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What happens when the census population figure does not match the estimates?

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Censuses can produce unexpected results. François Héran and Laurent Toulemon review surprises in French censuses from 1968 to 2004. They examine the adjustments made by the National Institute for Statistics and Economic Studies (INSEE), compare them with practice in the United Kingdom, and assess their effects on demographic indicators. They also explain how INSEE has made upward adjustments to net migration figures for recent years.

Every year INSEE publishes the population balance for the previous year. It rolls forward data from the last census by adding the natural increase (surplus of births over deaths) and net migration (surplus of arrivals over departures). The sum of the two – or total balance – gives the annual population change. This operation is repeated every year until the next census. When the census gives a different population figure from the current estimate (a situation called "error of closure" by the US demographers), consistency must be restored to the enumeration process.

This is what was done after the first wave of the rotating census, performed in January 2004 [1] (see Box 1). For the population of metropolitan France, the new census recorded 460,000 more people (Table 1) than the current population estimate published at the beginning of 2004, just before the census. In 1999 the opposite result was obtained: the census, performed in the conventional way, counted 480,000 fewer people than the estimate (1). What should be done about these differences? And how much importance should they be given?

Adjustment methods from 1968 to 1990

To restore consistency, three types of adjustment are possible: ignore the results of the latest census and maintain the current estimate; change the previous census figure; or revise the total balance estimated in the interval, either by altering the components (natural increase or net migration) or by applying an overall adjustment. The methods used in France and in the UK depend on the problems encountered. After the surprise of the 2001 census – 1 million fewer people than

Table 1 - Population of metropolitan France at 1 January (in millions)

Year	Estimates based on the census of:		
	1990	1999	2004
1990	56,577		
1991	56,893	56,841	
1992	57,218	57,111	
1993	57,530	57,369	
1994	57,779	57,565	
1995	58,020	57,753	
1996	58,258	57,936	
1997	58,492	58,116	
1998	58,728	58,299	
1999	58,977	58,497	
2000		58,749	58,796
2001		59,043	59,143
2002		59,342	59,501
2003		59,635	59,856
2004		59,900	60,200
2005			60,561

* *Institut national d'études démographiques*

(1) To ensure that figures remain comparable over time, this article is limited to the population of metropolitan France.

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expected – the UK Office for National Statistics (ONS) used a combination of all the available methods (see Box 2). What did INSEE do in France?

Let's start with the census of 1968 (Figure 1). The population of France was expected to exceed 50 million. But the census counted 360,000 fewer people than the current estimate. INSEE decided to reduce net migration by 160,000 for the years 1963-1967 and make a negative adjustment of 200,000 to offset the increase in omissions since the previous census [2].

In 1975 the discrepancy between the census and the estimate was only 43,000. Net migration was tweaked for years 1968-1974. The decision to end labour immigration in 1974 was reflected in a conventional estimate of zero net migration, which was subsequently contradicted by the 1982 census. Annual net migration was raised, then taken back to zero again for want of reliable data.

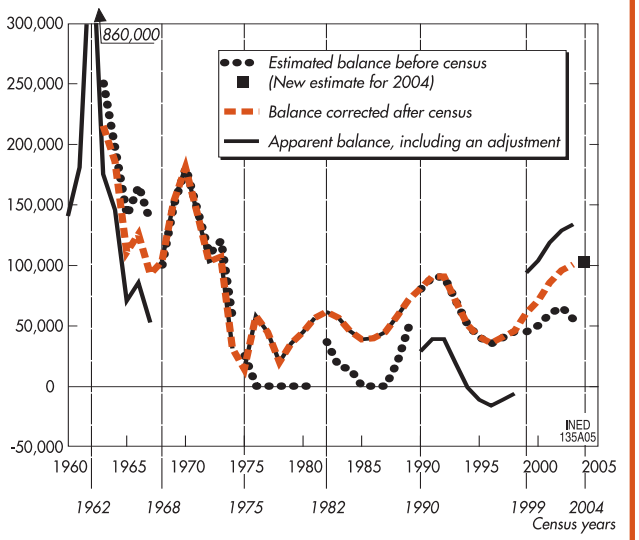
The 1990 census reported 274,000 more people than the estimate. Since records of births and deaths are extremely accurate, INSEE decided to revise net migration up and to make tentatively unbiased estimates from then on. A complex calculation program was brought into use for population enumeration which integrated, among other things, net balances by sex and age estimated from changes in numbers between 1982 and 1990, as well as inward migration trends reported by OMI and OFPRA (2).

After the 1990 census, a coverage survey was conducted [3], which estimated the percentage of people omitted (1 million) at 1.8% and the percentage of people counted twice (400,000) at 0.7%, i.e. a net shortfall of 1.1% (600,000). Should the survey results be taken at face value and the 1990 census corrected upwards [4]? INSEE had ruled out this option for statistical reasons: the coverage survey also contained biases and inaccuracies, its confidence intervals were much larger than the differences it was supposed to correct, and it could not be used to rectify figures at municipal level. So prior to the 1999 census, INSEE decided to eliminate error in advance by cross-checking students' double addresses and counting dwellings using council tax records.

1999 census: 480,000 fewer people

In 1999 the result was the opposite: the census reported 480,000 fewer people than the current estimate. This may seem huge, but it is less than 1% of the total population and two times smaller than the shortfall that appeared in England-Wales in 2001. In fact, counting a population of 60 million people to within 500,000 people represents an error rate of 1 in 120. So INSEE decided to ratify the results of the 1999 and 1990 censuses (despite the net omissions identified by the coverage survey) and revise down the population estimates in the interval.

Figure 1 - Annual net migration in metropolitan France



Interpretation: before the 2004 census, INSEE's net migration estimate was 40,000 in 2000. It subsequently calculated a net migration figure of 70,000. An adjustment of 33,000 was then added to take account of the surplus population counted in 2004. This takes the "apparent balance of arrivals minus departures" (net migration + adjustment) to 103,000. Censuses were conducted in 1962, 1968, 1975, 1982, 1990, 1999 and 2004. The peak in 1962 includes repatriates from Algeria.

Another solution would have been to correct stocks rather than flows, i.e. to rely on current estimates rather than censuses. But, without a reliable coverage survey, by how much should the population be re-evaluated? How should the surplus be divided between municipalities? After some deliberation, INSEE's demographers decided that revising up the population figure in the 1990 and 1999 censuses, as logical as it seemed, involved more disadvantages than advantages, given the small shortfall to be corrected.

They therefore revised down the population increase for the years 1990-1998 from 2.4 million to 1.92 million. But the negative adjustment of 480,000 people did not affect either the natural increase – considered accurate – or net migration, which had been properly estimated during the 1990-1998 period (with a cumulative total of 533,000) [5]. The new total balance was therefore the sum of three elements: the natural increase, net migration and the adjustment.

To what can the shortfall of 480,000 people in 1999 be ascribed? After a careful comparison with the 1990 census, an INSEE study [6] proposed the following breakdown: 260,000 additional omissions, attributed to greater difficulty in accessing dwellings (due to increased security and multiple residences); the removal of an additional 100,000 double counts after the

(2) *Office des migrations internationales* (OMI – French Office for International Migration, not to be confused with the International Organization for Migration, IOM in English, OIM in French) and *Office français de protection des réfugiés et apatrides* (OFPRA – French office for the protection of refugees and stateless persons).

systematic checking of students' addresses; and an increase of 120,000 in the number of French expatriates.

A partial, provisional adjustment in 2004

From the first wave of the new census in January 2004, INSEE estimated a population of 60,360,000 at 1 January 2004 compared with the total of 59,900,000 given in the population balance. However, of this surplus of 460,000 to be spread over the years 1999-2003, INSEE is only taking 300,000 into account. The provisional result of the first census wave is thus only partly taken into account, pending confirmation by subsequent waves.

Where does the surplus recorded in 2004 come from? Possibly partly from less efficient removal of overcounts than in 1999. More probably from improved data collection due to the implementation of computerized registers of addresses in large municipalities. It is hard to say more at this stage. The quality of data collection of the new census is currently being assessed by an independent body composed of elected members of local government bodies and statisticians.

A necessary revision of net migration

To bring the years 1999-2003 into line with the 2004 census, INSEE corrected net migration. Of the surplus of 300,000 people accumulated over the four years, 164,000 were attributed to the adjustment and 136,000 to net migration. The programme for calculating annual net migration implemented after the 1990 census worked well until the "*Réséda*" (3) Act on the entry of foreigners and asylum in 1998, which introduced new categories of residence permits. Taking these new categories (in particular "private and family life") into account required manual updating, which was only partly completed during the 1999-2003 period, while the number of cases of indirect legalization and family reunification rose, along with the number of asylum applications.

When asylum applications began to decline in 2003, INSEE concluded that net migration was trending down, even though the growing number of new residence permits appeared to indicate the opposite. After consulting INED, INSEE identified the exact reason for its underestimate. INSEE rectified its system for estimating net migration, which now takes recent changes to immigration legislation into account. The system will also incorporate data on first residence permits held by the Ministry of the Interior, which can now be accessed.

Since this correction corroborated the adjustments made after the 2004 census, INSEE re-evaluated net migration, even doubling it in 2003 (a little over 100,000

(3) "*Réséda*": acronym of "*loi relative à l'entrée et au séjour des étrangers en France et au droit d'asile*".

Box 1

The new population census

INSEE introduced a new census method in 2004. The population is no longer enumerated every eight or nine years, but by annual rotation over a five-year cycle. To avoid the costs of a more frequent census, the full census has given way to a sample of 70% of the population over five years, which represents an average between a 100% coverage rate for half the population living in municipalities of fewer than 10,000 people and a 40% coverage rate for the population living in municipalities of more than 10,000 people.
Rotation groups have been defined with known sampling fractions so that each annual wave of the census covers 14% of the population (a fifth of 70%) and is used to extrapolate a provisional total population of the country. However, INSEE will not publish the final results for the middle of the current cycle, i.e. 1 January 2006, until after the fifth round, scheduled for January 2008. After then, a final figure will be published every year.

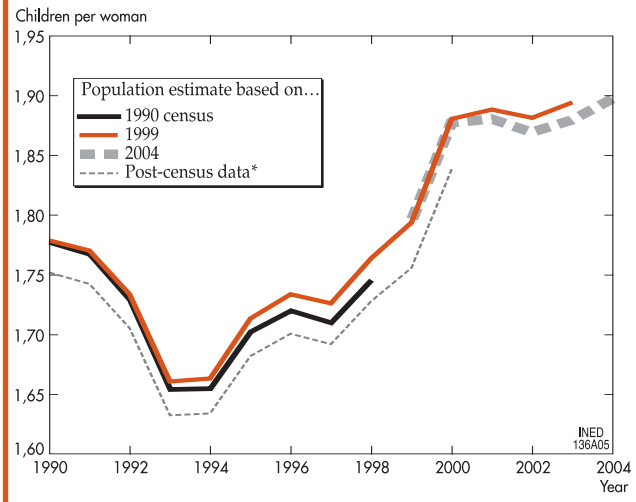
Box 2

The British method: adjust, de-adjust, readjust...

In the 2001 census, the ONS had to deal with a bigger discrepancy for England and Wales than for France: the census enumerated a population of 52,042,000 compared with an estimate of 53,180,000, i.e. a shortfall of 1,140,000 [8]. The previous censuses of 1981 and 1991 also recorded 1 million fewer people than the estimates, which prompted the ONS to revise those estimates upwards. In 2001 the ONS decided to change tack, considering, on the basis of a coverage survey of 320,000 households, that the census was of higher quality than the previous ones. Four measures were taken:
- the upward adjustment of 1991, considered excessive, was revised down by 351,000 people;
- net migration was reduced by 305,000 people, on the grounds that 249,000 departures were omitted and 57,000 too many arrivals were counted (according to a survey of intentions of new arrivals);
- the census population was increased by 193,000 to offset under-coverage, especially of men aged 25 to 34;
- an overall negative adjustment of 291,000 was made to maintain the consistency of trends.

The algebraic sum of these corrections, which are still provisional, restores the missing 1,140,000 people. But the method is complex: it adjusts both stocks and flows, affecting both the overall figure and its component parts, with retroactive corrections of the population back to 1982. Paradoxically, these corrections are part of the "One Number Census" (ONC), which was intended to produce a single reliable figure for the 2001 census.

Figure 2 - Fertility rate in France based on the different population estimates



Sources: INSEE, Demographic situation in 1999; authors' calculations.
* Follow-up survey of 1990 [3] and assessment by INSEE's demography department [6].

per year, instead of 50,000). Note that this is a net figure (arrivals minus departures), not be confused with total annual inward migration, which is necessarily higher (between 150,000 and 210,000, depending on whether students are included or not) [7].

The effects of this correction still need to be evaluated. In January 2004, the authors already estimated that doubling net migration would not be sufficient to change France's ranking in Europe on one essential point: the contribution of migration to annual population growth. Even though this contribution rose from 1/5 to 2/5 after 2003, of all the large European countries, France's population growth has been the least dependent on migration over the last ten years. While many of its neighbours grow by immigration only, France still has a strong rate of natural increase.

A negligible impact on demographic indicators

Do the adjustments made by INSEE affect the demographic indicators for France? The effect on the fertility rate is negligible (Figure 2). The fertility rate falls if the calculation base is a larger-than-expected female population, and rises in the opposite case. Since the people most likely to be omitted from the census are not women of childbearing age, the adjustments made since 1999 only reduce by 1% the number of women concerned. The fertility rate in 1998 was raised accordingly from 1.746 to… 1.764, i.e. an increase of 0.018 children per woman. The reverse correction in 2004 reduced the fertility rate by 0.015 children per woman.

Such tiny adjustments have no effect on fertility trends. If the omission rates of the post-census coverage survey of 1990 were used to increase the population over the long term, the number of women of childbearing age would be revised up by 1.1% in 1990 and by 1.5% in 1999, without altering the increase in the fertility rate since 1995. Beyond that, it is difficult to maintain corrections going back to 1990.

The impact of the correction on mortality is even smaller, because elderly people are more accurately recorded than young adults. The adjustment increases life expectancy by one-tenth of a year, compared with an actual increase of 2.5 years over 10 years, i.e. 25 times more.

As to whether the census adjustments minimize immigration, the answer is the same: the effect is negligible. The post-census survey in 1990 did report 3% of omissions for foreigners compared with 0.8% for native French people, i.e. four times more. But these percentages are still too low to modify the proportion of foreigners living in France. Though only 97% of foreigners were covered by the census, compared with 99% of the native French, this means that the percentage of foreigners in the population, estimated at 6.4% by the 1990 census, is in fact just over 6.5%.

All in all, the adjustments that follow each census do not affect either the measurement of demographic behaviour or the analysis of population structures.

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