Population projections in Belgium and in France since the 1930s
Confrontation to reality and identification of errors

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Context and objective

Since the 1930s-1940s, population projections have been regularly produced by national statistics offices in developed countries, and have been widely used as in government planning. It is well known that these projections, which are often used as if they were *forecasts*, are affected by significant errors. Several authors have shown that errors in total population are often in the range of 5 to 15 % for projections 20 years ahead, and errors for specific age-groups may be much larger (NRC, 2000 ; Keilman, 1997).

The evaluation of these errors and the identification of the reasons why old forecasts went wrong are essential to improve population projections. Such evaluations have been done (at least partially) in several industrialised countries over the last 30 years (for a review, see Keilman 1997). Yet, these evaluations have often been restricted to specific components of population projections (e.g. old people, life expectancy, number of births…), and they have also rarely compared the population projections produced to observed evolutions of population over a longer period than 20 or 30 years back. Detailed evaluation of errors in population projections have also not been conducted in the two countries studied in this paper (Belgium and France).

The overall objective of this paper is to compare official population projections produced in France and in Belgium since the 1930s to the observed evolutions of population, and to identify the sources of errors in these projections. More specifically, this paper will focus on four specific objectives:

- To measure the extent to which results of population projections differ from reality for (1) the total population, and (2) the population structure by age of the two countries.

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- To identify the main components of demographic change responsible for these errors. Using a method of decomposition of errors (see below), we will be able to measure the impacts of errors in fertility, mortality and migration on the overall errors.

- To relate errors in the various components of demographic change to the historical context in which the projections were made. For example, was natality more likely to be underestimated in the 1930s and 1940s, when fears of depopulation were very strong in Western Europe?

- To compare the errors in population projections in Belgium and in France. More specifically, we will evaluate if the same type of errors were made at similar periods in the two countries, or if they rather tend to be uncorrelated. The new results produced for Belgium and France will also be briefly compared to the results from similar studies conducted in other countries (Canada, Norway, The Netherlands, USA).

Data & methods

The data used in this study are a selection of some of the official population projections carried out in Belgium and France since the 1930s. Six sets of population projections will be used in Belgium (1940, 1955, 1965, 1971, 1981 and 1992) and six sets will also be selected in France (1932, 1954, 1964, 1975, 1985 and 1990). These projections will be compared to the observed populations and to the components of demographic change (birth rates, death rates, net migration rates).

The decomposition of errors in projected populations is based on a method used by Bulatao (2001). The error in the projection of total population is defined as the ratio of the projected population at time t, to the observed population at time t:

$$E = \frac{P_t^*}{P_t}$$

Taking the natural logarithm of this ratio, the total error can then be decomposed into four components: (1) error on base population, (2) error in birth rates, (3) error in death rates and (4) error in migration rates.

$$\ln(E) = \ln\left(\frac{P_0^*}{P_0}\right) + (b^* - b).t + (-d^* + d).t + (m^* - m).t$$

Where *b**, *d** and *m** are the average projected birth rate, death rate and net migration rate over the projection period (*t*), and *b*, *d* and *m* are the observed rates over the same period.

Expected results

Preliminary analyses in Belgium (Schoumaker, Peltier and Bahri, 2005) have shown some of the following results.

▪ Errors in projected total population have usually been very large since the 1940s. For example, a projection in 1940 forecast a population of 7.5 millions for 1980, while the observed population was around 9.5 million at that date (figure 1).

▪ The relative errors varied between -6 % and +6 % for a projection 15 years ahead. Total population were underestimated in the 1940s and the 1950s, were overestimated in the 1960s and the 1970s, and were again underestimated in the 1980s and the 1990s.
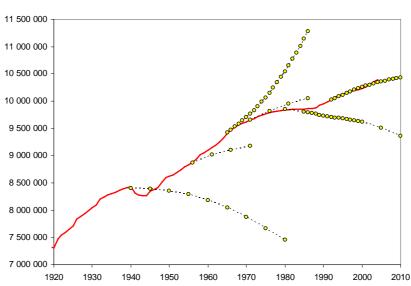
Figure 1 : Comparisons observed total population of Belgium and six sets of population projections since the 1940s.

▪ The decomposition of errors into four components (figure 2) indicates that errors in fertility and migration are the main source of errors in population projections in Belgium since the 1940s, although their respective effects have varied over time.

▪ In the 1940s and the 1950s, fertility rates had been underestimated and significantly contributed to the underestimation of population projections. On the other hand, fertility rates were largely overestimated in the projections carried out in the early 1960s, and have been consistently overestimated since then.

▪ Net migration rates have been almost systematically underestimated since the 1940s, except in the 1960s (a period of high immigration from North Africa), where it was slightly underestimated.

- Improvement in mortality rates have also been systematically underestimated, except in the 1960s.
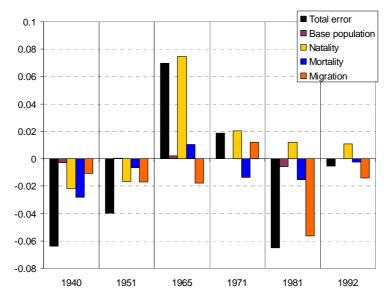
Figure 2 : errors in population projections at time t+15 and decomposition of errors into four components for six sets of population projections in Belgium.

- Errors in population structure also indicate that errors are most important among children and among old people. The proportion of old people have tended to be underestimated due to the overestimation of mortality (especially at old ages), while the proportion of children have been overestimated since the 1960s due to the overestimation of fertility rates.

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