

# Fertility in Italian regions: analysis and estimation of cohort indicators

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## 1. Introduction

The paper focuses on the analysis of cohort fertility in Italy. In particular, the aim is to analyse in detail the fertility of the generations resident in Italy and in the Italian regions, estimating the total fertility rate of the cohorts that in 2019 are still in the reproductive age groups (15-49 years), born between 1970 and 1987. Therefore, this study also wants to focus attention on younger cohorts who have experienced economic difficulties, related to the 2008 economic crisis, in the middle of their reproductive lives and who may not be able to recover their postponed fertility in the future.

In studies about fertility, a cross-sectional perspective is generally adopted and period fertility measures are used. Indeed, period analysis has been and is an excellent tool for describing period changes in the propensity to have children. However, period fertility rates, by attributing a given level of fertility to a fictitious cohort of women, are strongly influenced by changes in the birth calendar, hence by the so-called *tempo* (Bongaarts, Feeney 2008; Caltabiano 2008). Especially in periods of strong changes, they therefore provide an inaccurate estimate of the final fertility, the *quantum*, of the cohorts and thus of the capacity that the generations have to replace themselves (Caltabiano 2006). The longitudinal approach is therefore the only one able to consider dynamics that vary over time and of providing a measure of the changes and trends in demographic phenomena over time (Gesano 2011). In addition, since the demographic behaviours at various ages are affected by the experiences and behaviours of previous ages, the study of phenomena from a longitudinal perspective appears to be more natural for interpreting demographic phenomena.

Conducting a study on this subject by also focusing on the differences existing between sub-national territories, e.g. the Italian regions, is fundamental for making the analysis more complete. In fact, territorial contexts constitute dimensions in which economic, social and cultural inequalities can be present and can influence the effect of certain variables on certain demographic phenomena. The convergence observed between the different areas of Italy in period and cohort fertility (e.g. Caltabiano 2008) are then the result of different dynamics between the various territories that could again change in direction and intensity in the future and for the younger generations.

## 2. Fertility in Italy and cohort fertility: motivations for the study

The evolution of fertility in developed countries and, in particular, the fertility decline in southern European countries and Italy, is an extremely important issue. The propensity of a population to have children, connected to important social, economic and cultural changes, is a strong signal of changes within the population. The dynamics of fertility, together with that of mortality, determine the size and age structure of the population and its sub-populations. The continuous increase in life expectancy, together with the continuous decrease in fertility and birth rate, has determined a significant ageing process that has led the Italian population to be among the oldest in Europe and in the world.

Italy, following the rapid and intense decrease in the average number of children per woman after the *baby-boom*, has for some time now been one of the countries with the lowest fertility rate in the European context. After an upturn in the mid-1990s, caused by the recovery of women who had postponed motherhood in the past and by the higher fertility of foreign women, there has been a new phase of stability and, in recent years, a slight decline. While period fertility, although tending to decline, has therefore experienced phases of recovery, the same has not happened for cohort fertility, which has been in constant decline. Among the generations, there would therefore seem to be an underlying long-term trend towards a propensity to have few children (Caltabiano 2008).

This research is therefore part of the vast group of studies about the fertility decline in developed countries and, in particular, those relating to the analysis of the evolution of cohort fertility. The studies based on a longitudinal perspective are less widespread than those oriented towards a period perspective. In fact, the analysis by generations and the use of cohort fertility measures, although considered as the best tools to proceed to an in-depth study of the changes in the propensity to have children over time and across generations, clash with the main weakness of longitudinal measures and analyses: the lack of data for incomplete cohorts (Giorgi, Viola 2003). Over the years, however, a number of scholars have carried out longitudinal analyses that have also forecast the future fertility of the younger generations, estimating the specific fertility rates of the missing ages, and thus the final total fertility rate, through the use of various techniques (e.g. Cheng, Lin 2010; Li, Wu 2003; Ryder 1990). In the Italian research, several scholars have used the longitudinal perspective to study the evolution of the fertility of the Italian generations that have already left the reproductive period or, through estimates, of those about to complete their fertility. Caltabiano (2008) studied the trend, in the Italian regions, of the fertility of the cohorts born from 1935 to 1956 and estimated the trend of the incomplete generations born from 1957 to 1967. For the generations close to the end of their fertile period, the fertility of the previous cohorts at the same ages was attributed; for the younger cohorts, the evolution of fertility was studied through the analysis of the dynamics of cumulative fertility. Caltabiano, Castiglioni and Rosina (2009), on the other hand, studied the specific fertility of generations born between 1950 and 1980, comparing the territories of the North and those of the South.

In order to be able to forecast the specific fertility rates for the missing ages and thus the final fertility rate, it is necessary to make certain assumptions and, on the basis of these, it is possible to choose between different methods. As explained by Giorgi and Viola (2003) there are simpler techniques and methodologies, based on the assumption that the missing age rates for a given generation can be equal to those observed in the last period for the same ages, or that they can present the same relationship existing between the period rates, thus assuming the constancy of the relationships between the age-specific rates. Other parametric methods, on the other hand, use the available information on specific fertility to estimate parameters and extrapolate, through these parameters, the fertility for the missing ages (Kohler, Ortega 2002; Cheng, Lin 2010). Ryder (1990), on the other hand, used the experience of past cohorts at the same ages to estimate fertility at certain ages. Other methods and forecasting techniques have combined the latter two methods, using both information on the fertility of past cohorts and information on the fertility already expressed by incomplete cohorts, for which the missing specific rates are estimated. Evans (1986), for example, estimated a linear regression model to predict the specific rates for ages 25-39 by including as variables cumulative fertility up to age 24, the ratio of fertility expressed in ages 15-19 and 20-24, and the fertility at the same age of previous cohorts. Some forecasts have been conducted using ARIMA forecasting techniques, thus considering the succession of cohorts as a historical series (e.g. Giorgi, Viola 2003). In order to estimate the specific fertility of incomplete cohorts, the so-called Age-Period-Cohort models have also been used, in which forecasts are made through statistical techniques that project the evolution of rates and parameters estimated by a certain fertility function (Giorgi, Viola 2003; Li, Wu 2003).

### *3. Research design, data and methods*

The research questions of this project are therefore as follows: (1) What will be the final fertility rate of generations not yet concluded their reproductive life, especially of those generations that may have experienced difficulties linked to the period of economic crisis in the middle age groups of their reproductive lives? (2) Will there be relevant differences between Italian regions? It is assumed that the future fertility of these cohorts is influenced by the fertility of past generations but also by the fertility achieved in previous years. This estimation is also conducted at the regional level, in order to provide a framework of the similarities and differences between Italian territories.

For this research project, the data used are those collected and processed by the National Institute of Statistics (Istat) in the regional fertility tables of the resident population in Italy. In particular, the fertility measures used

to estimate the total future fertility rate of incomplete generations are: (1) specific fertility rates for all ages (15-49) of the complete generations 1952-1968, (2) specific fertility rates for the available ages of the incomplete generations 1969-1985.

17 complete generations preceding the incomplete generations were chosen because the influence of the fertility of much older cohorts is assumed to have no effect on the fertility levels of younger cohorts.. The incomplete generations for which the prediction was made are also 17; the choice to stop the fertility estimation for the generation born in 1987 (32 years in 2019, for which the first age of specific fertility to be estimated is 33 years old) was made since a more complete information on the fertility achieved at younger ages is available. The choice of 32 years is dictated by the observation of the specific fertility rates trend available for the generations born before 1987, which shows decreasing specific fertility after this age and the presence of the highest levels of specific fertility between 28 and 32 years. By moving only along the ages after 32 years, it is possible to have a more precise estimate of fertility at ages after those at which the maximum specific fertility has already been recorded.

The analysis will be conducted using a new methodology that has elements in common with the various methodologies used in this field of research. The coefficients of the fertility function will be estimated through a Poisson regression and the parameters provided by this model will be used to make the predictions. In this regression, the independent variable will be the number of births per mother's age, the offset will be the average number of women per age, and the predictors will be the ages, the ages estimated as a parabola (i.e. the shape assumed by all specific rate curves), the cohort, the interaction between age and cohort, and the interaction between ages estimated as a parabola and cohort. The hypothesis behind the formulation of this model is that the series of age-specific fertility rates, resulting from the ratio of the number of births to the average female population, is influenced by an age effect and a cohort effect and by the interaction of the effect between cohort and age. Using the parameters provided by this model, it is assumed that the future fertility of the incomplete generations may depend on the effect of the fertility already expressed at younger ages and the fertility expressed by the different cohorts at different ages. The choice of variables to be used in the model has therefore been made on the basis of known demographic dynamics, but the technique used for the forecasts is purely statistical, relying on the parameters expressed by the model.

#### *4. Preliminary findings and further steps*

The preliminary results draw a picture of great changes. The descriptive analysis of the evolution of the fertility of the complete generations confirmed what had already been observed for the previous generations (e.g. Caltabiano, 2008; Caltabiano, Castiglioni, Rosina, 2009), namely a continuous decline in the final fertility, which also involved the cohorts that had recently left the reproductive ages. The differences in the levels of final cohort fertility between the Italian regions of the Centre-North and the South have been decreasing. According to the preliminary estimates, the process of convergence of the final cohort fertility between the different Italian regions, which had already begun for the generations of the mid-1960s, could become even stronger for the subsequent generations, but with opposing trends in the different regions. From what emerges from the preliminary results, in the regions of the Centre-North the drop in fertility could be repeated for the generations born in the early 1980s, while in those of the South and the Islands, this drop could be continuous and affect all the generations after 1970. The regions in which there seems to be a slight increase, or stability, in the final fertility of the generations born in the 1970s are precisely those in which there has been a phase of recovery of period fertility, confirming the importance of recovery strategies in determining the final fertility (Rosina, Caltabiano, 2012). In the latter regions, the possible decrease in the final fertility of the cohorts born in the early '80s could instead be a sign of new difficulties encountered by the younger generations in realising their life and reproductive projects, compared to those of the '70s that preceded them. Moreover, it could indicate a shift in the strategies for recovering previously postponed fertility, determined by the changes in work and economic contexts. This scenario poses a series of doubts and questions on the fertility behaviour of the younger generations and on how the difficult economic and social situation in Italy has influenced, is influencing and may still influence the various generations in the future. Moreover, it places a shadow on the

future evolution of the population in Italy in general, and in its territories in particular, considering that the generations of the '80s are already less numerous, coming from the already low fertility rate of those years. If reality will be close to the estimates, the geography of cohort fertility would change radically, as had already emerged from Caltabiano's (2008) analysis. Liguria, for example, would no longer be among the regions with the lowest fertility per cohort, and a region with a low fertility rate like Sardinia would be joined by southern regions like Calabria and Basilicata. Moreover, in most Italian regions, the final fertility of the generations of the '80s would not exceed the level of 1.3, i.e. the lowest low fertility threshold. Even in Campania, the fertility of these generations could be equal to 1.37. That process of convergence observed at provincial level for the fertility over the period, would therefore be strongly re-proposed also for the final cohort fertility at regional level. For the regions of Southern Italy, a new phase of an important demographic crisis would thus open up, for now only slightly defined, which could be made even more worrying by the different economic and social situation existing in these territories compared to the central and northern regions. In fact, although period and cohort fertility is converging between the different territories, they do not seem to converge on other aspects that are strongly linked to demographic behaviour and reproductive dynamics, such as female employment, availability of childcare services and the gender system. In this sense, detailed knowledge, at a territorial level, of the present and future evolution of cohort fertility can be of support in interpreting the phenomenon at a general level and in being able to deal with the consequences associated with it also, and above all, from a local point of view. The analysis of the possible evolution of the fertility of the younger generations is of particular interest, not only because it can communicate something about past behaviour but also because it can help to stem current trends that may have important consequences for the future.

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