Fertility in Italian regions: analysis and estimation of cohort indicators

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Abstract

The aim of the paper is to analyze the fertility of the cohorts in the Italian regions, estimating the completed fertility of the cohorts born in 1970-1987, still in the reproductive ages in 2019. Italy is one of the countries with the lowest level of fertility in the European context. While period fertility, although tending to decline, has experienced phases of recovery, the same has not happened for the cohort fertility. The analysis will be conducted using ISTAT data, estimating the coefficients of the fertility function through a Poisson regression and using the parameters provided by this model to make predictions of the specific fertility rates for the missing ages of the incomplete generations. Preliminary results show a continuous decline in the fertility, both for the complete and incomplete cohorts. In particular, in the regions of the South and the Islands, drop in fertility could be continuous and affect all the cohorts after 1968. Detailed knowledge of the evolution of the present and future cohorts fertility is important in order to deal with the consequences associated with the fertility decline.

Keywords: fertility, Italy, cohort fertility, regions, incomplete cohorts

1. Introduction

The paper focuses on the analysis of cohort fertility in Italy[1]. In particular, the aim is to analyse in detail the fertility of the cohorts resident in the Italian major socio-economic regions (NUTS 1)[2] and in the Italian regions (NUTS 2), estimating the completed fertility of the cohorts that in 2019 were in the reproductive age groups (13-50 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 hypothetical 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

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[2] Italy is divided into 5 major socio-economic regions (NUTS 1, North-West, North-East, Centre, South, Islands) and 20 regions (NUTS 2).

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 demographic phenomena. Then, the convergence observed between the different areas of Italy in period and cohort fertility (e.g. Caltabiano 2008) are 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 fertility dynamic, together with mortality dynamic, 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*, is one of the countries with the lowest fertility rate in the European context. After an increase 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. Therefore, the cohorts seem to experience 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 cohorts 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 estimate the completed fertility of the younger generations, estimating the specific fertility rates of the missing ages, and thus the completed 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 for the Italian cohorts that have left the reproductive period or, through estimates, of those about to complete their fertility. Caltabiano (2008), for the Italian regions, studied the trend of completed fertility of cohorts born from 1935 to 1956 and estimated the trend for the incomplete generations born from 1957 to 1967. For the cohorts close to the end of their reproductive 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 cohorts 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 completed 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-specific 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 cohorts that did 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, and what are the differences between old and young cohorts? (2) Will there be relevant differences between Italian regions? It is assumed that the completed fertility of these cohorts is influenced by the fertility of past generations but also by the fertility achieved in previous years. This estimation is 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 completed fertility rate of incomplete cohorts are: (1) age-specific fertility rates for all ages (13-50) of the complete cohorts born in the years 1950-1969, (2) age-specific fertility rates for the available ages of the incomplete generations born in the years 1970-1987.

15 complete cohorts preceding the incomplete ones 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. These generations were at reproductive ages in the time period between the end of 60s and today. The incomplete cohorts for which the prediction was made are 18 and entered the reproductive period from 80s onwards. 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 age-specific fertility rates trend available for the cohorts born before 1985, 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 was 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 were estimated through a Poisson regression and the parameters provided by this model were used to make the predictions. In this regression, the dependent variable is the number of births per mother's age, the offset is 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 completed fertility of the incomplete cohorts 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 the variables 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.

The evolution of completed fertility is also examined for complete cohorts, starting with the 1939 cohort.

4. Preliminary findings and conclusions

The preliminary results draw a picture of changes. The descriptive analysis of the trend in the completed fertility of the complete generations in the major socio-economic regions confirmed a decline, which also involved the cohorts that had recently left the reproductive ages (e.g. Caltabiano, 2008; Caltabiano, Castiglioni, Rosina, 2009). The first results, including estimates, show a decline in the completed cohort fertility from the

cohort born in 1939 and the incomplete cohort born in 1987. But there are some differences in the trends and levels between the different Italian major socio-economic regions. Indeed, in the area of North-West and North-East, the cohort fertility could slightly increase for cohort born after 1965 but then decrease for cohort born in 80s. In the Centre, South and Island areas, the drop in the completed cohort fertility could be constant and more intense for all generations.

Anyway, the differences in the levels of completed cohort fertility between the Centre-North and South have been decreasing. Hence, according to these preliminary estimates, the convergence process of the completed cohort fertility between the different Italian areas, which had already begun for the generations born in the mid-1960s, could become even stronger for the subsequent cohorts, but as a result of different trends in the areas.

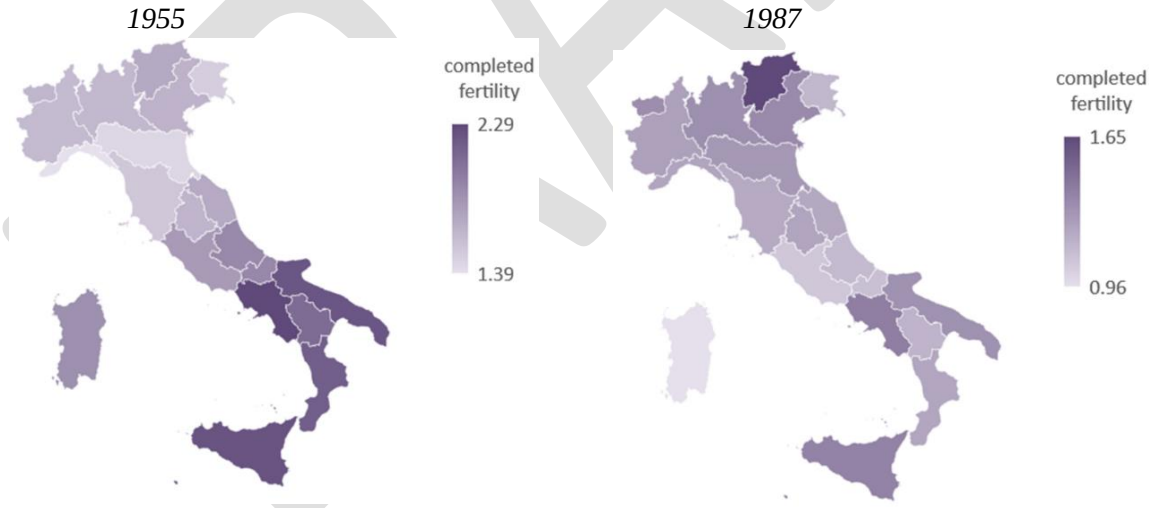
By looking at the differences at regional level and by focusing on complete cohorts, from cohort born in 1939 and cohort born in 1969, the major decrease in completed cohort fertility is observed for Sardinia region, with a decrease equal to 50%. The region that experienced the minor negative variation in completed cohort fertility is Umbria, a region in the Centre. For the last complete cohort the higher level of fertility is recorded in Campania (a region in South Italy) and in Liguria (a region in North-West). Regarding the incomplete cohorts, the major decrease in completed fertility between the first incomplete (but almost complete) cohort born in 1970 and the last incomplete cohort born in 1987 could be recorded in Sardinia (Table 1). So, this region would continue the alarming decreasing trend and the cohort born in 1987 could record a completed fertility below 1. The regions in which there seems to be a slight increase, or stability, in the completed 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 these regions, the possible decrease in the completed fertility of the cohorts born after the mid-1980s 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. For the 1987 cohort, fertility could be below the Lowest Low Fertility threshold of 1.3 in 13 out of 20 regions. Of these 13 regions, 2 are in the North-West, 2 in the North-East, 4 in Central Italy (all those belonging to this area), 4 are in the South of Italy and 1 in the Islands. Compared to the decrease from cohort born in 1939 to that born in 1969, similar in intensity in all Italian regions, the decrease between the 1970 and 1987 cohort could be stronger in the regions of Centre and South Italy (Table 1). These dynamics could lead to a new geography of the completed cohort fertility (Figure 1). Indeed, the different trends existing in North and South regions will lead to a greater convergence between the various Italian regions in the completed cohort fertility. For example, for the cohort born in 1987, the lowest levels (below 1.2) of completed fertility could be recorded in central and southern regions, such as Lazio, Abruzzo, Molise, Basilicata and Sardinia. The highest level would be in a northern region such as Trentino South Tyrol and Liguria would no longer be the region with the lowest cohort fertility.

Table 1. Completed cohort fertility for incomplete cohorts born in 1970, 1975 ,1980, 1985, 1987. Italian regions (NUTS 2)

	1970	1975	1980	1985	1987	% var. 39-69	% var. 70-87	% var. 39-87
Piedmont	1.34	1.34	1.41	1.37	1.25	-25.44	-6.46	-30.31
Aosta Valley	1.44	1.45	1.56	1.34	1.34	-22.69	-7.30	-26.85
Lombardy	1.38	1.41	1.49	1.46	1.33	-29.82	-3.71	-31.71
Trentino-South Tyrol	1.64	1.63	1.69	1.70	1.65	-28.88	0.65	-26.25
Veneto	1.37	1.37	1.44	1.44	1.35	-36.03	-1.04	-36.39
Friuli-Venezia Giulia	1.25	1.28	1.36	1.34	1.15	-32.51	-7.95	-36.35
Liguria	1.21	1.25	1.31	1.33	1.23	-29.68	2.37	-27.44
Emilia-Romagna	1.30	1.36	1.46	1.41	1.29	-27.63	-0.88	-27.80
Tuscany	1.32	1.31	1.35	1.31	1.21	-27.70	-8.65	-33.11
Umbria	1.34	1.35	1.36	1.30	1.23	-21.44	-8.29	-30.63
Marche	1.40	1.35	1.40	1.33	1.22	-28.20	-13.04	-36.60
Lazio	1.45	1.41	1.37	1.26	1.08	-32.10	-25.70	-50.37
Abruzzo	1.51	1.39	1.34	1.27	1.13	-27.68	-25.16	-45.61
Molise	1.52	1.35	1.29	1.31	1.11	-27.15	-27.22	-47.45
Campania	1.78	1.64	1.56	1.48	1.41	-35.72	-20.76	-49.77
Apulia	1.64	1.52	1.43	1.42	1.32	-40.38	-19.55	-52.21
Basilicata	1.56	1.43	1.34	1.30	1.16	-39.68	-25.11	-56.10
Calabria	1.64	1.50	1.40	1.27	1.23	-40.28	-25.27	-56.35
Sicily	1.78	1.65	1.56	1.49	1.39	-32.72	-22.10	-47.89
Sardinia	1.30	1.19	1.17	1.07	0.96	-50.59	-26.22	-63.53

Source: elaboration on ISTAT data

Figure 1. Completed cohort fertility. Cohorts 1955 and 1987 (estimate). Italian regions (NUTS2)



Source: elaboration on ISTAT data

These estimates are not an exact picture of what the completed fertility rate will be for cohorts that have not yet completed their productive lives. Moreover, the estimates are based on a model and techniques that can certainly be improved. However, these estimates, although imprecise, provide a picture of a reality that could be plausible, considering the fertility trends in Italy and the difficulties that families and couples continue to encounter in realizing their reproductive plans, especially in some geographical areas. The COVID-19

pandemic has certainly added an element of difficulty and uncertainty, making it even more complex to predict reproductive behavior and draw up scenarios.

The scenario outlined by the estimates 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. For the regions of Southern Italy, a new phase of an important demographic crisis, for now only slightly defined, would begin. This crisis could be made even more worrying by the different economic and social situation existing in these territories compared to the central and northern regions. Indeed, 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 completed 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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