1931	50-54	70-74	312,154	260,062	−52,092	2.26	2.30
1932-1936	45-49	65-69	296,648	264,001	−32,647	2.26	2.30
1937-1941	40-44	60-64	277,179	255,717	−21,462	2.16	2.20

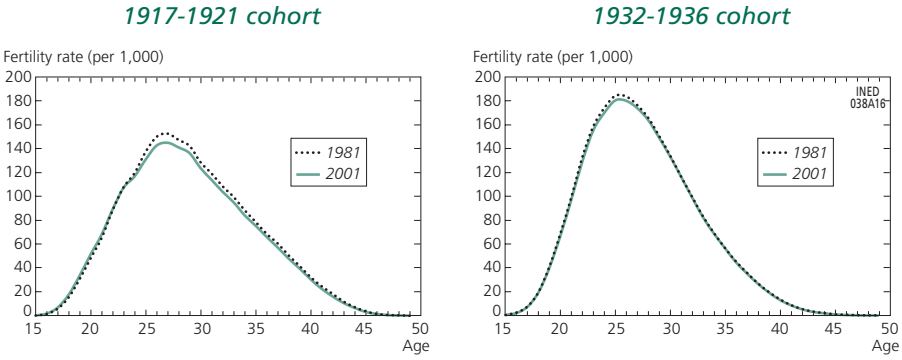
Sources: 1981 and 2001 censuses, Belgium.

(25) We have no information about the individuals from these cohorts who died or emigrated prior to 1981. Differences between the 1981 and 2001 census data may also be attributable to immigration during that period, which would, however, only be minimal for the cohorts born before the Second World War. The 1937-1941 cohort, for example, consists of women who were aged 60-64 at the time of the 2001 census. They may have immigrated after age 40, but at those ages international immigration is very low (Eggerickx, 2006).

the fertility rates derived from the 1981 and the 2001 censuses are small. They are highest (6%) for the cohort of women born between 1917 and 1921 (Figure 7), and gradually narrow across the subsequent cohorts.

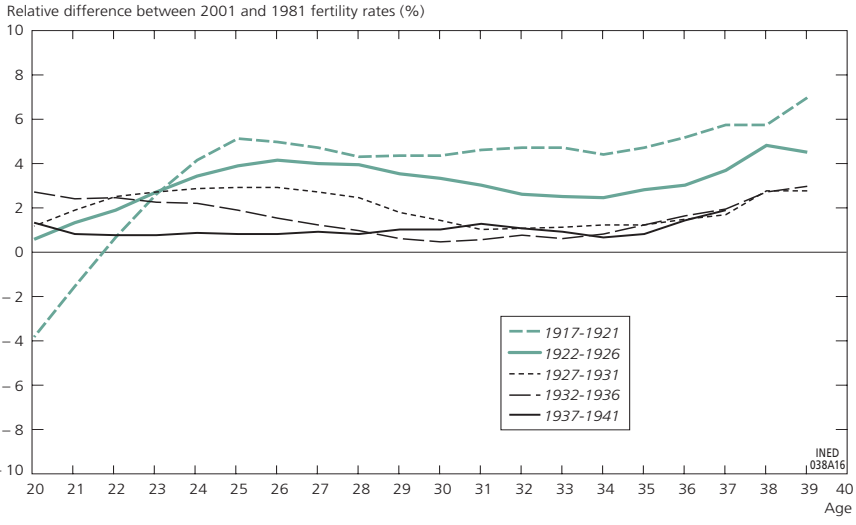
Even if the selection and memory biases appear to be negligible and therefore do not invalidate the use of these retrospective data, the completed fertility and age-specific fertility rates calculated on the basis of the 2001 census are always slightly higher than those extracted from the 1981 census. In other words, the women who disappear from observation because they died or

Figure 6. Age-specific fertility (per 1,000 women) by cohort for the Belgian censuses of 1981 and 2001



Sources: Censuses, Belgium.

Figure 7. Relative differences (%) between the age-specific fertility rates in the Belgian censuses of 1981 and 2001 by mothers' cohort



Note: Relative difference: (2001 fertility rate – 1981 fertility rate) / 1981 fertility rate.
Sources: 1981 and 2001 censuses, Belgium.

emigrated seem to show slightly lower fertility than the others, a similar result to that obtained by Andersson and Sobolev (2013) for Sweden.

For France, the question is different, since the surveys are conducted on a sample, not the total population. Completed fertility is similar, whatever the survey (average difference 5%, Table 3) as are age-specific fertility rates (Figure 8), although the differences are larger than for the Belgian censuses. Let us examine the 1926-1930 and 1931-1935 cohorts (Figure 8), which are the only cohorts for which four surveys are available. Overall, the 1990 survey slightly under-estimates fertility compared with the 1982 survey, while the 1999 survey slightly over-estimates fertility compared with the 1990 survey (Table 3). The 2011 survey strongly under-estimates fertility compared with all the other surveys. For the 1926-1930 cohort, for example, the differences between the fertility rates calculated from the various surveys compared with that of 1982 are mostly below 10%, and even below 6% if we exclude the 2011 survey (Figure 9). We do not observe any increase in the differences for the oldest cohorts (as for Belgium); in fact the reverse sometimes occurs. Conversely, the biggest differences are found for women aged 35 and over.

Table 3. Numbers of women and completed fertility of the same cohorts, observed in the 1982, 1990, 1999 and 2011 Family surveys, France

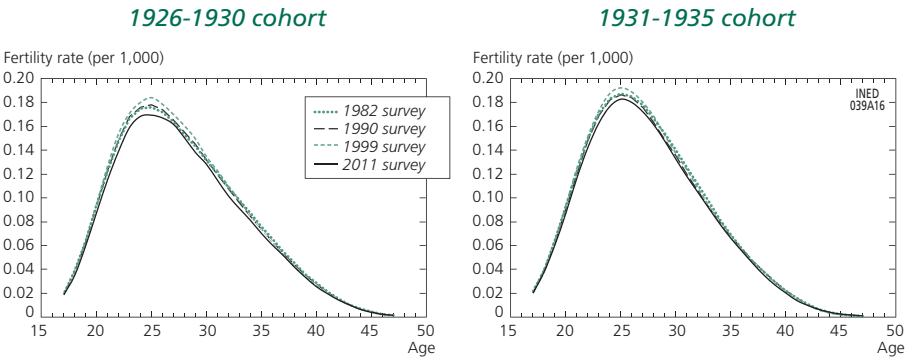
Cohort	Age in 1990	Number of women				Completed fertility			
		1982	1990	1999	2011	1982	1990	1999	2011
1921-1925	65-69	30,067		12,950	5,782	2.50		2.49	2.39
1926-1930	60-64	30,435	30,663	14,583	9,660	2.56	2.57	2.62	2.46
1931-1935	55-59	30,028	30,552	15,215	11,907	2.58	2.56	2.61	2.48
1936-1940[a]	50-54	16,862	28,502	14,492	12,279	2.52	2.46	2.47	2.36
1941-1945	45-49		28,358	14,668	12,946		2.24	2.31	2.17
1946-1950	40-44				19,935			2.14	2.03
1951-1955	35-39				19,725			2.09	2.03

(a) 1936-1938 for the 1982 survey. Variable: "How many liveborn children have you had?".
Sources: Family surveys, France.

The use of surveys rather than exhaustive population censuses may in itself explain the larger differences. But other biases are possible. It is hard to attribute these to recall errors because that would imply, for example, that the women, who were older in 1999 than in 1990 and 1982 reported having had more children (Table 3) and at slightly older ages (Figure 9) when they were older. The differences in results can probably be attributed to sampling differences between the first two surveys[26] and the later two

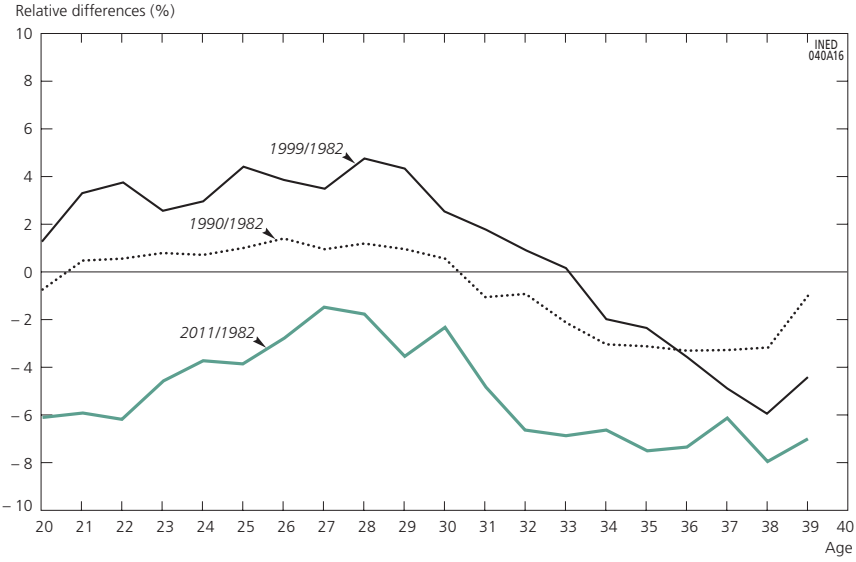
(26) The 1982 and 1990 surveys were based on the following sampling method: "the areas where the survey was conducted are census zones containing on average 500 individuals assigned to each enumerator. These zones were selected by a random draw designed to obtain a sample that is representative at the regional level" (INSEE).

Figure 8. Age-specific fertility rates (births per 1,000 women) by cohort, 1982, 1990, 1999 and 2011 Family surveys, France



Note: Five-year moving averages of ages.
Sources: Family surveys, France.

Figure 9. Relative differences between the age-specific fertility rates based on the 1982, 1990, 1999 and 2011 Family surveys for the 1926-1930 cohort, France



Sample calculation: Relative difference 2011/1982 = (2011 rate – 1982 rate)/1982 rate.
Sources: Family surveys, France.

surveys.[27] There is a stronger clustering effect in 1999 and 2011 than in 1982 and 1990, and the participation rate in the later surveys was slightly

(27) The sampling method changed for the 1999 survey: "The sampling method – the first of its kind – also had to be representative at the regional level. It is based on average sample sizes of 1/170th of the male population and 1/100th of the female population, with a minimum of 5,000 men and 8,500 women in regions where those sampling rates would have produced lower numbers (except for Corsica and Limousin)" (INSEE, 1982, 1990, 2002).

lower (79.4% and 83.4%, respectively; INSEE, 2002, 2014) than the 87% participation rate in the earlier surveys (INSEE, 1982, 1990).

In sum, the tests validate the use of the retrospective data from the 1961, 1981 and 2001 Belgian population censuses and the French Family surveys for longitudinal studies of fertility. Memory errors do not appear to affect the results, and selection biases related to mortality and migration do not seem to have a major impact either. By contrast, sampling biases are evident in the Family surveys due to their data collection method which, by definition, is not exhaustive, and the sampling method.

In the case of France, we recommend using the 1999 Family survey for longitudinal and diachronic analyses of fertility because the results of that survey are more consistent with those calculated from other data sources. In the case of Belgium, we recommend using the 1981 census to cover the cohorts born between 1897 and 1936, and the 2001 census for the cohorts born between 1937 and 1966, because the numbers of women are higher and they offer a better match with the series of indicators from civil registration data. If we add the more partial data from the 1961 census – a 1/10th population sample and a single question about the number of liveborn children –, it is possible to go back as far as the cohort born in 1872, and thus to cover longitudinally a large portion of the history of fertility in Belgium during the first and second demographic transitions.

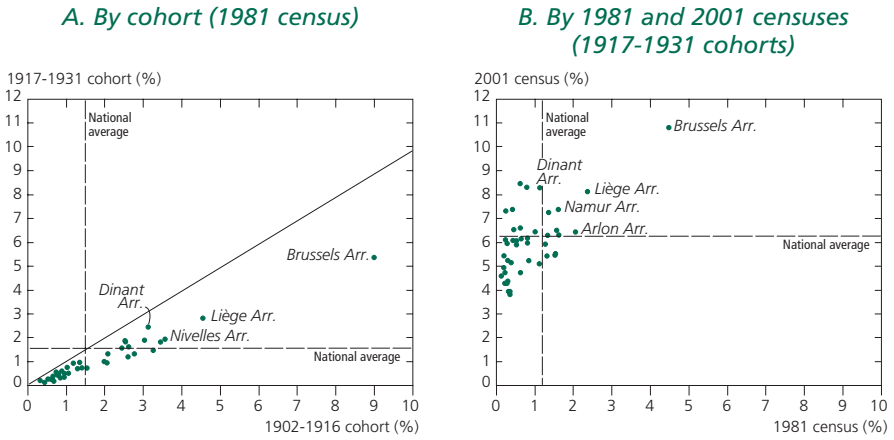
III. Using retrospective fertility data at the sub-national level

Retrospective data from censuses and surveys are a reliable source for reconstituting fertility trends at national level. But what about the sub-national level? As previously, we shall first examine the impact of non-response and then of potential selection biases related to disappearance from observation due to death, international migration and internal migration.

1. Non-response

Figure 10A shows the non-response rates to the question about the number of liveborn children in the Belgian census of 1981, distinguishing between the cohorts of women born between 1902 and 1916 and between 1917 and 1931. As previously, and for each *arrondissement*, the non-response rate increases with the age of the women surveyed. For the two cohorts in question, the vast majority of *arrondissements* (80%) have a non-response rate below or equal to the national average (2.7% for the 1902-1916 cohort and 1.6% for the 1917-1931 cohort), i.e. moderate values. Only the urban *arrondissement* of Brussels stands out from the rest with non-response rates far higher than the national average.

Figure 10. Non-response rates (%) at arrondissement level, to the question about the number of liveborn children in the Belgian censuses of 1981 and 2001



Note: Five-year moving averages of ages.
Sources: Censuses, Belgium.

A comparison of the 1981 and 2001 censuses for the cohort of women born between 1917 and 1931 (Figure 10B) confirms, without exception, the national results, namely that for the reasons mentioned earlier (collection method), the non-response rate of the 2001 census is higher, and its data therefore probably less reliable.

The same trends are found in the 589 municipalities. In general, focusing on the 1981 census, the non-response rates are quite acceptable at the municipal level. For example, for the cohort of women born between 1902 and 1916, in 80% of the municipalities (469 out of 589) the non-response rate was below the national average, whereas in 7.5% (45 out of 589) it was above 5%. These include most of the highly urbanized municipalities making up the conurbation of Brussels and the city of Liège, where large immigrant communities may explain, at least partly, the higher non-response rates, in line with the findings of Neels (2010) on the 1991 census. Higher-than-average non-response rates are also observed in small towns and rural municipalities, mainly located in Wallonia.

In sum, the non-response rates do not invalidate, at the sub-regional and local levels, the use of retrospective data from the Belgian censuses for the study of fertility. However, it should be borne in mind that non-response rates are not distributed randomly in space and tend to be higher than average in the most urbanized areas.

In the French Family surveys of 1999 and 2011, the non-response rates among women born between 1910 and 1939 to the question about the number of liveborn children were 13% in 1999 and 18% in 2011, levels comparable to the rates in other non-compulsory surveys but much higher than the rates in

the 1982 and 1990 Family surveys, which were 0.15% and 0.23% respectively.[28] We find a repeat of the trends observed at the national level, namely that the oldest cohorts at the time of the survey respond less frequently to the question than the other cohorts. Note that the share of non-respondents increases in the cohorts born after the Second World War.

Not all the regions have the same non-response rates. In the 1999 survey, they were consistently higher in Corsica, Île-de-France and Provence-Alpes-Côte d'Azur (PACA) for all the cohorts. In the 2011 survey, this was the case in only two regions: Corsica and Île-de-France (Figure 11B). The standard deviation of the non-response rate is higher in the 2011 survey (3.9) than in the 1999 survey (2.5), indicating that differences between regions were more pronounced in the more recent survey.

The 1999 and 2011 surveys thus have higher non-response rates to the question about the number of liveborn children, and the distribution of non-response is not random across the French regions (even if the standard deviations between regions are fairly small). This needs to be taken into account in any analysis of French fertility at the regional level based on those surveys.

2. Estimating selection biases in retrospective data at the sub-national level

In retrospective studies of fertility at the regional level, in addition to selection biases stemming from disappearance from observation due to death or emigration, there are selection biases resulting from internal migration. A woman's geographical attachment is determined by her place of residence on the date of the census or the survey, but her reproductive life may have taken place elsewhere, given that she may have moved (migrated internally) before the census or survey. In that case, there would only be an indirect relationship between place of residence at the time of the census or survey and the fertility of migrating women. The smaller the geographical scale, the greater the scale of internal migration in proportional terms and the larger the potential distortion.

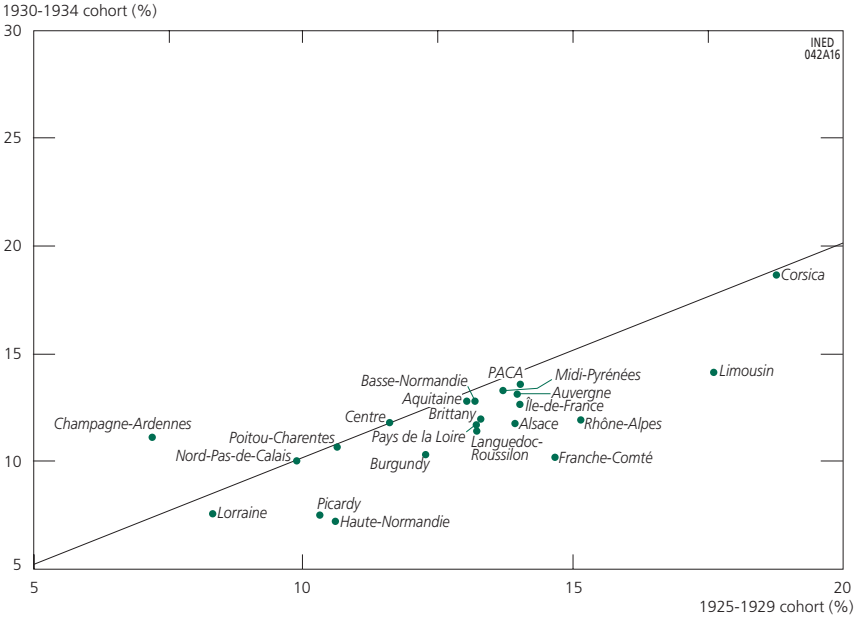
The regional level in France

Firstly, let us look briefly at the distortions that can be caused by internal migration. If internal migration concerns small numbers and involves only short distances, it does not alter measures of fertility. However, in the case of frequent, long-distance internal migration, women's past fertility may not be representative of fertility levels in their place of residence at the time of the census.

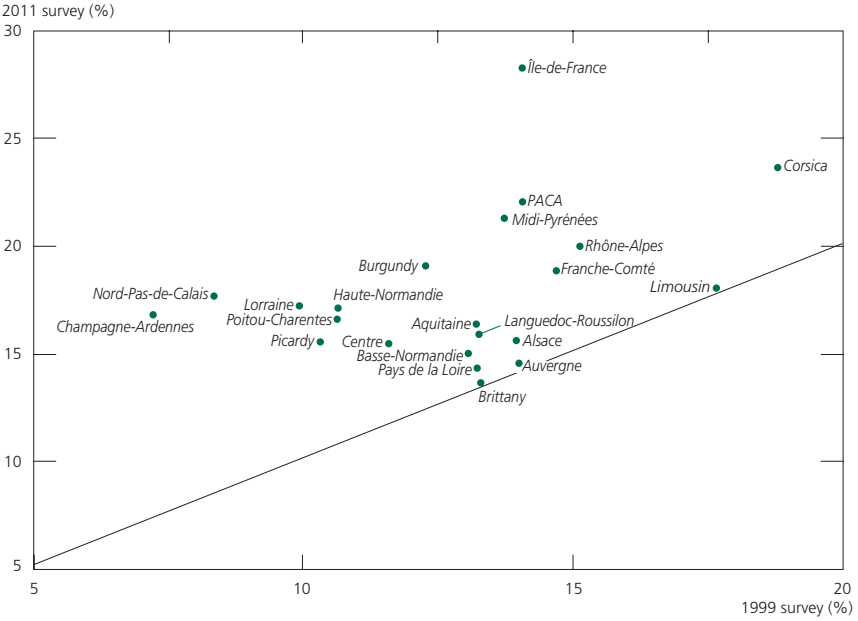
(28) In the 1982 and 1990 survey files, there is no mention of the original "number of children" variable ("ne" for *nombre d'enfants*), even though it is referred to in the description of variables. It seems to have been replaced by a variable called "variabl0", described in the data files as "reported number of children" (the other variables relating to a woman's number of children take the form of a count of the children recorded in the tables about each child, for which there is no non-response).

Figure 11. Rates of non-response (%) to the question on the number of liveborn children in the Family surveys, France of 1999 and 2011 at regional level

A. By cohort (1999 survey)



B. By 1999 and 2011 surveys (1925-1929 cohort)



Sources: 1982, 1990, 1999 and 2011 Family surveys, France.

Internal migration is harder to analyse in France than in Belgium, because there are no statistics comparable to Belgian population registers, which record arrivals and departures from municipalities (Desplanques, 1994). Different sources can nevertheless be used to measure population movements, notably by analysing internal migration between censuses. Internal migration increased between 1954 and 1975, then decreased between 1975 and 1990, before rising again from the 1990s onwards (Baccaïni, 2007; Desplanques, 1994).

Analyses of internal migration between the 1975 census and the 2006 census show that the south of France attracts migrants, while the north, particularly the north-east, is an area of out-migration (Baccaïni, 1993, 2001, 2009). Migration is also differentiated by age group. Young adults (aged 20-30) are highly mobile because many of the causes of residential mobility – education, first job, union formation and family formation – concern this age group in particular. They are attracted to high-employment areas, namely the Paris region (Île-de-France) – and more recently the neighbouring regions (Baccaïni, 2007) – and the south (Midi-Pyrénées, PACA, Rhône-Alpes, Languedoc-Roussillon). These regions are also highly attractive to the 30-39 age group. Among individuals aged 60 and over, there is a clear rejection of the north-eastern quarter of France, particularly Île-de-France and Nord-Pas-de-Calais (Baccaïni, 1993, 2001, 2009; Cribier and Kych, 1992). Migration in this age group, which started increasing in the 1950s with the generalization of retirement pensions, may represent a return to the home region, a move to the outskirts of large cities which are less expensive than city centres or, for the most affluent, retirement to a house in the country, a coastal resort or a spa town (Cribier and Kych, 1993). However, this migration is fairly limited, since only 4% of people aged 60 and over moved to another *département* between 2001 and 2006 (Baccaïni and Lévy, 2009). Moreover, the distances covered are small: among individuals who moved, those born between 1911 and 1935 moved 84 km on average, and more than half of them less than 7.4 km (Baccaïni, 1994). Consequently, the analysis of fertility at the regional level is unaffected by this inter-regional migration, firstly because it is small, and secondly because there is no change of *département* in many cases. The differences between Family surveys cannot be attributed to internal migration in this age group.

The Family surveys are conducted on the basis of representative samples at the level of the 22 French regions, so this is the smallest spatial scale available for analysis.[29] The regional level nevertheless raises a problem of low numbers. Even when respondents are grouped into five-year cohorts, numbers are particularly small in some regions, especially in the 1999 survey. While 310,000 women were surveyed in 1982 and 340,000 in 1990, only 278,000 were surveyed in 1999 and 238,000 in 2011. In the latter two surveys, all

(29) The 1999 and 2011 surveys also indicate the respondents' *département* of residence (the administrative division below the regional level), but the samples are not designed to be representative at this level.

women aged 18 and over were surveyed, which reduces the number of women per cohort with respect to the first two surveys, which only included women aged 18-64. In Corsica, for example, there are never more than 130 women per age group .[30] In the 1982 and 1990 surveys, the numbers for each region are much higher, although still fairly low in Corsica and Limousin.

By comparing completed fertility based on the various Family surveys, the consistency of the three series of results can be assessed through a correlation analysis. This comparison presents extremely homogeneous results for the first three surveys (Table 4), despite the change in sampling method between surveys.[31] The correlation coefficients r are particularly high between the 1982 and 1990 surveys (r = 0.94 on average) and the 1990 and 1999 surveys (r = 0.90 on average). The coefficients between the 2011 survey and the other three surveys are lower on average (even for the most recent cohorts), but they are almost always above 0.80.

Table 4. Correlation coefficients of regional completed fertility between the 1982, 1990, 1999 and 2011 Family surveys, France

Cohort	Family surveys					
	1982-1990	1982-1999	1982-2011	1990-1999	1990-2011	1999-2011
1920-1924		0.79	0.91			0.63
1925-1929	0.94	0.89	0.87	0.86	0.85	0.82
1930-1934	0.96	0.88	0.87	0.92	0.89	0.86
1935-1939	0.92	0.87	0.93	0.91	0.85	0.81
1940-1944				0.90	0.91	0.83
1945-1949						0.79
1950-1954						0.88

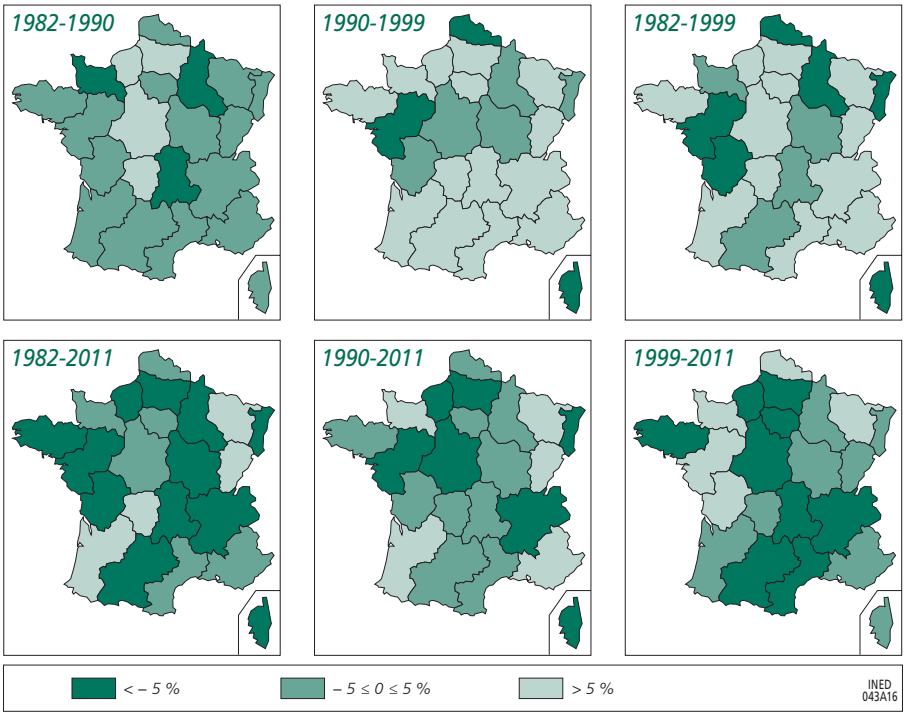
Sources: 1982, 1990, 1999 and 2011 Family surveys, France.

We will focus on the 1925-1929, 1930-1934 (Figure 12) and 1935-1939 cohorts, the only ones for which the four surveys are available. On the scale of the regions, as on the national scale, the results of the 1982 and 1990 surveys are the closest (average relative differences in regional completed fertility below 4%), and the results of the first three surveys differ markedly from those of the 2011 survey (always above 5%), especially the 1982 survey results. No clear spatial pattern emerges and it is therefore likely that the differences are attributable to the change in sampling methods (see Footnote 27). The 2011

(30) Eight other regions (Haute-Normandie, Centre, Basse-Normandie, Brittany, Champagne-Ardenne, Lorraine, Midi-Pyrénées and Limousin) contain fewer than 500 women in each five-year age group for the cohorts born before 1945.

(31) See Footnote 23.

Figure 12. Relative differences (%) between completed fertilities based on the different Family surveys for the 1930-1934 cohort, France



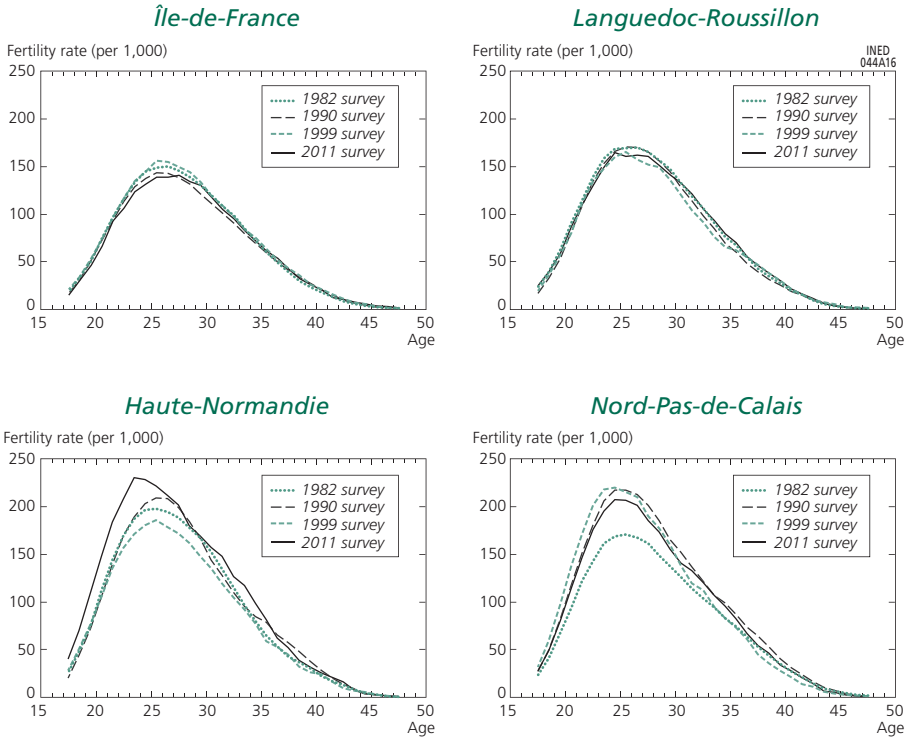
Note: The difference between 1982 and 1990 is calculated as $(X_{1990} - X_{1982})/ X_{1982}$.
Sources: Family surveys, France.

survey generally under-estimates fertility compared with the other surveys, but no clear regional trend emerges.

What about age-specific fertility rates on the regional scale? The relative differences between the various regions in the four surveys are higher than at the national level, which can be attributed mainly to the small numbers. On the regional scale, at age 25, the biggest differences are found between the 1999 and 2011 surveys (as on the national scale) and the smallest differences between the 1990 and 2011 surveys (while the smallest differences on the national scale are found between the 1982 and 1990 surveys). The average relative differences at age 25 are around 5% between the 1990 and 2011 surveys (standard deviation of 4.8) for the cohorts of 1920-1924, 1930-1934 and 1935-1939, and 10% between the 1999 and 2011 surveys (standard deviation of 6.6).

The age-specific fertility rates from the 1999 survey tend to be slightly higher than those from the two previous surveys (Figure 13), whereas those from the 2011 survey tend to be lower. But, as the example of the Nord-Pas-de-Calais region shows, this pattern can be reversed. Moreover, the spatial distribution of the differences between completed fertility calculated on the

Figure 13. Age-specific fertility rates (per 1,000) of the 1930-1934 cohort for selected regions in the four Family surveys, France



Note: The 1930-1934 cohort is the only one for which all four surveys can be used. The regions were selected to show two of the highest correlations between surveys (Île-de-France and Languedoc-Roussillon) and two of the lowest (Haute-Normandie and Nord-Pas-de-Calais).

Sources: Family surveys, France.

basis of the surveys differs from the that of the differences between fertility rates at age 25. For future analyses, it will be important to take account of all available surveys, and to properly appreciate the extent of differences which, with only a few exceptions, are fairly small.

The arrondissement *level in Belgium*

For Belgium, several factors argue in favour of a retrospective, spatial approach to fertility.

Firstly, the specific characteristics of internal migration behaviour in Belgium support the use of these data. Most internal migration takes place, now as in the past, over small distances within the *arrondissements*. So, although there are roughly 1 million changes of address in Belgium every year, half of them take place within each of the 589 municipalities. Of the 500,000 inter-municipal moves, only 200,000 involve a change of *arrondissement* (43 *arrondissements*) and 65,000 a change of province (11 provinces) (Eggerickx

et al., 2012). Furthermore, after age 25, rates of inter-municipal and inter-*arrondissement* migration decrease sharply, as home ownership and family formation lead to greater residential stability (Eggerickx et al., 2012).

Furthermore, a recent study (Eggerickx et al, 2014) has shown that internal migration has little impact on fertility. By linking the data from the 1981 and 2001 censuses, the authors analysed the cohorts of women born between 1952 and 1966 (whose childbearing occurred mainly between the two censuses). The study was based on a division of the Belgian municipal scale into six homogeneous types of municipalities in terms of fertility trends.(32) Within each type of municipality, two groups of women were identified:

- women who did not move to a different type of municipality during their reproductive lives, i.e. whose fertility can be used simply to calculate fertility in the type of municipality where they were living in 2001;
- women who moved during their reproductive lives, i.e. the group that could distort the calculation of fertility in a retrospective, spatial approach.

The study found that the "distorting" group had a minimal impact on fertility indicators across all types of municipalities. The inclusion of this group in retrospective fertility measures in the place of residence produces, for the 1952-1956 cohort, for example, a consistent over-estimation of completed fertility of 0.01 children per woman on average and an over-estimation of the mean age at first childbirth of 0.3 years. These analyses also show the existence of a host-territory effect on the fertility of in-migrating women: in all types of municipalities, the fertility behaviour of in-migrating women is closer to that of the host territory than to that of the territory of origin. That study, based on a typology of municipalities and on fairly recent cohorts, shows that internal migration does not seem to distort the retrospective observation of fertility. What about the oldest cohorts in the standard administrative division by *arrondissement*?

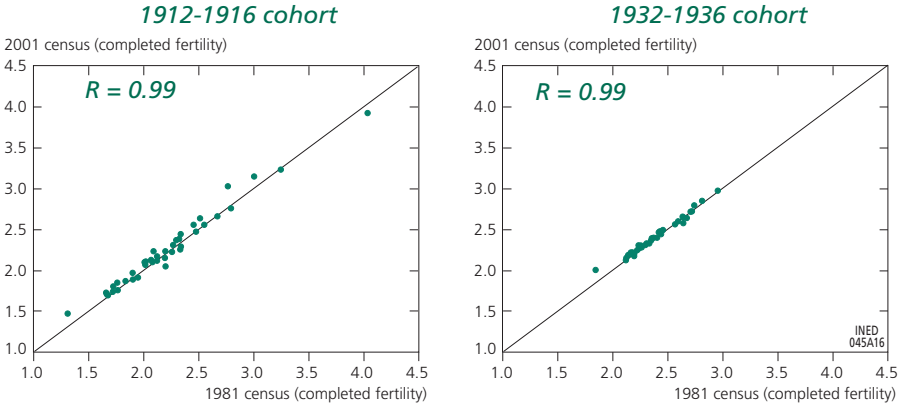
As we showed in the second section, for the same cohort, a comparison of data from the 1981 and 2001 censuses at the national level confirms the hypothesis that fertility is independent of mortality and international migration. At the *arrondissement* level, internal migration is another potential selection bias, especially as it involves a significant percentage of the population, particularly in the most urbanized areas (Eggerickx et al., 2012), and as inter-*arrondissement* migration is likely to be correlated with fertility behaviour more than inter-regional migration in France.

For the same cohort of women, any significant difference between the rates derived from the 1981 and 2001 censuses would indicate a major selection bias, reflecting differences in behaviour between the observed populations and those that had disappeared from observation. As Figure 14 illustrates, the

(32) This is a typology of municipalities developed using a hierarchical cluster analysis method (Ward's method) based on a series of cross-sectional indicators of the timing and intensity of fertility from 1971 to 2005. It is detailed in Costa et al. (2010).

series derived from the two censuses are highly correlated: for all cohorts for which comparison of 1981 and 2001 data is possible, the correlation coefficient is always close to 0.99. The same exercise was performed on the 1961 and 1981 data, and again the correlation coefficients are very high, always above 0.95. In other words, completed fertility for the same cohort, calculated in 1981 and in 2001, is almost identical, even for the small *arrondissements* in Luxembourg province (in southern Belgium). On the scale of the *arrondissements*, the potential selection biases do not invalidate the use of retrospective fertility data from population censuses.

Figure 14. Comparison of completed fertility by *arrondissement* between the Belgian censuses of 1981 and 2001



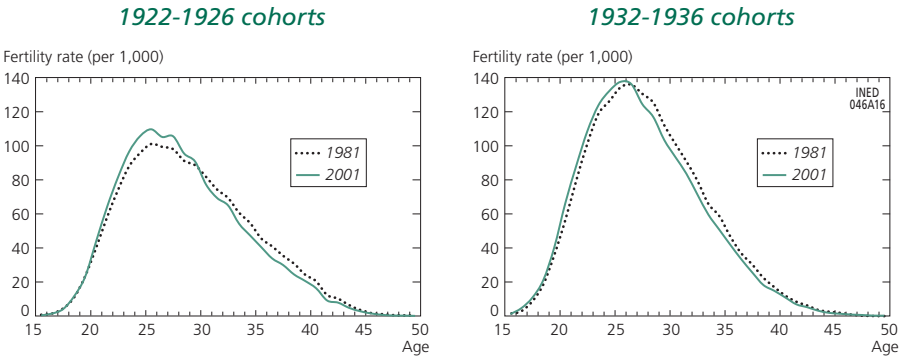
Sources: 1981 and 2001 censuses, Belgium.

It is for the urban *arrondissement* of Brussels that the differences between the censuses are the sharpest: for the cohort of women born between 1912 and 1916, completed fertility calculated on the basis of the 1981 census is 1.31, compared with 1.48 for the 2001 census. For the cohort born between 1932 and 1936, the values for completed fertility are 1.85 and 2.00, respectively.(33)

What about age-specific fertility rates? Figure 15 compares the fertility rates of the 1922-1926 and 1932-1936 cohorts for the Brussels *arrondissement*, where the differences in completed fertility between the 1981 and 2001 censuses were the largest. For all the cohorts, the curves of the age-specific fertility rates cross over, which indicates earlier timing of births in the 2001 census. Differences between the rates are small and may be attributable to a significantly larger immigrant population in Brussels in 2001 than in 1981, characterized by earlier fertility timing (Eggerickx, 2006). Overall, the differences between the curves

(33) At this stage of our investigation, aside from the lower quality of the 2001 census compared with the 1981 census, we cannot attribute this difference to a possible selection effect stemming from migration by older childless women. In any case, for all the cohorts born before the Second World War, and regardless of the source of observation, fertility in Brussels is very low, and significantly below the levels in the other *arrondissements*.

Figure 15. Age-specific fertility rate (births per 1,000 women) for the Brussels *arrondissement* based on the censuses of 1981 and 2001



Sources: 1981 and 2001 censuses, Belgium.

are small and tend to decrease with each cohort. For the 1922-1926 cohort, the largest differences are observed at ages 21-25, but do not exceed 8 per 1,000 as an absolute fertility rate or 10% in relative terms. For the 1932-1936 cohort, it is at ages 31-35 that the differences are largest, but they do not exceed 8 per 1,000 either. Once again, this test validates the data.

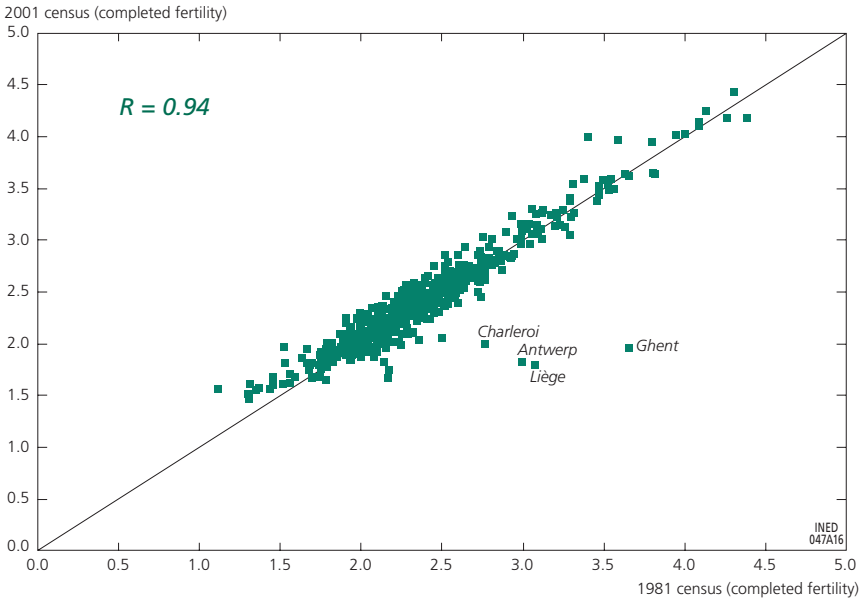
The municipal level in Belgium

As previously, the test involves comparing, for the same cohorts, the completed fertility rates calculated on the basis of the 1981 and 2001 censuses. This will verify the impact of selection biases related to disappearance from observation due to death and internal and international migration between 1981 and 2001. The results seem to show that even on the scale of the municipalities, where the proportion of inhabitants who migrate is largest, the selection biases are moderate (Figure 16). For example, for the cohort of women born between 1922 and 1926, the comparison of completed fertility in 1981 and 2001, calculated on the scale of their municipality of residence, gives a linear correlation coefficient of 0.94.[34] For the later cohorts, the match is even better.

Let us take the case of the cohort of women born between 1922 and 1926. In 64% of the municipalities (378 out of 589), completed fertility shows a relative difference of ±5% between the two censuses, which corresponds to a maximum of ±0.1 children for completed fertility of two children. The (positive or negative) differences range from 5% to 10% in 25% of the municipalities, which is a fluctuation of 0.1 to 0.2 children for completed fertility of two children. Last, for the remainder of the municipalities (10%), the difference between the two censuses is above 10%. These include the large cities of Ghent, Antwerp, Liège and Charleroi, which show major differences, and to a lesser extent the urban municipalities in the Brussels

(34) The same comparison provides a coefficient of 0.81 for the cohorts born between 1917 and 1921.

Figure 16. Comparison of completed fertility of municipalities in the Belgian censuses of 1981 and 2001 for the cohort of women born between 1922 and 1926



Sources: 1981 and 2001 censuses, Belgium.

conurbation. Unlike the national and *arrondissement* levels in which the 2001 census gives slightly higher indices than the 1981 census for the same cohorts – which implies slightly below-average fertility in the populations that disappeared from observation –, these municipalities had higher fertility rates in 1981. This situation can probably be attributed to higher non-response rates in 2001, especially in the most urbanized areas,[35] rather than to higher-than-average fertility in the populations that disappeared from observation, mainly as a result of internal emigration.[36] For the oldest cohorts, we therefore recommend using the retrospective municipal data extracted from the 1981 census rather than the 2001 census.

Conclusion

The use of retrospective data extracted from population censuses or specific surveys to reconstitute fertility may entail a significant risk of bias. First, recall errors can affect the responses, especially in the oldest cohorts of women.

(35) The non-response rates are significantly higher among more disadvantaged social groups and among foreign-born populations, which are characterized by higher fertility rates.

(36) This is not verified in the periurbanization process that has affected these conurbations in recent decades (Eggerickx et al., 2014).

Second, censuses do not cover all individuals in the cohorts concerned; we have no information about the fertility of women who disappeared from observation because they died or emigrated, which may cause selection biases. Third, a share of the population does not answer some questions and the individuals concerned are not distributed evenly across the territory or across population groups (age groups, social groups, etc.). Moreover, the estimates derived from the French surveys exhibit some variability since only a fraction of the population (a representative sample) is observed and the women in the sample are not the same from one survey to another.

The analyses conducted on the two countries show that the risks of bias related to recall errors and selection effects are limited and confirm the findings of Andersson and Sobolev (2013) on the Swedish population registers, and of Neels (2006) and Van Bavel (2014) on the Belgian censuses. Levels of completed fertility calculated on the basis of censuses and surveys closely match those derived from civil registration data and from indirect methods. Furthermore, a comparison of the fertility of women from the same cohort observed in different censuses or surveys reveals minimal differences, except in large cities.

One of the key benefits of using retrospective data from censuses and, to a lesser extent, from surveys, is their potential for capturing the spatial dimension of fertility. At the sub-national level, selection bias should be analysed with the additional parameter of internal migration; the women's place of residence at the time of the census or survey is not necessarily the same as where their reproductive life took place, as women may have moved between censuses. On the whole, our tests show that the potential bias linked to internal migration does not invalidate the use of a retrospective, spatial approach to fertility, even if prudence is necessary in the case of large cities where international migration, in particular, may affect comparisons between censuses.

A retrospective approach to fertility in Belgium based on census data is therefore possible, even on a small spatial scale. Censuses represent a rich source of data for analysing fertility trends over the twentieth century. In particular, they can be used to calculate various fertility indicators, such as completed fertility, parities, parity progression ratios, birth spacing, and age at childbearing. In the case of the French Family surveys, although the results show larger variations than for the Belgian censuses, they can still be used to reconstitute fertility in France retrospectively, including at regional level, with a high level of reliability.

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Sandra Brée, Thierry Eggerickx, Jean-Paul Sanderson, Rafael Costa • **Comparison of Retrospective Fertility Data from Censuses in Belgium and Family Surveys in France**

Fertility behaviour in France and Belgium in the first half of the twentieth century is still quite poorly understood, owing mainly to legislation that prohibits the use of individual data less than 100 years old, and to the paucity of cross-sectional aggregate data. This article tests whether it is possible to bridge that gap via a retrospective approach, using the questions about women's reproductive life from family surveys conducted in France and population censuses in Belgium. The analyses show that the risks of bias related to recall errors, selection effects and non-response, inherent in these retrospective observations, are limited. The reconstituted birth histories of the various cohorts of women recorded at the time of the survey or census therefore offer considerable research potential, making it possible to calculate more detailed, more diversified indicators of the intensity and timing of fertility for cohorts of women born since the end of the nineteenth century. They also enable us to capture the spatial dimension of fertility, at the level of the regions in France, and of the *arrondissements* and even the municipalities in Belgium.

Sandra Brée, Thierry Eggerickx, Jean-Paul Sanderson, Rafael Costa • **Comparaison des données rétrospectives de fécondité dans les recensements en Belgique et les enquêtes *Famille* en France**

Les comportements de fécondité au cours de la première moitié du xx^e^ siècle restent relativement méconnus, en raison notamment des législations interdisant l'exploitation de données individuelles vieilles de moins de 100 ans, ou de la pauvreté relative des données agrégées transversales. L'objectif de cet article est de vérifier s'il est possible de combler cette lacune en exploitant de manière rétrospective les questions posées sur la vie féconde des femmes lors des enquêtes *Famille* menées en France et des recensements de la population en Belgique. Les analyses ont démontré que les risques de biais liés aux erreurs de mémoire, aux effets de sélection et aux non-réponses, inhérents à ces observations rétrospectives, sont limités. La reconstitution de la vie génésique des différentes générations de femmes interrogées au moment de l'enquête ou du recensement offre donc un potentiel analytique important. Elle permet de calculer des indices plus fins et diversifiés de l'intensité et du calendrier de la fécondité pour des générations de femmes nées à partir des dernières décennies du xix^e^ siècle. Cela permet par ailleurs de prendre en considération la dimension spatiale de la fécondité, à l'échelle des régions en France et à celle des arrondissements et même des communes en Belgique.

Sandra Brée, Thierry Eggerickx, Jean-Paul Sanderson, Rafael Costa • **Comparación de los datos retrospectivos de fecundidad en los censos en Bélgica y en las encuestas Familia, en Francia**

Los comportamientos de fecundidad durante la primera mitad del siglo xx son relativamente poco conocidos, a causa sobre todo de las legislaciones que prohíben la explotación de datos individuales de menos de 100 años o de la relativa pobreza de los datos agregados transversales. El objetivo de este artículo es comprobar si se puede rellenar este vacío explotando retrospectivamente las respuestas a las preguntas sobre la vida fecunda de las mujeres, hechas en las encuestas Familia francesas y en los censos belgas. Los análisis han demostrado que los riesgos de sesgo asociados a los errores de memoria, a los efectos de selección y a las no-respuestas, inherentes a este tipo de observación, son limitados. La reconstitución de la vida genésica de las diferentes generaciones de mujeres interrogadas en la encuesta o en el censo, ofrece así un alto potencial analítico. Es posible, en efecto, calcular índices más detallados y diversificados de la intensidad y del calendario de la fecundidad en las generaciones nacidas en las últimas décadas del siglo xix. Dicha reconstitución permite también considerar la dimensión espacial de la fecundidad, a nivel regional en Francia y a nivel de distrito e incluso de municipio en Bélgica.

Keywords: Fertility, retrospective data, survey, census, France, Belgium.

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